LIST OF ABSTRACTS OF PUBLISHED SCIENTIFIC PAPERS FROM FOOD SCIENCE AND TECHNOLOGY DEPARTMENT MEMBERS OF ACADEMIC STAFF FROM 2019 TODATE

Dr. Samuel Imathiu

1. **Acceptability of cereal-cricket porridge compared to cereal and cereal-milk- porridges among caregivers and nursery school children in Uasin Gishu, Kenya.**

   Kinyuru, J., Kipkoech, C., **Imathiu, S**., Konyole, S., Roos, N., 2021. International Journal of Tropical Insect Science. DOI: https://doi.org/10.1007/s42690-020-00388-1

   Abstract
   Crickets have been promoted as a possible animal protein source in child feeding by enriching porridge with cricket powder due to its nutritional contribution and affordability. The aim of this study was to develop a nutrient-dense cereal- cricket porridge suitable for school feeding programmes in Kenya and determine its safety and acceptability in comparison to cereal and cereal-milk porridges. Porridge flours containing maize and millet (MM), maize, millet and milk powder (M10) or maize, millet and cricket powder (C5) were processed by extrusion cooking based on nutritional requirements of children aged 3–5 years. Microbial and aflatoxin safety was determined using standard methods. Caregivers (n = 73) evaluated the sensory attributes of the porridges using a seven-point hedonic scale while consumer acceptability by children (n = 138) was evaluated in a randomized parallel intervention study over four weeks. The children were served 300 ml of either MM, M10 or C5 porridge during school days for four weeks. Daily porridge consumption quantities were taken with consumption of >75% of the porridge being rated highly acceptable, 50–75% moderately acceptable and < 50% least acceptable. The results showed that the developed porridge flours contributed essential macro- and micronutrients for 3–5 years old children. They were safe for human consumption with all assessed microbes being below the acceptable limits and no aflatoxins detected. M10 porridge had the most preferred colour (6.4) and taste (5.5) by the caregivers. Overall, the caregivers preferred M10 and MM, however, all the porridges including C5 registered overall acceptability scores of ≥5 (Liked very much). Among the children, acceptability of the different types of porridge increased from week 1 to 4. Based on the proportion of children who consumed >75% of the serving, acceptance of MM increased from 98% in week 1 to 100% in week 4, M10 increased from 91% to 100% while C5 increased from 55% to 70% over the same period. Only 5% of the children recorded <50% acceptance of C5 porridge in the fourth week compared to 15% at week 1. The study shows that crickets can be used to develop nutritious, porridge with considerable acceptability compared to conventionally consumed porridges. The study also shows that children can develop a liking for the less familiar food with continued exposure over time.

   Key words: Child nutrition, cricket powder, consumer acceptability, safety, cricket-based porridge

2. **Multinomial logistic regression analysis of factors influencing food safety, hygiene awareness and practices among street food vendors in Kiambu county, Kenya.**

Mwove, J., **Imathiu, S**., Orina, I. and Karanja, P., 2020. Current Research in Nutrition and Food Science, 8, 988-1000. DOI: http://dx.doi.org/10.12944/CRNFSJ.8.3.26

Abstract

Street food vending is a very popular and unique part of the informal sector, particularly in developing countries. However, the safety of street vended foods is a major public health concern since poor food safety and hygiene knowledge and practices are often reported among street food vendors (SFVs). The objective of this study was to identify the factors influencing food safety, hygiene awareness and practices (FSHAP) among SFVs in Kiambu County, Kenya. Structured questionnaires and an observation checklist were administered to randomly selected 345 SFVs. Results showed that good food safety and hygiene awareness scores were significantly (P <0.05) influenced by education level, food hygiene and safety training, mobility of SFVs, public health inspection, and the category of SFVs. Public health inspection was the only factor that significantly (P less than 0.05) influenced all FSHAP score categories. Mobile vendors were 1.86 and 2.20 times more likely to have poor working conditions and poor food handling practices scores compared to those who were not mobile, respectively. Training and education level significantly (P <0.01 and P <0.05, respectively) increased food safety and hygiene awareness score whereas the duration of time in street food vending significantly (P <0.05) improved food handling practice score. Public health inspection of SFVs was found to be the most effective way of improving FSHAP among SFVs. The study recommends regular inspections of SFVs by public health officials to enhance compliance with food hygiene and safety standards and regulations governing the street food sector as well as scheduled training on food safety and hygiene targeting all categories of street food vendors.

Key words: Food hygiene, food safety, logistic regression, public health inspection, street food vendors

3. **Moisture sorption properties of two varieties of dehydrated mango slices as determined by gravimetric method using Guggenheim–Anderson–de Boer model.**

Nyangena, S., Owino, W., Ambuko, J. and **Imathiu, S.**, 2020. Journal of Food Processing and Preservation. DOI: https://doi.org/10.1111/jfpp.15041

Abstract

The moisture sorption isotherms for oven dried mango were constructed gravimetrically at three different temperatures of 25°C, 30°C, and 35°C, and relative humidity ranging 8.3%–97.0%. The Guggenheim–Anderson–de Boer model was used to fit sorption data and constant equations determined using nonlinear regression analysis. The isotherms had J-shaped curve that represents type III isotherms characterized by sugar-rich products. At increased temperatures, it was observed that equilibrium moisture content increased and crossing effect of isotherm curves was observed with a corresponding increase in water activity. A substantial increase in equilibrium moisture content was observed above water activity of 0.6. Monolayer moisture content of between 8 and 9.6% was predicted for dried slices where the lowest value indicated that moisture content should not be lower than 8.0% to avoid unnecessary energy consumption. For assured microbiological stability, the safe storage moisture content for dried mango should be maintained at approximately 15% or less that corresponded to 0.6 water activity.

Keywords: Equilibrium moisture content, GAB, mango, moisture sorption isotherm, water activity

4. Climate change: a natural streamliner towards entomophagy?

Nyangena, D., Kinyuru, J. and **Imathiu, S.,** 2020. International Journal of Tropical Insect Science. DOI: https://doi.org/10.1007/s42690-020-00292-8.

Abstract

Climate change has escalated into a global problem owing to its devastating impact on agriculture and food security. More specifically, climate change has triggered extreme weather events which have affected the overall agricultural sustainability, either negatively or positively, with the former outdoing the latter. This has led to a concomitant nutritional imbalance and health challenges in the human population, particularly in developing countries. Further, a nutritional imbalance and high feed prices is being felt in the animal feed production chain, due to over reliance on conventional raw material and/or ingredients, which further negatively affects livelihood incomes. Edible insects have recently gained a lot of attention, as one of the strategies to curb food/feed and nutrition insecurity due to its several already documented benefits. This review discusses how climate change has affected food and cash crop production, together with animal production, the resulting human nutritional imbalances and the impact climate change has on edible insects. Several factors on the benefits of promotion and adoption of edible insects as food and feed have also been

discussed, with an inclination towards their role in curbing global warming, while alleviating the global challenge of food and nutrition insecurity, currently and in the future.

Keywords: Climate change, edible insects, malnutrition, entomophagy, agriculture

5. **Food safety knowledge and practices of street food vendors in selected locations within Kiambu County, Kenya**

Mwove, J., **Imathiu, S**., Orina, I. and Karanja, P., 2020. African Journal of Food Science 14, 174-185. DOI: https://doi.org/10.5897/AJFS2020.1929

Abstract

The safety of street foods remains a public health concern especially in developing countries like Kenya where foodborne illnesses associated with these foods have often been reported. This study determined the food hygiene and safety knowledge and practices of 345 street food vendors (SFVs) in selected locations within Kiambu County, Kenya. Data collection was accomplished through face-toface interviews using structured questionnaires and extensive observation using an assessment tool for observation of personal hygiene and food handling practices of SFVs and the condition of the vending environment. The results indicated that the majority of the SFVs were male (63.2%) with 38.1% of them having attained secondary school education. About 93% of the SFVs had not received any formal training on food hygiene and safety. Majority of SFVs handled food with bare hands (96.8%) or handled money while serving food without washing hands (86.1%). Few also practiced preservation with 78.3% storing foodstuff that required refrigeration at ambient temperatures while 22.3% stored leftovers without any form of preservation and sold them the following day. Whereas public health officers' visits were found to significantly ($P<0.0001$) motivate SFVs to obtain a food handler's medical certificate, only about 27% had obtained it. These findings suggest that street vended foods sold in this study area may pose a significant potential hazard to public health due to the poor hygiene and handling practices reported.

Keywords: Street vended food, food safety, food hygiene, public health, street food legislation

6. **Assessment of food safety knowledge, beliefs and attitudes of undergraduate students at a Kenyan university: Results of an online survey**

Imathiu, S., 2020. European Journal of Agriculture and Food Sciences, 2.
DOI: https://doi.org/10.24018/ejfood.2020.2.4.85

Abstract

A descriptive, cross-sectional survey was conducted using an online questionnaire to assess food safety knowledge, beliefs and attitudes among Jomo Kenyatta University of Agriculture and Technology undergraduate students. A total of 329 learners consented to participate in the study. The results revealed that overall respondents answered 46.2% of the food safety knowledge questions correctly with similar scores across the five colleges (Agriculture and Natural Resources 47.4%, Human Resource and Development 45.2%, Engineering and Technology 46.7%, Health Sciences 45.4%, and Pure and Applied Sciences 46.5%). Over 70% of respondents seemed to have positive beliefs and attitudes in most of the food safety beliefs and attitudes statements. A 78.7% of respondents agreed or strongly agreed that food safety knowledge is important to them while 72.1% and 77.7% of the respondents were willing to learn how to make their food safe to eat, and how to prevent food poisoning from occurring respectively. Only a small proportion (3.3%) of respondents felt that food safety was not their responsibility. The areas of most concern in food safety knowledge were in regard to cross-contamination and temperature control/food preservation. The proportions of correct responses on; "Imagine that your electricity went off and the meat, chicken, and/or seafood in your freezer thawed and felt warm. To prevent food poisoning, what should you do?", "A refrigerator has three shelves, on which shelf do you think raw meat should be placed?" and "What should be done if the leftovers are still not eaten completely?" were 7.3%, 24% and 24.6% respectively. These results show that students who participated in this study generally had unsatisfactory food safety knowledge regardless of their study category. There is therefore a need to offer food safety education/training to all learners, perhaps in short courses forms and not only on theory, but also on practical food safety aspects to bridge the food safety information gap.

Keywords: Food handling, food hygiene, food safety, food safety knowledge, Kenya, university students

7. **Modification of oligosaccharide and short chain fatty acid content of cowpea milk through fermentation with selected mixed starter cultures**

Aduol, K., **Imathiu, S.** and Onyango, A.N., 2019. Journal of Food and Nutritional Sciences Research. DOI: https://doi.org/10.37512/400.

Abstract

Cowpea milk was fermented with three mixed starter cultures containing (i) Lactobacillus acidophilus, Bifidobacterium sp, and Streptococcus thermophilus (ABT) (ii) Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus (DT) or (iii) Lactobacillus rhamnosus GR-1 and Streptococcus thermophilus (GT). Effects of these cultures on flatulencecausing raffinose family oligosaccharides and the production of postbiotic short chain fatty acids were determined. The oligosaccharides and short chain fatty acids were determined by high performance liquid chromatography and gas chromatography, respectively. The stachyose content of raw cowpea (1.388±0.23 g/100 g) was higher than raffinose (0.221±0.06 g/100 g), while verbascose was not detected. Cowpea milk fermentation caused 67-100% reduction in raffinose and 20-70% reduction in stachyose in a culture-dependent manner. All the cultures produced propionic acid, butyric acid and valeric acid in differing concentrations but only GT and ABT produced isovaleric acid. The product fermented with DT attained 2430 ppm of propionic acid, which was four times and ten times higher than the concentrations produced by the ABT and GT cultures, respectively. In conclusion, fermentation of cowpea milk with the three starter cultures reduced flatulence-causing oligosaccharides and produced postbiotic short chain fatty acids that might promote health regardless of the survival of the microorganisms in the gut.

Keywords: Fermentation, legume milk, probiotic, prebiotic

8. **Proximate, microbial and sensory characteristics of cowpea milk fermented with probiotic starter cultures**

Aduol, K., **Imathiu, S**. and Onyango, A.N., 2020. European Journal of Agriculture and Food Sciences, 2. DOI: https://doi.org/10.24018/ejfood.2020.2.4.65

Abstract

Fermentation of cowpea milk was carried out using three mixed starter cultures containing (i) Lactobacillus acidophilus, Bifidobacterium spp, and Streptococcus thermophilus (ABT) (ii) Lactobacillus delbrueckii subsp. bulgaricus and Streptococcus thermophilus (DT) or (iii) Lactobacillus rhamnosus GR-1 and Streptococcus thermophilus (GT). Proximate composition of raw and fermented cowpea milk was determined using the AOAC methods. Lactic acid bacteria survival and sensory attributes of the fermented cowpea milk was also determined. Crude fat decreased significantly ($P<0.05$) after fermentation except for GT culture which led to 33.2% increase. Crude fiber was not detected in all the samples. Fermentation with GT also led to increase in protein content, although this was not significant. A decrease was observed for carbohydrate content, after fermentation, with DT culture leading to the highest decrease of 7.1%. There was a general increase in microbial growth during the first two weeks of storage (refrigeration at 4˚C). Thereafter the number reduced to Log10 4.11 cfu/ml on the 28th day of storage. No significant differences were observed for sensory attributes of taste, texture and overall acceptability. However, aroma and appearance had significant differences among the samples ($P<0.05$). The study demonstrated that nutritional quality of cowpea milk can be achieved through fermentation. Also, cowpea milk fermented with lactic acid bacteria produce a yoghurt-like product that can be sweetened to taste and be acceptable to consumers. The study therefore recommends that more work should be done to improve the sensory acceptability of the products and that their potential health benefits should be determined through in vivo studies.

Keywords: Cowpeas, cowpea milk, fermentation, probiotics

9. Benefits and food safety concerns associated with consumption of edible insects – Review article.

Samuel Imathiu, 2020. NFS Journal, 18, 1-11.
DOI: https://doi.org/10.1016/j.nfs.2019.11.002

Abstract

Many types of edible insects in raw and processed forms have been consumed by many cultures globally since time immemorial, particularly in developing countries where they are mostly traditionally viewed as a delicacy besides provision of nutrition. As a food type, they are consumed in two main forms; whole insects or incorporated in various food products as an ingredient, the

choice of which is consumer preference driven. Recently, there has been a lot of research interest in edible insects farming, processing and consumption mainly in an effort to eradicate food insecurities prevalent in many developing countries and boost nutrition. Inclusion of edible insects in human diets has been shown to improve the nutritional quality of foods due to their high micro- and macronutrient levels comparable and sometimes higher than those of animal-derived foods. It is in this regard that they can actually be used in directly addressing the first three UN's Sustainable Development Goals (no poverty, zero hunger, and good health and well-being). Edible insects production also helps in mitigating the negative effects of climate change and improve biodiversity both of which positively contributes to food security. Even with all these benefits, several challenges are encountered in the promotion of edible insects farming and consumption in developing and developed countries. Top in the list of these obstacles is the issue of food safety where, especially western consumers willing to consume edible insects and/or edible insects-derived foods are wary of the microbiological and chemical health risk they could pose. Based on the current literature, there is clearly a need to balance the food safety concerns and the nutritional benefits of edible insects. There is a necessity to promote food safety and hygiene practices in the entire edible insect value chain including during wild harvesting in order to ensure that this highly nutritious food that requires little resources to produce is availed to the consumers in a state that does not pose any health risks. Lack of regulations on edible insects value chain which lacks in many countries, especially developing countries is also another problem that requires urgent attention as addressing this issue is likely to boost consumer confidence and ease trade of this commodity between countries.

Key words: Edible insects, entomophagy, farmed insects, food safety, nutrition, wild insects

10. **Effects of traditional processing techniques on the nutritional and microbiological quality of four edible insect species used for food and feed in East Africa**.

Dorothy N. Nyangena, Christopher Mutungi, **Samuel Imathiu**, John Kinyuru, Hippolyte Affognon, Sunday Ekesi, Dorothy Nakimbugwe and Komi K.M. Fiaboe, 2020. Foods, 9, 574. DOI: 10.3390/foods9050574.

Abstract

Edible insects are increasingly being considered as food and feed ingredients because of their rich nutrient content. Already, edible insect farming has taken-o_ in Africa, but quality and safety

concerns call for simple, actionable hazard control mechanisms. We examined the effects of traditional processing techniques - boiling, toasting, solar-drying, oven-drying, boiling + oven-drying, boiling +solar-drying, toasting + oven-drying, toasting + solar-drying—on the proximate composition and microbiological quality of adult *Acheta domesticus* and *Ruspolia differens*, the prepupae of *Hermetia illucens* and 5th instar larvae of Spodoptera littoralis. Boiling, toasting, and drying decreased the dry matter crude fat by 0.8–51% in the order: toasting > boiling > oven-drying > solar-drying, whereas the protein contents increased by 1.2–22% following the same order. Boiling and toasting decreased aerobic mesophilic bacterial populations, lowered *Staphylococcus aureus*, and eliminated the yeasts and moulds, Lac+ enteric bacteria, and Salmonella. Oven-drying alone marginally lowered bacterial populations as well as yeast and moulds, whereas solar-drying alone had no e_ect on these parameters. Oven-drying of the boiled or toasted products increased the aerobic mesophilic bacteria counts but the products remained negative on Lac+ enteric bacteria and *Salmonella*. Traditional processing improves microbial safety but alters the nutritional value. Species- and treatment-specific patterns exist.

Keywords: Entomophagy, processing, traditional knowledge, food/feed safety, nutrition

11. Can farm weeds improve the growth and microbiological quality of crickets (*Gryllus bimaculatus*)?

Jeremiah Ng'ang'a, **S. Imathiu**, F. Fombong, A. Borremans, L. Van Campenhout, J. Vanden Broeck, John Kinyuru, 2020. Journal of Insects as Food and Feed, 6, 199-209. DOI: https://doi.org/10.3920/JIFF2019.0051.

Abstract

Farming of edible insects has been proposed as a means to reduce current practices of harvesting from the wild. While farming could relieve the pressure on wild populations, as well as on their natural habitats, and generate a continuous supply of edible insects to the consumers, the high cost of commercial chicken feeds is still a challenge to many farmers. The aim of this study was to investigate whether the partial replacement of commercial chicken feed with the farm weed, wandering Jew (*Commelina sinensis*), would have an impact on weight gain and microbial quality of farmed field crickets (*Gryllus bimaculatus*). Therefore, we have experimentally compared two types of feed: (1) starter commercial chicken feed only (SO); and (2) starter commercial chicken feed supplemented with fresh wandering Jew weeds (S+W). After a feeding period of thirty days,

the final body weight differed significantly (P=0.026) between crickets fed with SO and with S+W, which averaged at 1.11 and 1.39 g, respectively. Generally, high counts of total aerobic, *Enterobacteriaceae*, lactic acid bacteria, bacterial endospores, yeasts and moulds were observed in both experimental groups. However, bacterial endospore counts of S+W fed crickets (2.7 log cfu/g) were significantly lower (P=0.021) than these of the SO fed ones (3.9 log cfu/g). Metagenetic analyses indicated that Proteobacteria, Firmicutes and Tenericutes were the most abundant phyla, while members of the family Coxiellacea, and the genera *Lactobacillus*, and *Spiroplasma* were the most abundant operational taxonomic units (OTUs). Concerning the food safety, a few OTUs could be associated with potential food pathogens, such as *Clostridiaceae*, *Staphylococcus* and *Enterobacteriaceae*. In summary, the inclusion of fresh wandering Jew weeds in commercial starter chicken feed produced crickets with increased body weight and improved microbial quality.

Keywords: Edible insects, food safety, microbial numbers, next-generation sequencing, weight gain

12. Changes in chemical and microbiological quality of semi-processed black soldier fly (*Hermetia illucens* L.) larval meal during storage.

E. Kamau, C. Mutungi, J. Kinyuru, **S. Imathiu**, H. Affognon, S. Ekesi, D. Nakimbugwe and K.K.M Fiaboe, 2020. Journal of Insects as Food and Feed, 7, 1-12. DOI: https://doi.org/10.3920/JIFF2019.0043.

Abstract

Edible insects are receiving attention as a protein source in the food and feed sector. However, successful commercialisation requires mass production matched with appropriate processing and storage techniques. The quality of dried and pulverised black soldier fly larvae stored in woven polypropylene (PP) sacks, polyethylene (PE) bags and plastic containers with screw lid (PL) in ambient and refrigerated environments was monitored over six months. Chemical indicators (oxidation, fatty acid profile), microbiological parameters (total viable counts, yeast and moulds, *Enterobacteriaceae*, presumptive coliforms, *Salmonella*) and colour change were examined. Temperature and relative humidity of the storage environments were monitored. In the ambient environment (temperature: 23.6±2.7°C; relative humidity: 57.6±7.0%), chemical deterioration progressed 1.5 and 1.2 times faster in PP and PE, respectively, compared to PL. Refrigeration (temperature: 5.4±1.1°C; relative humidity: 97±5.7%) exacerbated spoilage in the PP due to

permeation of moisture through the woven strands, but slowed chemical deterioration by factors of 3.3 (PL) and 2.8 (PE). Likewise, based on the average counts of *Enterobacteriaceae* and yeast and moulds, microbiological deterioration progressed 2.1 and 1.4 times faster in the PP and PE, respectively, while refrigeration retarded build-up of microbial loads by factors of 1.3-9.6. The presence of *Salmonella* spp. in the experimental product indicates that due attention must be given to adequacy of processing and handling procedures for dried black soldier fly meal.

Keywords: Edible insects, entomophagy, processing, packaging, shelf-life.

13. Evaluation of five essential oils by gas chromatography-mass spectrometry and their effect on fungal growth inhibition and sensory acceptability of soymilk.

Marguerite Niyibituronsa, Arnold Nola Onyango, Svetlana Gaidashova**, Samuel Imathiu**, Zhang Ming, Yang Ruinan, Zhang Weiqi, Wang XiuPin, Zhang Qi, Zhang Zhaowei and Li Peiwu, 2020. Journal of Food Research, 9, 36-47. DOI: https://doi.org/10.5539/jfr.v9n2p36.

Abstract

Essential oils are widely used in the food industry as natural food preservatives to extend product shelf life and as flavoring agents. However, not much has been done on their use in soymilk. The aim of the study is to determine the compounds of five essential oils by GC-MS and their effect on fungal growth inhibition and sensory acceptability of soymilk. The components of the essential oils of five spices, namely citronella, basil, cinnamon, eucalyptus and mint were analysed by gas chromatography-mass spectrometry (GC-MS). The minimum inhibitory concentration (MIC) of the essential oils was tested on the fungus *Aspergillus flavus* 3.4408 on PDA (agar dilution method). Sensory evaluation of soymilk flavored with the essential oils of citronella, basil and mint at different concentrations was done by ten member panelists using a 9-point hedonic scale. The main compound for basil was eugenol 83.26%. Cinnamon contained cinnamaldehyde (97.3%). The main compounds in citronella (*Cymbopogon nardus*) were limonene (38.51%), citronellal (30.29%). Eucalyptus (*Eucalyptus globulus*) essential oil mainly contained eucalyptol/cineole (76.70%), and Mint (*Mentha arvensis*): Menthol 42.72%, Menthone 25.72%. The MICs of citronella, basil, cinnamon, eucalyptus and mint were 5-10 µl/ml, 0.5-1 µl/ml, ≤0.1 µl/ml, >>10 µl/ml and 10-20 µl/ml, respectively. Thus, cinnamon was the most effective in inhibiting fungal growth, while eucalyptus was the least effective. These essential oils improved the soymilk flavor. Mint was the

most preferred flavor, followed by citronella and basil. Thus, essential oils especially mint and citronella can be used for improving acceptability of soymilk at low concentration.

Keywords: Basil, CFU, citronella, cinnamon, eucalyptus, mint, sensory attributes, soybean

14. The growth of different probiotic microorganisms in soymilk from different soybean varieties and their effects on antioxidant activity and oligosaccharide content.

Marguerite Niyibituronasa, Arnold Onyango, Svetlana Gaidashova, **Samuel Imathiu**, Marthe De Boevre, Diederik Leenknecht, Ellen Neyrinck, Sarah De Saeger, Pieter Vermeir and Katleen Raes, 2019. Journal of Food Research, 8, 41-51. DOI: 10.5539/jfr.v8n1p41.

Abstract

Soymilk is a good source of proteins and health-promoting isoflavones, but it contains oligosaccharides that cause flatulence. Fermenting it with probiotic bacteria may reduce the oligosaccharides and enhance its health benefits.The present study determined the growth of different lactic acid bacteria (LAB) in soymilk obtained from soybean varieties grown in Rwanda and the effect of fermentation on oligosaccharides that cause flatulence (stachyose, raffinose and verbascose), and antioxidant activity of fermented soybean milk. After fermentation at 30°C for 24 hours, *Lactobacillus plantarum, Lactobacillus acidophilus, Lactobacillus brevis, Lactobacillus reuteri, Lactobacillus rhamnosus, Lactococcus cremoris* and *Lactobacillus casei* attained around 8 log CFU/ml, which is sufficient for probiotic effects. However, only *L.reuteri, L.brevis* and *L.plantarum* caused sufficient drop in pH and increase in viscosity characteristic of a good fermented product. Soymilk from different soybean varieties did not show significant differences in the growth of these three LAB. These LAB reduced content of oligosaccharides and total polyphenols, but increased antioxidant activity in soymilk, which translate into health benefits of fermented soybean products.

Keywords: fermentation, lactic acid bacteria, polyphenols, raffinose, Rwanda

15. Bacterial contamination of selected fruits, fresh juice contact surfaces and processor's hands: potential risk for consumers' health in Uganda.

Phoebe P. Kaddumukasa**, Samuel M. Imathiu**, Julius M. Mathara and Jesca L. Nakavuma, 2019. Journal of Food Science and Nutrition Research, 2, 199-213.

Abstract

A cross sectional study to assess bacteriological safety of 60 fruits, 85 juice contact surfaces and 30 hands was carried out in Kampala, Uganda. Sampling was done according to ISO 18593. Mean aerobic plate counts of 8.3, 8.6 and 8.5 $\log_{10}$CFU/cm² on passion, mango and pineapple fruit surfaces respectively, were obtained. Juice dispensers, refrigerators and hands had mean aerobic plate counts of 5.6, 5.9 and 7 $\log_{10}$ CFU/cm² respectively. Mean coliform counts of 4, 3.9 and 3.7 $\log_{10}$ CFU/cm² were observed for dispenser, refrigerator and hands respectively. Mean *S. aureus* count of 5 $\log_{10}$ CFU/cm^2 and range from no detection to 6.8 $\log_{10}$ CFU/cm^2 was observed for dispenser surfaces. Thirty-eight (56.7%), n=67 refrigerators were contaminated with *S. aureus* above the detection limit. Eighteen (60%), of 30 hand samples were contaminated with *S. aureus* above the detection limit. *Staphylococcus aureus* was the most prevalent pathogen while *Salmonella* and *Listeria* spp were absent from all samples. One (6.7%) out of 15 coagulase positive isolates was positive for the *mec*A gene. These findings show that fruit, fresh juice contact surfaces and hands can be potential vehicles through which bacterial contamination could occur in fresh juices. There is therefore great need to emphasize stringent hygiene and use of good manufacturing practices to ensure production of microbiologically safe products.

Keywords: Bacterial contamination, food contact surfaces, fruit juice, microbial quality, refrigerators

16. Effect of pretreatments prior to drying on antioxidant properties of dried mango slices

Isaac O. Nyangena, Willis O. Owino, **Samuel Imathiu** and Jane Ambuko, 2019. Scientific African, 6, 1-9. DOI: https://doi.org/10.1016/j.sciaf.2019.e00148.

Abstract

Chemical, thermal or osmotic pretreatments prior to drying can improve the quality aspects of dried foods. Three pretreatments prior to drying were evaluated for antioxidant capacity in two mango varieties viz. Ngowe and apple that were dehydrated in either, oven (50 and 65 °C) and solar dryer.

The antioxidant properties analyzed included polyphenols, vitamin C, carotenoids, flavonoids and total antioxidant activity. Total polyphenol content was determined through Folin–Ciocalteu method and quantified using UV-Spectrophotometer. Vitamin C was analyzed by HPLC system while total carotenoids, total antioxidants, and flavonoids were analyzed using UV-Spectrophotometer at varied wavelengths. Method of drying and pretreatment type had significant effect ($p \leq 0.01$) on the flavonoid content, total carotenoids and β-carotene for differently pretreated and dried mango slices. The results showed increased content in total antioxidants, polyphenols and flavonoids for the pretreated and dried slices compared to the fresh samples of both varieties. The highest flavonoid content (43.66 ± 1.27 mg/100 g) was recorded in 1% citric acid pretreated samples dried at 50 °C while the lowest amount (16.73 ± 1.14 mg/100 g) was recorded in blanched Ngowe oven dried at 65 °C. Vitamin C decreased with increased drying temperature from 50–65 °C and the largest value (78.87 ± 0.46 mg/100 g) was observed in fresh Apple mango variety while the lowest value (28.45 mg/100 g) was observed in Ngowe variety samples oven dried at 65 °C for 10 h. β-carotene for dried mango slices ranged from 6.65 mg/100 g to 40.88 mg/100 g among the differently pretreated and dried mango slices and the values were lower than the content in fresh samples in the respective varieties. Total polyphenol content varied from 5.83–29.9 mg (GAE)/100 g. This research demonstrated that appropriate pretreatments in this case, 1% citric acid pretreatment prior to drying at 50 °C can enhance retention of antioxidants in dried mango product.

Keywords: Antioxidants, drying, mango, phenolics, pretreatment, vitamin C

17. Enhancement of anaerobic batch digestion of spineless cacti (Opuntia ficus indica) feedstock by aerobic pre-treatment.

H. Myovela, A.M. Mshandete and **S. Imathiu**, 2019. African Journal of Biotechnology, 18, 12-22. DOI: https://doi.org/10.5897/AJB2018.16652.

Abstract

One of the best options for African countries to meet rural energy needs is to grow care-free crassulacean acid metabolism plants on a massive scale in waste lands. This can enable bioenergy production without disrupting food supplies and hence sustainable energy supply for the future. *Opuntia ficus indica* is an ideal plant for arid regimes but has barely been studied as a potential bioenergy source. This study investigated the effect of aerobic pretreatment on methane yield of *O. ficus indica* biomass. This effect was investigated in batch bioreactors which were exposed to

aerobic conditions by varying time from 3 to 72 h before the start of anaerobic digestion. Reducing sugar content and dissolved oxygen levels after pretreatment period was analyzed. Reducing sugar content in bioreactors increased with increase in pretreatment time from 12.22 ±0.69 to 59.08 ± 5.35 g/L in the untreated and 72 h pretreated batches, respectively. Methane yields after pretreatment were observed to range from 0.286 to 0.702 L/kg volatile solids at 9 and 72 h of pre-treatment, respectively. A 9 h pre-treatment of feedstock prior to anaerobic digestion yielded 123% higher methane yield when compared to that without pre-treatment. The findings that there was an increase in reducing sugar production and methane yield at 9 h of aerobic pre-treatment suggests that there was increased hydrolysis with pretreatment. Hence, short pre-treatment period could be an option to increasing solubilization of cladodes and promoting methane productivity. Therefore, pre-aeration of *O. ficus indica,* was shown to be an effective method for enhancing both its digestibility and improved methane yield during anaerobic digestion.

Key words: Anaerobic digestion, biogas, methane, *Opuntia*, pretreatment, spineless cacti.

18. Effect of lactic acid bacteria starter cultures on vitamin and oligosaccharide composition of milk extracted from three common bean (*Phaselous Vulgaris* L) varieties.

C. Anino, A. Onyango, **S. Imathiu** and J. Maina, 2019. Journal of Food Research, 8, 103-110. DOI: 10.5539/jfr.v8n3p103.

Abstract

Fermented foods have in recent times attracted consumer interest mainly due to perceived health benefits of probiotic microorganisms. This study characterized changes in the concentrations of selected B-complex vitamins and oligosaccharides of common bean milk during fermentation by a common dairy starter culture, YF L-903 (*Streptococcus thermophilus* + *Lactobacillus Bulgaricus* subs *Debulgaricus*), and three probiotic cultures namely ABT (*Lactobacillus acidophilus* La-5 + *Bifidobacterium animalis* Bb-12 + *Streptococcus thermophilus*), Yoba (*Lactobacillus rhamnosus* yoba + *Streptococcus thermophilus*), and Yoba Fiti (*Lactobacillus rhamnosus* GR1 + *Streptococcus thermophilus*). Bean milk was prepared from three common bean varieties. It was found that, apart from thiamine (vitamin B1) and riboflavin (vitamin B2), fermentation with each of the mixed cultures caused significant increase in the vitamin B complex. Significant reductions ($p<0.05$) in the oligosaccharides concentration of thebean milks were observed upon fermentation. Highest reduction in the oligosaccharide sugars of 77.8% was found in milk from pinto bean variety

fermented with ABT culture. These findings suggest that LAB probiotic cultures have a potential for improving biosynthesis of vitamins and removal of the verbascose, stachyose and raffinose oligosaccharides, thus making the product more digestible and the nutrients more bioavailable.

Keywords: Common bean, bean milk, fermentation, vitamin biosynthesis.

19. Microbial quality of edible grasshoppers *Ruspolia differens* (Orthoptera: Tettigoniidae): From wild harvesting to fork in the Kagera Region, Tanzania.

J. Ng'ang'a**, S. Imathiu**, F. Fombong, M. Ayieko, J. Vanden Broeck and J. Kinyuru, 2019. Journal of Food Safety, 39, e12549. DOI: https://doi.org/10.1111/jfs.12549.

Abstract

In Tanzania, edible *Ruspolia differens* are still harvested from the natural environments. In this perspective, little is known about the microbiological quality of wild harvested *R. differens* . This study was conducted to assess the microbiological quality of wild harvested *R. differens* and evaluate the efficacy of conventional processing methods in reducing microbial load. Two districts (Bukoba rural and Muleba) within the Kagera region were purposively selected for the study. Sampling was done from the same batches along the *R. differens* food chain as follows: (a) at harvest points in the villages, (b) after transportation to the market and plucking of wings and legs, (c) after rinsing with potable tap water, and (d) after processing using conventional methods. Generally, high microbial counts, that is, total viable aerobic count (TVC), *Enterobacteriaceae* , lactic acid bacteria, bacterial endospores, and yeasts and molds were observed in raw *R. differens* samples. A significant increase in microbial counts after transportation and plucking was only observed for TVC, bacterial endospores, and yeasts and molds. A statistically significant reduction in all types of counts, with the exception of bacterial endospores, was observed after processing. All processed samples analyzed were devoid of salmonellae, *Listeria monocytogenes* , and *Escherichia coli* .

Keywords: entomophagy, microbial counts, processing methods, bacterial endospores, handling.

20. The effect of different processing methods on nutrient and isoflavone content of soymilk obtained from six varieties of soybean grown in Rwanda.

M. Niyibituronsa, A.N. Onyango, S. Gaidashova, **S. Imathiu**, M. Uwizerwa, Emelda Phillis Ochieng, Fredrick Ng'ang'a, Josephine Birungi, Sita Ghimire and Jagger Harvey, 2019. Food science and nutrition, 7, 457-464. DOI: https://doi.org/10.1002/fsn3.812.

Abstract

Soymilk is rich in nutrients and isoflavones, and could greatly promote nutrition and health. However, this product is not widely accepted due to an objectionable beany flavor. Several methods involving heat treatment and soaking in basic solutions prior to soymilk extraction have been reported to reduce the objectionable flavor. However, the effects of such treatments on the nutritional value and isoflavone content of soymilk, and the responses of different soybean varieties to nutrient extraction by these methods is not well studied. The aim of this study was to determine the effect of three processing methods on protein, fat, minerals, and isoflavone content in soymilk from six soybean varieties grown in Rwanda (Peka-6, SB 24, Sc. Sequel, Sc, Squire, and a local variety) to find the best variety and processing method. The first method (M1) involved soaking soybeans in water for 12 hr prior to milk extraction, M2 involved blanching in $NaHCO_3$ prior to extraction and M3 involved soaking in $NaHCO_3$ solution for 16 hr and subsequent cooking prior to extraction. M1 resulted in significantly higher nutrient and isoflavone extraction than M2 and M3. Thus, M1 extracted more nutrients and can be recommended for soymilk production. However, where consumers prefer soymilk obtained by M2 or M3, Sc Squire and the local variety may be recommended. Sc. Squire has another advantage of higher isoflavone content than the other varieties. Further comprehensive studies on the sensory acceptability of products made from different varieties by different methods among different consumer categories will be necessary.

Key words: chemical composition, fat, *Glycine max*(L.), *Merrill*, minerals, protein

21. Chemical composition of the seed and 'milk' of three common bean (*Phaseolus vulgaris* L) varieties.

C. Anino, A.N. Onyango, **S. Imathiu**, J. Maina and F. Onyangore, 2019. Journal of Food Measurement and Characterization, 13, 1242-1249. DOI: https://doi.org/10.1007/s11694-019-00039-1.

Abstract

Beans are a good source of nutrients and a variety of phytochemicals such as flavonoids, tannins and phytates. On the one hand, these non-nutrient phytochemicals reduce nutrient bio availability, but on the other hand they have some health benefits including reducing the risks for aging-related diseases. This study investigated the content of nutrients and non-nutrient phytochemicals in three varieties of common beans, namely red haricot, pinto and yellow kidney beans, and their corresponding milk extracts. Carbohydrates were the most abundant nutrient in the beans (63–66%), followed by proteins (21–24%), crude fiber (5–7%), crude ash (4–5%), and crude fat (2–3%). The beans were also rich in non-nutrient phytochemicals. The protein, carbohydrate and fat contents of the milk (18–26%, 63–67%, and 3–4%, respectively) did not differ much from the beans. Unlike the beans, the milk lacked crude fiber, and had greatly reduced ash (2%) and phytochemicals. Consistent with the reduction in ash, there was a reduction in minerals; calcium, iron, zinc and magnesium in the milk. The reduction in minerals was less than the reduction of phytates, indicating that the milk may have higher bioavailability of minerals than the beans. The milk also had higher protein digestibility. Thus, consumption of bean milk may be encouraged as an alternative way of bean consumption, especially by individuals whose greater needs are for nutrients rather than phytochemicals. The bean varieties had significant differences in the retention of nutrients and phytochemicals, and such differences should be considered during bean milk production.

Keywords: Common beans, bean milk, anti-nutrients.

22. Effect of selected pretreatments prior to drying on physical quality attributes of dried mango chips.

I. Nyangena, W. Owino, J .Ambuko and **S. Imathiu**, 2019. Journal of food science and technology, 56, 3854-3863. DOI: https://doi.org/10.1007/s13197-019-03857-9.

Abstract

This study investigated the effect of pretreatments namely citric acid, lemon juice and blanching on the physical attributes of dried chips from two popular commercial mango varieties grown in Kenya viz 'Apple' and 'Ngowe'. The pretreated mango chips were either subjected to a convective dryer or solar drying. Moisture content, extent of dryness, rehydration characteristics, water activity and color retention were determined to establish the effect of the pretreatments before drying on physical quality attributes of dried mango chips. Moisture content, water activity and color were determined using standard procedures. Equilibrium relative humidity was estimated using Drycard™. Results obtained indicated that optimal drying was achieved with dryer temperatures of 50 °C and 65 °C for 10 and 7 h respectively that reduced moisture content to ~ 11% and water activity to below 0.65 (sufficient for inhibited spoilage). The best color parameters and rehydration characteristics were observed with 1% citric acid and 0.5 v/v lemon acid pretreated samples. Blanched as well as control (untreated) samples showed relatively poor color retention in relation to flesh mango chips and had the least rehydration ratio (1.65 ± 0.01) and coefficient of rehydration (0.33 ± 0.1). As pretreatments before drying affect physical parameters of dried mango chips, the best choice of pretreatments should be made to produce high quality end products. Citric acid and lemon juice pretreatments before drying at 50 °C and 65 °C had the optimal outcome and produced the best physical quality parameters.

Keywords: Fruits, drying, equilibrium relative humidity, moisture content, dehydration, mango

23. Socio-demographic characteristics of vendors and manufacturing practices of fresh unpasteurized fruit and vegetable juices in Kampala, Uganda.

Phoebe Kaddumukasa, **Samuel Imathiu**, Julius Maina Mathara and Jesca L. Nakavuma, 2019. International Journal of Advanced Research, 7, 372-379. DOI: 10.21474/IJAR01/8337

Abstract

Fresh juices as beverages are valued because they offer numerous health benefits to consumers. However, the manufacturing methods used in their preparation produce a great variation in terms of product quality. The aim of this study was to examine fresh juice production practices and determine the socio-demographic characteristics of vendors involved in the juice business in Kampala. A structured questionnaire was used to examine the practices of ninety juice vendors using the interview method. Findings from the study indicate that different blends of fresh juice were made with passion fruit as the main type of a single beverage. Poor manufacturing practices used in extraction of the juices were statistically significant ($p<0.05$). Women (74%) with low level of education dominated the production and vending of juices. Statistically significant ($p <0.05$) vending practices were observed for the following manufacturing practices namely; fruit vegetable and juice storage; sanitation of equipment, transportation of fresh produce and level of education within the food establishments. Great need in the use of good manufacturing practices by all juice vendors should be promoted and encouraged by the government and all concerned regulatory bodies in Kampala.

Keywords: Fresh juice, preparation, practices, storage, vending.

Dr. Julius Maina Mathara

1. Dominic A. Stoll, Eliud N. Wafula, **Julius M. Mathara**, Bernhard Trierweiler, Sabine E. Kulling , Melanie Huch (2021. Fermentation of African nightshade leaves with lactic acid bacterial starter cultures. International Journal of Food Microbiology 342 (2021) 109056

Abstract

The interest in the consumption of African indigenous leafy vegetables increased in African countries, e.g., Kenya, within the last years. One example of African indigenous leafy vegetables is African nightshade (Solanum scabrum) which is nutritious, rich in proteins and micronutrients and therefore could contribute to a healthy diet. African nightshade has several agricultural advantages. However, the most important disadvantage is the fast perishability which leads to enormous post-harvest losses. In this study, we investigated the fermentation of African nightshade as a post-harvest processing method to reduce post-harvest losses. The two lactic acid bacterial starter strains *Lactiplantibacillus plantarum* BFE 5092 and *Limosilactobacillus fermentum* BFE 6620 were used to inoculate fermentations of African nightshade leaves with initial counts of 106–107 cfu/ml. Uninoculated controls were conducted for each fermentation trial. Fermentations were performed both in Kenya and in Germany. The success of the inoculated starter cultures was proven by the measurement of pH values and determination of lactic acid concentration.

Lactobacilli strains dominated the microbiota of the starter inoculated samples in contrast to the non-inoculated controls. This was supported by classical culture-dependent plating on different microbiological media as well as by the culture-independent molecular biological methods denaturing gradient gel electrophoresis and 16S rRNA gene high-throughput amplicon sequencing. We could demonstrate that the use of the selected starter cultures for fermentation of African nightshade leaves led to controlled and reliable fermentations with quick acidification. Thus, controlled fermentation with appropriate starter cultures is a promising method for post-harvest treatment of African nightshade leaves.

2. Vivian C. Kitum, Peter K. Kinyanjui, **Julius M. Mathara**, and Daniel N. Sila (2020). Effect of Lb. plantarum BFE 5092 Fermentation on Antinutrient and Oligosaccharide Composition of Whole Red Haricot Bean (Phaseolus vulgaris L), International Journal of Food Science Volume 2, 2020, Pg. 1-8

Abstract

Common beans are a leguminous plant of the genus Phaseolus. They are rich in protein, energy, and minerals. They confer a wide range of health benefits when consumed. Utilization of common bean has however been poor due to high antinutrient content that results in reduced nutrient digestibility and mineral bioavailability. Flatulence after consumption is also a huge deterrent to common bean consumption. Lactic acid fermentation is the most common form of food fermentation with the Lactobacilli spp dominating most spontaneous fermentations. The objective of this study was to determine the effect of lactic acid bacteria (LAB) on the antinutrient and flatulence causing oligosaccharide composition of red haricot bean. A factorial research design was used in the study. Red haricot beans were sorted and soaked for 15 h. The soaked beans were fermented in 2% salt-sugar solutions for 120 h. Experimental batch was inoculated with Lb. plantarum BFE 5092 (IF), and the control batch was spontaneously fermented (SF). Microbial growth and pH were monitored every 24 h during fermentation. After fermentation, the beans were dried and milled, and the flours were subjected to biochemical analysis. ANOVA was done using SPSS statistics 23. The pH decreased significantly () from 6.06 to 3.9 in both batches at the end of fermentation. The LAB counts significantly increased in both batches, whereas coliform counts decreased significantly (). Fungi were not detected in both batches. Soaking lowered tannins and phytates and raffinose concentrations significantly but had no significant effect on stachyose concentration. At the end of 120 h of fermentation, the tannin content was 109.50 and 54.04 mg/100 g in IF and SF, respectively. Phytates were at 242.52 and 163.43 mg/100 g in IF and SF, respectively. Raffinose content was 32.85 and 32.58 mg/100 g in IF and SF, respectively, while stachyose content was 593.33 and 467.49 mg/100 g in IF and SF, respectively. This research showed that LAB is able to ferment soaked whole red haricot and lower the tannin, phytate, raffinose, and stachyose content significantly. Spontaneous fermentation lowered these antinutrients and oligosaccharides better than inoculation with *Lb. plantarum* BFE 5092.

3. Alice Nyambura Maina, Francis B. Mwaura , Miriam Jumba , Peter Muturi , Kering Kimutai , David Goulding , Derek Pickard , Ana L. Toribio **, Julius M. Mathara**. (2020). Newly isolated vibrio cholerae bacteriophages from environmental waters of Kenya, International Journal of Life Sciences Research ISSN 2348-3148, Vol. 8, Issue 3, pp: (20-26),

Abstract:
Viruses that infect bacteria are known as bacteriophages and can be used as biocontrol agents to complement antibiotics. The aim of the study was to isolate Vibrio cholerae lytic bacteriophages from environmental waters of different regions in Kenya that included: Lake Victoria, Coast, Nairobi and Central. A total of 140 environmental water samples were collected from ponds, rivers, lake, beaches, springs, boreholes, wells and Indian Ocean. Pathogenic Vibrio cholerae strains isolated from some these sources were used as respective propagating strains for isolation of vibriophages. Identification of the Vibrio cholerae bacterial strains by Polymerase Chain reaction was through amplification and sequencing of partial 16S ribosomal RNA gene. In total, 15 Vibrio cholerae bacteriophages were isolated; nine from rivers, three from beaches and three from ponds using the double layer method of purification. Lytic spectrum confirmed that all the 15 bacteriophages were infective to both environmental and clinical Vibrio cholerae isolates. Further characterization by Transmission Electron Microscope assigned the vibriophages to order Caudovirales of Myoviridae family owing to their icosahedral capsid and contractile tails. The average tail length, head diameter were 90nm and 79nm respectively. The current study has proved that vibriophages have established a niche in Kenyan environmental waters. The bacteriophages may have the potential for biocontrol of Vibrio cholerae bacterium.

4. Elijah Heka Kamau, **Julius Maina Mathara** and Glaston Mwangi Kenji (2020). Characterization of the Chemical and Phytochemical Profiles during Fruit Development and Ripening in Selected Cultivars of African Nightshade (Solanum Nigrum Complex) Edible Berries. Journal of Agricultural Studies, 2020, Vol. 8, No. 2 pg. 806-819.

Abstract:
Solanum nigrum complex is a green, indigenous leafy vegetable that grows in many parts of the world and its utilization can deliver more nutrients and phytochemicals into the diet. Even though it can help in alleviating the burden of hidden hunger, only the leafy part is utilized whereas the plant has edible berries. This study sought to address the problem of underutilization by looking at the benefits that can be derived from the berries. Four varieties of the plant were harvested through four stages; green, colour break, ripe and at senescence. Chemical analyses of the berries were done to determine the content and changes in macro and micro-nutrients and the phytochemical content of the berries as they ripened. Analysis of Variance (ANOVA) was used to determine the significant difference between nutrient and phytochemical composition of the different S. nigrum varieties at different ripening stages. The results show that fibre, ash and protein increased at senescence while carbohydrates decreased. Magnesium was the most abundant mineral. As berries ripened, oxalates, total phenols, flavonoids

and phytates decreased while Vitamin C, tannins and total carotenoids increased. Conclusively, the berries in this study have comparable nutritional value with other commonly consumed fruits and could, therefore, be incorporated into the family pot.

5. Phoebe P. Kaddumukasa, Samuel M. Imathiu, **Julius M. Mathara** and Jesca L. Nakavuma (2019). Socio-Demographic Characteristics Of Vendors And Manufacturing Practices Of Fresh Unpasteurized Fruit And Vegetable Juices In Kampala, Uganda. Int. J. Adv. Res. 7(1), 372-379

Abstract
Fresh juices as beverages are valued because they offer numerous health benefits to consumers. However, the manufacturing methods used in their preparation produce a great variation in terms of product quality. The aim of this study was to examine fresh juice production practices and determine the socio-demographic characteristics of vendors involved in the juice business in Kampala. A structured questionnaire was used to examine the practices of ninety juice vendors using the interview method. Findings from the study indicate that different blends of fresh juice were made with passion fruit as the main type of a single beverage. Poor manufacturing practices used in extraction of the juices were statistically significant ($p<0.05$). Women (74%) with low level of education dominated the production and vending of juices. Statistically significant ($p <0.05$) vending practices were observed for the following manufacturing practices namely; fruit vegetable and juice storage; sanitation of equipment, transportation of fresh produce and level of education within the food establishments. Great need in the use of good manufacturing practices by all juice vendors should be promoted and encouraged by the government and all concerned regulatory bodies in Kampala.

6. Elijah H. Kamau, **Julius M. Mathara**, and Glaston M. Kenji (2020). Sugar Content and Physical Characterization of Four Selected African Nightshade (Solanum nigrum) Edible Berries. European journal of Agriculture and Food Science Vol.2 (3) May 2020 pg. 1-8

Abstract:
Fruits constitute a major part of the diet in many parts of the world, highly recommended for the nutritional value derived from them. Fruit maturity is an important determinant of the quality as it affects the appearance, an aspect of quality considered by most consumers. Sugar content, colour, size and firmness are some of the quality indicators associated with maturity. While the ripening and maturity indicators are well documented for climacteric fruits, non-climacteric fruits such as berries lag behind. African nightshade (*Solanum nigrum* L.) edible berries are among them. This study evaluated the quality parameters of the edible berries of four varieties of African nightshade and found out that they accumulate glucose and fructose as they ripen with glucose being the most abundant sugar. Sucrose is only present during the senescence stage. Size remained relatively constant within each variety while firmness decreased progressively after veraison. Black NS differed with the others in colour besides fructose and sucrose content at 29.35 and 388.40 mg/100g, respectively. Giant NS recorded the highest glucose content at 172.44 mg/100g when ripe.

Conclusively, the African nightshade berries are characteristically similar to other non-climacteric fruits adopted as part of the normal diet and should be considered as a valuable addition to the diet.

7. Phoebe P Kaddumukasa, Samuel M Imathiu, **Julius M Mathara**, Jesca L Nakavuma (2019) Bacterial Contamination of Selected Fruits, Fresh Juice Contact Surfaces and Processor's Hands: Potential Risk for Consumers' Health in Uganda. J Food Sci Nutr Res 2019; 2 (3): 199-213

Abstract

A cross sectional study to assess bacteriological safety of 60 fruits, 85 juice contact surfaces and 30 hands was carried out in Kampala, Uganda. Sampling was done according to ISO 18593. Mean aerobic plate counts of 8.3, 8.6 and 8.5 log10CFU/cm² on passion, mango and pineapple fruit surfaces respectively, were obtained. Juice dispensers, refrigerators and hands had mean aerobic plate counts of 5.6, 5.9 and 7 log10 CFU/cm² respectively. Mean coliform counts of 4, 3.9 and 3.7 log10 CFU/cm² were observed for dispenser, refrigerator and hands respectively. Mean S. aureus count of 5 log10 CFU/cm2 and range from no detection to 6.8 log10 CFU/cm2 was observed for dispenser surfaces. Thirty-eight (56.7%), n=67 refrigerators were contaminated with S. aureus above the detection limit. Eighteen (60%), of 30 hand samples were contaminated with S. aureus above the detection limit. Staphylococcus aureus was the most prevalent pathogen while Salmonella and Listeria spp were absent from all samples. One (6.7%) out of 15 coagulase positive isolates was positive for the mecA gene. These findings show that fruit, fresh juice contact surfaces and hands can be potential vehicles through which bacterial contamination could occur in fresh juices. There is therefore great need to emphasize stringent hygiene and use of good manufacturing practices to ensure production of microbiologically safe products.

8. Calvince Anino, Arnold N. Onyango, Samuel Imathiu, **Julius Maina**, Faith Onyangore (2019). Chemical composition of the seed and 'milk' of three common bean (Phaseolus vulgaris L) varieties. Journal of Food Measurement and Characterization 13, 1242-1249.

Abstract:

Beans are a good source of nutrients and a variety of phytochemicals such as flavonoids, tannins and phytates. On the one hand, these non-nutrient phytochemicals reduce nutrient bio availability, but on the other hand they have some health benefits including reducing the risks for aging-related diseases. This study investigated the content of nutrients and non-nutrient phytochemicals in three varieties of common beans, namely red haricot, pinto and yellow kidney beans, and their corresponding milk extracts. Carbohydrates were the most abundant nutrient in the beans (63–66%), followed by proteins (21–24%), crude fiber (5–7%), crude ash (4–5%), and crude fat (2–3%). The beans were also rich in non-nutrient phytochemicals. The protein, carbohydrate and fat contents of the milk (18–26%, 63–67%, and 3–4%, respectively) did not differ much from the beans. Unlike the beans, the milk lacked crude fiber, and

had greatly reduced ash (2%) and phytochemicals. Consistent with the reduction in ash, there was a reduction in minerals; calcium, iron, zinc and magnesium in the milk. The reduction in minerals was less than the reduction of phytates, indicating that the milk may have higher bioavailability of minerals than the beans. The milk also had higher protein digestibility. Thus, consumption of bean milk may be encouraged as an alternative way of bean consumption, especially by individuals whose greater needs are for nutrients rather than phytochemicals. The bean varieties had significant differences in the retention of nutrients and phytochemicals, and such differences should be considered during bean milk production.

9. Haeyoung Jeong; Sanghaeng Choi; Gun-Seok Park; Yosep Ji; Soyoung Park; Wilhelm Heinrich Holzapfel; **Julius Maina Mathara** and Jihee Kang. (2019). Comparative Genomic Analysis of Lactobacillus rhamnosus BFE5264, a Probiotic Strain Isolated from Traditional Maasai Fermented Milk Microbiol. Biotechnol. Lett. (2019), 47(1), 25–33

Abstract

Lactobacillus rhamnosus BFE5264, isolated from a Maasai fermented milk product ("kule naoto"), was previously shown to exhibit bile acid resistance, cholesterol assimilation, and adhesion to HT29-MTX cells in vitro. In this study, we re-annotated and analyzed the previously reported complete genome sequence of strain BFE5264. The genome consists of a circular chromosome of 3,086,152 bp and a putative plasmid, which is the largest one identified among L. rhamnosus strains. Among the 2,883 predicted protein-coding genes, those with carbohydrate-related functions were the most abundant. Genome analysis of strain BFE5264 revealed two consecutive CRISPR regions and no known virulence factors or antimicrobial resistance genes. In addition, previously known highly variable regions in the genomes of L. rhamnosus strains were also evident in strain BFE5264. Pairwise comparison with the most studied probiotic strain L. rhamnosus GG revealed strain BFE5264-specific deletions, probably due to insertion sequence-mediated recombination. The latter was associated with loss of the spaCBA pilin gene cluster and exopolysaccharide biosynthetic genes. Comparative genomic analysis of the sequences from all available L. rhamnosus strains revealed that they were clustered into two groups, being within the same species boundary based on the average nucleotide identities. Strain BFE5264 had a sister group relationship with the group that contained strain GG, but neither ANI-based hierarchical clustering nor core-gene-based phylogenetic tree construction showed a clear distinctive pattern associated with the isolation source, implying that the genotype alone cannot account for their ecological niches. These results provide insights into the probiotic mechanisms of strain BFE5264 at the genomic level. Keywords: Lactobacillus, Lactobacillus rhamnosus, genome analysis, comparative genomic analysis, probiotics

10. Calvince Anino; Arnold Onyango; Samuel Imathiu & **Julius Maina** (2019). Effect of Lactic Acid Bacteria Starter Cultures on Vitamin and Oligosaccharide Composition of Milk Extracted from Three Common Bean (*Phaseolus Vulgaris* L) Varieties Journal of Food Research; Vol. 8, No. 3; 2019 103 – 110

Abstract

Fermented foods have in recent times attracted consumer interest mainly due to perceived health benefits of probiotic microorganisms. This study characterized changes in the concentrations of selected B-complex vitamins and oligosaccharides of common bean milk during fermentation by a common dairy starter culture, YF L-903 (*Streptococcus thermophilus* + *Lactobacillus bulgaricus subs debulgaricus*), and three probiotic cultures namely ABT (*Lactobacillus acidophilus* La-5 + *Bifidobacterium animalis* Bb-12 + *Streptococcus thermophilus*), Yoba (*Lactobacillus rhamnosus* yoba + *Streptococcus thermophilus*), and Yoba Fiti (*Lactobacillus rhamnosus* GR1 + *Streptococcus thermophilus*). Bean milk was prepared from three common bean varieties. It was found that, apart from thiamine (vitamin B1) and riboflavin (vitamin B2), fermentation with each of the mixed cultures caused significant increase in the vitamin B complex. Significant reductions ($p<0.05$) in the oligosaccharides concentration of the bean milks were observed upon fermentation. Highest reduction in the oligosaccharide sugars of 77.8% was found in milk from pinto bean variety fermented with ABT culture. These findings suggest that LAB probiotic cultures have a potential for improving biosynthesis of vitamins and removal of the verbascose, stachyose and raffinose oligosaccharides, thus making the product more digestible and the nutrients more bioavailable.

11. J.W. Gatheru , F.M. Khamis , F.L.O. Ombura , J. Nonoh , C.M. Tanga , **J. Maina** , S.A. Mohamed , S. Subramanian , S. Ekesi , and K.K.M. Fiaboe (2019). Impact of processing methods on microbial load of reared and wild-caught edible crickets (*Scapsipedus icipe* and *Gryllus bimaculatus*) in Kenya. Journal of Insects as Food and Feed: 0 (0)- 1 – 14.

Abstract

The microbial composition of farmed and wild Scapsipedus icipe and Gryllus bimaculatus is presented. The aim of this study is to determine the microbial load of the two cricket species and evaluate the efficiency of processing methods (boiling, sun-drying, freeze-drying, snap-freezing and deep-frying) in reducing microbial counts. Farmed and wild species were compared based on microbial diversity. Fresh crickets had high microbial counts, bacterial and fungal populations ranged from 4.26-4.58 log cfu/g and 3.48-4.48 log cfu/g fresh weight, respectively. Upon processing, microbial counts reduced, bacterial counts ranged from 1.00-2.08 log cfu/g dry weight (boiled) and 2.70-3.34 log cfu/g dry weight (sun-dried). Fungal counts ranged from1.85-1.95 log cfu/g dry weight (boiled) and 2.95-3.51 log cfu/g dry weight (sun-dried). Deep-frying, freeze-drying and snap-freezing emerged as the best processing methods. Although there is no alarm in consuming fresh crickets, a processing method is advisable to minimize any possible risks.

Dr. Peter Kahenya

1. Food Fortification: The Level of Awareness among Kenyan Consumers

Authors: Amaya Aura Linda, Florence Kyallo, Judith K Okoth, Peter Kahenya, Anselimo Makokha, Daniel Sila, John Mwai
Publication date: 2020/4/7
Journal: Journal of nutrition and metabolism
Volume: 2020

Abstract
More than half of the morbidity and mortality cases among children in Kenya are as a result of micronutrient deficiencies (MNDs). Food fortification is considered by the Government of Kenya as a feasible strategy for addressing MNDs. Worldwide, fortification has been proven to be effective since it does not require any change in dietary habits. Success of large-scale food fortification however may depend on consumer awareness of the fortification benefits. A cross-sectional study was conducted in 13 counties to collect information on fortification awareness using structured questionnaires. 1435 respondents were selected using the Lot Quality Assurance Sampling method. Data were analyzed using Stata version 14.0 and statistical significance. The study participants were described using descriptive statistics. The association of sociodemographic characteristics and awareness of fortification was performed using binary logistic regression analysis. The median age of the study participants was 35 years. Only 28% of the respondents were aware of the term "fortification." Of the respondents, about 27% heard of food fortification through radio. Vernacular radio emerged as the most preferred channel for communicating fortification information among 24.9% of the respondents. Although awareness of vitamins (32%) and minerals (1.5%) was limited, most (76%) respondents reported of existence of health risks for lacking micronutrients. Awareness of food fortification was significantly associated with respondents' occupation (), household size (), education levels (), and age ().

2. Effect of Lb. plantarum BFE 5092 Fermentation on Antinutrient and Oligosaccharide Composition of Whole Red Haricot Bean (Phaseolus vulgaris L)

Authors: Vivian C Kitum, Peter K Kinyanjui, Julius M Mathara, Daniel N Sila
Publication date: 2020/8/10
Journal: International Journal of Food Science
Volume: 2020

Abstract
Common beans are a leguminous plant of the genus Phaseolus. They are rich in protein, energy, and minerals. They confer a wide range of health benefits when consumed. Utilization of common bean has however been poor due to high antinutrient content that results in reduced nutrient digestibility and mineral bioavailability. Flatulence after consumption is also a huge deterrent to common bean consumption. Lactic acid fermentation is the most common form of food fermentation with the Lactobacilli spp

dominating most spontaneous fermentations. The objective of this study was to determine the effect of lactic acid bacteria (LAB) on the antinutrient and flatulence causing oligosaccharide composition of red haricot bean. A factorial research design was used in the study. Red haricot beans were sorted and soaked for 15 h. The soaked beans were fermented in 2% salt-sugar solutions for 120 h. Experimental batch was inoculated with Lb. plantarum BFE 5092 (IF), and the control batch was spontaneously fermented (SF). Microbial growth and pH were monitored every 24 h during fermentation. After fermentation, the beans were dried and milled, and the flours were subjected to biochemical analysis. ANOVA was done using SPSS statistics 23. The pH decreased significantly () from 6.06 to 3.9 in both batches at the end of fermentation. The LAB counts significantly increased () in both batches, whereas coliform counts decreased significantly (). Fungi were not detected in both batches. Soaking lowered tannins and phytates and raffinose concentrations significantly but had no significant effect on stachyose concentration.

3. Prediction of cooking times of freshly harvested common beans and their susceptibility to develop the Hard-To-Cook defect using near infrared spectroscopy

Authors: Elizabeth N Wafula, Irene N Wainaina, Carolien Buvé, Peter K Kinyanjui, Wouter Saeys, Daniel N Sila, Marc EG Hendrickx
Publication date: 2021/1/26

Abstract
The cooking time of common beans is influenced by genotype and storage conditions. This study aimed to use near-infrared (NIR) spectra of milled, freshly harvested (fresh) beans to predict their cooking times and their susceptibility to develop the storage-induced, hard-to-cook (HTC) defect. The physical characteristics of bean accessions, from two different seasons, were evaluated. The cooking times and susceptibility to HTC (determined by aging under standard adverse conditions) of the aforesaid beans were correlated to NIR spectra to develop calibrations using variable selection and partial least squares regression. The beans exhibited diverse physical characteristics, cooking times and susceptibility to HTC. The models predicting cooking times of fresh beans sufficiently overcame genotype and seasonal differences (R^2_P = 0.73, RMSEP = 4 min).

4. Status of commercial maize milling industry and flour fortification in Kenya

Authors: S Khamila, DS Ndaka, A Makokha, F Kyallo, PK Kinyanjui, OJ Kanensi, J Mwai
Publication date: 2019/3/31
Journal: African Journal of Food Science
Volume: 13, Issue, 3, Pages 65-82

Abstract
Maize is the most widely consumed staple food by the Kenyan population. Its wide consumption and centralized processing make it an appropriate fortification vehicle to supply essential micronutrients to the population. The legislation was enacted in 2012 that

makes it mandatory for all commercial maize mills in Kenya to fortify the maize flour with specified micronutrients as a public health effort to reduce the prevalence of micronutrient deficiencies. However, there is limited information on the current status of maize milling and implementation of the flour fortification programme by these mills. A cross-sectional study was therefore carried out to characterize the commercial maize mills and determine the status of flour fortification in Kenya. Questionnaires were used to collect data. Information was obtained from 22 large-scale, 25 medium-scale and 31 small-scale mills.

5. Application of near-infrared spectroscopy to predict the cooking times of aged common beans (Phaseolus vulgaris L.)

Authors: Elizabeth Nakhungu Wafula, Irene Njoki Wainaina, Carolien Buvé, Peter Kahenya Kinyanjui, Wouter Saeys, Daniel Ndaka Sila, Marc Hendrickx
Publication date: 2020/11/1
Journal: Journal of Food Engineering
Volume: 284, Pages 110056

Abstract
The cooking time of beans is an important quality indicator which can change considerably during ageing. Therefore, this study investigated the potential of near-infrared spectroscopy to rapidly predict cooking times of aged common beans. Four bean varieties were aged under different storage conditions, resulting in a range of samples for each of these varieties. The cooking kinetics of the aged beans were determined by finger pressing and modelled using logistic regression to obtain the times it took to cook 95% of the beans. The cooking times obtained were predicted from the NIR spectra of milled raw bean samples. This was done using partial least squares regression, after carrying out wavelength selection. Model performance was improved up to an average prediction error of 8 min by de-hulling the beans and reducing the number of varieties included.

6. Status of aflatoxin contamination in cow milk produced in smallholder dairy farms in urban and peri-urban areas of Nairobi County: a case study of Kasarani sub county, Kenya

Authors: Irene Kagera, Peter Kahenya, Florence Mutua, Gladys Anyango, Florence Kyallo, Delia Grace, Johanna Lindahl
Publication date: 2019/1/1
Journal: Infection ecology & epidemiology
Volume 9; Issue 1; Pages 1547095

Abstract
Introduction: Milk consumption in Kenya supersedes other countries in East Africa. However, milk contamination with aflatoxin M1 (AFM1) is common, but the magnitude of this exposure and the health risks are poorly understood and need to be monitored routinely. This study aimed at assessing the awareness, knowledge and practices of urban and peri-

urban farmers about aflatoxins and determining the levels of aflatoxin contamination in on-farm milk in a selected area within Nairobi County.

Materials and methods: A cross-sectional study was undertaken to assess aflatoxin contamination levels of milk in Kasarani sub-county. A total of 84 milk samples were collected from small-holder dairy farms and analyzed for AFM1 using Enzyme-Linked Immunosorbent Assay (ELISA).

Results and Discussion: Ninety nine percent of the samples (83/84) analysed were contaminated with AFM1.

Dr. Paul Karanja

1. **Author(s**): George Ooko Abong, Jackline Akinyi Ogolla, Michael Wandayi Okoth, Bruno De Meulenaer, Jackson Ntongai Kabira, **Paul Karanja**, Jacxsens Liesbeth

Title of Publication: Dietary acrylamide intake by potato crisps consumers: A case of Nairobi County

Abstract:
The levels of acrylamide intake because of potato crisps consumption remains unknown in Kenyan context. This study assessed the exposure to acrylamide because of consumption of potato crisps in Nairobi, Kenya. A cross-sectional survey was carried out among 315 crisps consumers in Nairobi, and consumption patterns were collected using a pre-tested structured 7-day recall questionnaire. A total of 43 branded and 15 unbranded potato crisps samples were purchased in triplicates of 100 g and acrylamide was quantified using a gas chromatograph with a flame ionization detector. Consumption data were combined with the data on acrylamide contents from which dietary acrylamide intake was calculated using a probabilistic approach based on risk analysis software for excel. The mean estimated acrylamide intake was 1.57 μg/kg body weight (BW) per day while the 95th (P95) percentile was 5.1 μg/kg BW per day, with margins of exposures (MOE) being 197 and 61, respectively. The intake of acrylamide was significantly ($P < 0.05$) higher in unbranded crisps with a mean value of 2.26 and 95th percentile of 6.54 μg/kg BW per day, MOE being 137 and 47, respectively. There were extremely lower MOE indicating higher exposure to acrylamide by the consumers mainly because of the higher acrylamide contents in potato crisps, and hence the need for mitigation measures.

Name of journal: Open Agriculture 2020; 5: 871–878
Year of Publication: 2020

2. **Author(s**): Johnson Mwove, Samuel Imathiu, Irene Orina and **Paul Karanja**

Title of Publication: Food safety knowledge and practices of street food vendors in selected locations within Kiambu County, Kenya

Abstract: The safety of street foods remains a public health concern especially in developing countries like Kenya where foodborne illnesses associated with these foods have often been reported. This study determined the food hygiene and safety knowledge and practices of 345 street food vendors (SFVs) in selected locations within Kiambu County, Kenya. Data collection was accomplished through face-to-face interviews using structured questionnaires and extensive observation using an assessment tool for observation of personal hygiene and food handling practices of SFVs and the condition of the vending environment. The results indicated that the majority of the SFVs were male (63.2%) with 38.1% of them having attained secondary school education. About 93% of the SFVs had not received any formal training on food hygiene and safety. Majority of SFVs handled food with bare hands (96.8%) or handled money while serving food without washing hands (86.1%). Few also practiced preservation with 78.3% storing foodstuff that required refrigeration at ambient temperatures while 22.3% stored leftovers without any form of preservation and sold them the following day. Whereas public health officers' visits were found to significantly ($P<0.0001$) motivate SFVs to obtain a food handler's medical certificate, only about 27% had obtained it. These findings suggest that street vended foods sold in this study area may pose a significant potential hazard to public health due to the poor hygiene and handling practices reported.

Name of journal: African Journal of Food Science, Vol. 14(6) pp. 174-185, DOI: 10.5897/AJFS2020.1929

Year of Publication: 2020

3. Author(s): Johnson Mwove, Samuel Imathiu, Irene Orina and **Paul Karanja**

Title of Publication:
Multinomial Logistic Regression Analysis of Factors Influencing Food Safety, Hygiene Awareness and Practices Among Street Food Vendors In Kiambu County, Kenya**.**

Abstract
Street food vending is a very popular and unique part of the informal sector, particularly in developing countries. However, the safety of street vended foods is a major public health concern since poor food safety and hygiene knowledge and practices are often reported among street food vendors (SFVs). The objective of this study was to identify the factors influencing food safety, hygiene awareness and practices (FSHAP) among SFVs in Kiambu County, Kenya. Structured questionnaires and an observation checklist were administered to randomly selected 345 SFVs. Results showed that good food safety and hygiene awareness scores were significantly ($P<0.05$) influenced by education level, food hygiene and safety training, mobility of SFVs, public health inspection, and the category of SFVs. Public health inspection was the only factor that significantly ($P<0.05$) influenced all FSHAP score categories. Mobile vendors were 1.86 and 2.20 times more likely to have poor working conditions and poor food handling practices scores compared to those who were not mobile, respectively. Training and education level significantly($P<0.01$and$P<0.05$, respectively) increased food safety and hygiene awareness score whereas the duration of time in

street food vending significantly (P<0.05) improved food handling practice score. Public health inspection of SFVs was found.

Name of journal: Current Research in Nutrition and Food Science, ISSN: 2347-467X, Vol. 08, No. (3) 2020, Pg. 988-1000

Year of Publication: 2020

Ms. Elizabeth Wafula

Published paper 1:

Title: Prediction of cooking times of freshly harvested common beans and their susceptibility to develop the Hard-To-Cook defect using near infrared spectroscopy

Authors: Elizabeth N. Wafula, Irene N. Wainaina, Carolien Buvé, Peter K. Kinyanjui, Wouter Saeys, Daniel N. Sila and Marc E.G. Hendrickx

PII: S0260-8774(21)00020-0

DOI: 10.1016/j.jfoodeng.2021.110495

Appears in: Journal of Food engineering

Abstract

The cooking time of common beans is influenced by genotype and storage conditions. This study aimed to use near-infrared (NIR) spectra of milled, freshly harvested (fresh) beans to predict their cooking times and their susceptibility to develop the storage-induced, hard-to-cook (HTC) defect. The physical characteristics of bean accessions, from two different seasons, were evaluated. The cooking times and susceptibility to HTC (determined by aging under standard adverse conditions) of the aforesaid beans were correlated to NIR spectra to develop calibrations using variable selection and partial least squares regression. The beans exhibited diverse physical characteristics, cooking times and susceptibility to HTC. The models predicting cooking times of fresh beans sufficiently overcame genotype and seasonal differences (R2P=0.73, RMSEP=4 minutes). The susceptibility of fresh beans to HTC was also successfully predicted (R2CV=0.8, RSECV=64%). NIR spectroscopy has high potential to rapidly identify beans with short cooking times and low susceptibility to HTC at harvest.

Keywords: near-Infrared spectroscopy, susceptibility, hard-to-cook, common beans, aging,

cooking times

Please cite this article as: Elizabeth N. Wafula, Irene N. Wainaina, Carolien Buvé, Peter K. Kinyanjui, Wouter Saeys, Daniel N. Sila and Marc E.G. Hendrickx (2021). Prediction of cooking times of freshly harvested common beans and their susceptibility to develop the Hard-To-Cook defect using near infrared spectroscopy. Journal of Food Engineering, (110495). https://doi.org/10.1016/j.jfoodeng.2021.110495.

Published paper 2:

Title: Application of Near-infrared Spectroscopy to Predict the Cooking Times of Aged Common Beans (Phaseolus vulgaris L.)

Authors: Elizabeth N. Wafula, Irene N. Wainaina, Carolien Buvé, Nghia D.T. Nguyen, Peter K. Kinyanjui, Wouter Saeys, Daniel N. Sila and Marc E. Hendrickx

PII: S0260-8774(20)30154-0

DOI: 10.1016/j.jfoodeng.2020.110056

Appears in: Journal of Food Engineering

Abstract

The cooking time of beans is an important quality indicator which can change considerably during ageing. Therefore, this study investigated the potential of near-infrared spectroscopy to rapidly predict cooking times of aged common beans. Four bean varieties were aged under different storage conditions, resulting in a range of samples for each of these varieties. The cooking kinetics of the aged beans were determined by finger pressing and modelled using logistic regression to obtain the times it took to cook 95% of the beans. The cooking times obtained were predicted from the NIR spectra of milled raw bean samples. This was done using partial least squares regression, after carrying out wavelength selection. Model performance was improved up to an average prediction error of 8 minutes by de-hulling the beans and reducing the number of varieties included. In conclusion, NIR spectroscopy has high potential to predict the cooking times of aged beans.

Keywords: common beans, ageing, logistic regression, cooking time, near infrared spectroscopy, partial least squares regression

Please cite this article as: Elizabeth N. Wafula, Irene N. Wainaina, Carolien Buvé, Nghia D.T. Nguyen, Peter K. Kinyanjui, Wouter Saeys, Daniel N. Sila and Marc E. Hendrickx (2020). Application of near-infrared spectroscopy to predict the cooking times of aged common beans (Phaseolus vulgaris L.). Journal of Food Engineering, 284(110056). https://doi.org/10.1016/j.jfoodeng.2020.110056.

Dr. Irene Orina

Published article 1

Title: Physico-chemical properties of selected Irish potato varieties grown in Kenya

Authors: Evelyne N. Gikundi, Daniel N. Sila, Irene N. Orina and Ariel K. Buzera

DOI: 10.5897/AJFS2020.2025

Appeared in: African Journal of Food Science

Abstract

Potatoes have attracted great interest as a feasible solution to food insecurity and climate change in Kenya. Many varieties have been developed but their nutritional value and suitability for domestic and industrial use are not sufficiently studied. A comparative study of physical attributes (tuber weight, size, shape, eye depth and number, specific gravity, colour) and nutrient composition (proximate, minerals, vitamins, and simple sugars) of three varieties (Unica, Shangi and Dutch robjin) were evaluated using standard methods. Shangi and Unica had lengths above 50 mm recommended for French fry processing, but had deep eyes (1.54-2.98 mm). Unica had a red skin colour while Shangi was yellow. Both varieties had yellow coloured flesh. The specific gravity of the varieties ranged from 1.08-1.12. Shangi and Unica were suitable for processing based on their physical attributes except for eye-depths. Dutch robjin had the highest content of protein (1.76%), carbohydrates (20.43%), total ash (1.10%), crude fibre (1.11%), iron (0.87 mg/100 g), thiamine (0.036 mg/100 g), niacin (0.93 mg/100 g), pyridoxine (1.92 mg/100 g) and folic acid (34.62 μg/100 g). Unica had the highest zinc (0.41 mg/100 g) and calcium (8.51 mg/100 g) contents. Reducing sugar content across the three varieties was within recommended range for processing (97.75-107.53 mg/100 g). There was a significant ($p<0.05$) varietal difference in most of the nutrient components. Dutch Robjin showed the best nutritional quality.

Key words: Potato quality, Solanum tuberosum L., physical characteristics, nutrient content, food composition

Published article 2

Title: Multinomial Logistic Regression Analysis of Factors Influencing Food Safety, Hygiene Awareness and Practices among Street Food Vendors in Kiambu County, Kenya.

Authors: Johnson Mwove, Samuel Imathiu, Irene Orina and Paul Karanja

DOI: http://dx.doi.org/10.12944/CRNFSJ.8.3.26

Appeared in: Current Research in Nutrition and Food Science

Abstract

Street food vending is a very popular and unique part of the informal sector, particularly in developing countries. However, the safety of street vended foods is a major public health concern since poor food safety and hygiene knowledge and practices are often reported among street food vendors (SFVs). The objective of this study was to identify the factors influencing food safety, hygiene awareness and practices (FSHAP) among SFVs in Kiambu County, Kenya. Structured questionnaires and an observation checklist were administered to randomly selected 345 SFVs. Results showed that good food safety and hygiene awareness scores were significantly (P less than 0.05) influenced by education level, food hygiene and safety training, mobility of SFVs, public health inspection, and the category of SFVs. Public health inspection was the only factor that significantly (P less than 0.05) influenced all FSHAP score categories. Mobile vendors were 1.86 and 2.20 times more likely to have poor working conditions and poor food handling practices scores compared to those who were not mobile, respectively. Training and education level significantly (P less than 0.01 and P less than 0.05, respectively) increased food safety and hygiene awareness score whereas the duration of time in street food vending significantly (P less than 0.05) improved food handling practice score. Public health inspection of SFVs was found to be the most effective way of improving FSHAP among SFVs. The study recommends regular inspections of SFVs by public health officials to enhance compliance with food hygiene and safety standards and regulations governing the street food sector as well as scheduled training on food safety and hygiene targeting all categories of street food vendors.

Keywords: Food Hygien; Food Safety; Logistic Regression; Public Health Inspection; Street Food Vendors

Published article 3

Title: Food safety knowledge and practices of street food vendors in selected locations within Kiambu County, Kenya.

Authors: Johnson Mwove, Samuel Imathiu, Irene Orina and Paul Karanja

DOI: 10.5897/AJFS2020.1929

Appeared in: African Journal of Food Science

Abstract

The safety of street foods remains a public health concern especially in developing countries like Kenya where foodborne illnesses associated with these foods have often been reported. This study determined the food hygiene and safety knowledge and practices of 345 street food vendors (SFVs) in selected locations within Kiambu County, Kenya. Data collection was accomplished through face-to-face interviews using structured questionnaires and extensive observation using an

assessment tool for observation of personal hygiene and food handling practices of SFVs and the condition of the vending environment. The results indicated that the majority of the SFVs were male (63.2%) with 38.1% of them having attained secondary school education. About 93% of the SFVs had not received any formal training on food hygiene and safety. Majority of SFVs handled food with bare hands (96.8%) or handled money while serving food without washing hands (86.1%). Few also practiced preservation with 78.3% storing foodstuff that required refrigeration at ambient temperatures while 22.3% stored leftovers without any form of preservation and sold them the following day. Whereas public health officers' visits were found to significantly ($P<0.0001$) motivate SFVs to obtain a food handler's medical certificate, only about 27% had obtained it. These findings suggest that street vended foods sold in this study area may pose a significant potential hazard to public health due to the poor hygiene and handling practices reported.

Keywords: Street vended food, food safety, food hygiene, public health, street food legislation.

Published article 4- This article has been accepted for publication awaiting payment of handling fee

Title: Quality and sensory properties of instant fried noodles made with soybean and carrot pomace flour

Authors: Mercy Tiony & Irene Orina

Journal: African Journal of Food Science

Abstract

Wheat flour commonly used in making noodles is rich in starch but poor in protein and fiber. Wheat flour substituted with soybean and carrot pomace flours were used to produce instant fried noodles. Soybean is high in protein while carrot pomace is rich in dietary fiber. The aim of this study was to evaluate the effect of substituting wheat flour with soybean and carrot pomace flour on the physicochemical, cooking and sensory properties of instant fried noodles. Four flour blends in ratios of 100:0:0, 80:15:5, 70:20:10, 60:25:15 wheat, soybean and carrot pomace flour respectively were prepared. The results indicated a significant difference ($P<0.05$) in protein and crude fiber content of the noodles made from the flour blends. The cooking loss and water absorption increased with increase in the amount of substituted soybean and carrot pomace flour. There was no significant difference in the tensile strength among noodles. However, breaking length of the noodles decreased with increase in replacement of soybean and carrot pomace flour. The noodles decreased in brightness with increased carrot pomace substitution. Noodles made from 80% wheat flour, 15% soybean flour and 5% carrot pomace were the most preferred by the sensory panelist. Incorporation of soybean flour and carrot pomace flour improved the nutritional quality and sensory attributes of the instant fried noodles.

Keywords: Instant fried noodleS, carrot pomace flour, soybean flour

Prof. Nelson Ojijo

Author(s)	Year	Title	Abstract
Dinga, L. A. and Ojijo, N. K. O.	2021	Assessment of Household Food Security Situation During the COVID-19 Lockdown in Kenya. Submitted to the Journal of Nutrition and Food Security.	This survey sought to assess the effects of the ongoing COVID-19 lockdown on household food security situation in Kenya. A survey was conducted from June to July 2020 through a structured questionnaire which was administered through online social networks. A total of 444 responses were received, but only 80 were completely filled. Quantitative data were collected on the socio-demographic characteristics, dietary practices and coping strategies based on a set of questions to assess behavioral responses to manage incipient household food shortage. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 23.0. Descriptive statistics such as mean, percentages and frequencies were carried out; relationships between the variables were assessed using chi-square test, Pearson correlation and multiple linear regression. Significance levels were determined at 95 percent confidence interval where a p-value of less than 0.05 was considered significant. The prevalence of low, medium and high dietary diversity scores were 7.5 percent, 17.5 and 75 percent, respectively, implying majority of the respondent households were food secure with pockets of food insecure households within the Nairobi Metropolitan region. There was a significant relationship between household dietary diversity and household income source (χ^2=7.71, p=0.02), household perceived economic pressure during the COVID-19 lockdown (χ^2=20.37, p<0.01), and household perceived ability to meet their food needs (χ^2=18.01, p<0.01). Consumption of less preferred and less expensive foods was the most (30 percent) often used coping strategy against food insecurity. The study recommends putting up mitigation strategies to support pockets of food insecure households during lockdowns imposed by state agencies in the wake of the COVID-19 pandemic.
Ojijo, N. K. O.	2020	A Study of the Impact of AGRA-Trained Personnel and Capacity Gap Assessment of Agricultural Personnel in African Countries: Kenya, Ghana, and Mozambique. Submitted to the Alliance for a Green Revolution in Africa (AGRA).	AGRA supported about 150 Ghanaians, Kenyans and Mozambicans for postgraduate programs in seven universities across Africa between 2002 and 2016. The host universities offered specially designed PhD programs in plant breeding, and similar PhD and MSc programs in seed systems, soil science, agronomy and other crop improvement specializations. By 2019, nearly 80 percent of the graduates had completed studies, returned home to their institutions, and are actively contributing to sector growth in the areas of seeds, soils, agricultural education, and policy. A study was conducted to determine systematically and holistically the contribution of these graduates to agricultural transformation in their respective

			countries. Specifically, the study provided reliable statistics on the number, age and quality of active scientists at post in public agricultural research institutes; determined the critical number and quality of scientists needed to trigger a Green Revolution in the countries; determined the whereabouts of AGRA-supported graduates, what they are engaged in and the impact they are making; characterized the support structures that influence the performance of the graduates in their workplaces; and analyzed AGRA's contribution to bridging identified capacity gaps in the three countries.
Ojijo, N. K. O.	2020	Food Security and Nutrition in Kenya: Current Status Policies and Institutional Environment. Submitted to FAO/RUFORUM.	There is need to engage with legislators in Eastern Africa and the other African regions to galvanize political commitment for the enactment and implementation of legislative and policy actions that would promote food security and nutrition. This has led to the formation of a high-level advocacy platform dubbed the Eastern Africa Parliamentary Alliance for Food Security and Nutrition (EAPA-FSN). The study was conducted to establish a reference base for agriculture and food security policy and associated indicators that will serve as benchmarks to monitor and track progress and impact of the EAPA-FSN activities in Kenya. The analysis was guided by the four pillars of the Food Security Framework adopted at the World Food Summit in 1996, viz.: availability, access, use/utilization, and stability, which can be probed at household, community, or national levels. In addition, the coherence of policies and strategies and Institutional framework for implementing FSN policies and strategies were reviewed.