

## 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 ( $R^2_p=0.73$ , RMSEP=4 minutes). The susceptibility of fresh beans to HTC was also successfully predicted ( $R^2_{cv}=0.8$ , RSECV=64%). NIR spectroscopy has high potential to rapidly identify beans with short cooking times and low susceptibility to HTC at harvest.

**Key Words:** 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.

**Key words:** 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>

## Published paper 3:

**Title:** Considerations for the shift in the roles of national and county governance towards the realization of food security in Kenya.

**Authors:** Elizabeth N. Wafula and Osia Odula

**ISSN:** 1684 5374

**DOI:** 10.18697/ajfand.83.17215

**Appears in:** *African Journal of Food, Agriculture, Nutrition and Development*

### Abstract

The international community's view on the state's role in a country's development and by extension food security situation is currently very positive. As a means to improve governance, decentralization in its many forms is being advocated all over the world. In August of 2010, Kenya embraced a new system of governance which involved the devolution of the central government and public participation as its new and critical components. This implied a shift in the roles of national and county governance towards the achievement of food security. Since food security is a multi-dimensional phenomenon, it is affected by many factors including governance. Thus, the government among other actors, plays a critical role in the achievement of food security. The scope of this review was 'Good Food Security Governance' within the national context, specifically focusing on the two tiers of government; national and county. This study aimed to call to attention the areas under governance in need of special attention by outlining the history of Kenya's political economy that has contributed to the current state of food insecurity. It also seeks to reinforce government's role in food security and propose possible key roles the national and county governments could embrace towards the realization of food security. There is need to eradicate corruption, streamline land tenure systems through effective land reforms, strengthen institutions that were weakened during former government regimes and empower county governments. The role of governments at both county and national level in food security should be reinforced by viewing food security as a public good and on the basis of the right to food as stipulated in the constitution of Kenya. While the national government needs to focus on capacity building of county governments, spurring economic growth, aiding poor rural farmers and putting in place social safety nets, the county government's role should be the identification and implementation of context-specific integrated approaches to improve food security of their peoples. In conclusion, if these considerations are to be properly addressed then governance for food security in Kenya can be improved.

**Key words:** Kenya, governance, decentralization, roles, food security, political economy, county

**Please cite this article as:** Elizabeth N. Wafula and Osia Odula (2018). Considerations for the shift in the roles of national and county governance towards the realization of food security in Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, 18(3): 13776-13791.

<https://doi.org/10.18697/ajfand.83.17215>

## Published paper 4:

**Title:** Impact of Ripening Stage and Drying on Selected Quality Attributes of Apple Mango Cubes and Leathers.

**Authors:** Elizabeth N. Wafula, Daniel N. Sila and Michael M. Wawire

**ISSN:** 1684 5374

**Appears in:** *African Journal of Food, Agriculture, Nutrition and Development*

### Abstract

Apple mango is an improved cultivar that has been widely adopted by farmers in Kenya for use in the fresh market and processing. However, its production and consumption are adversely affected by high postharvest losses, which result from the perishable nature of the fruit, especially during glut periods. This is partly due to limited availability of information on alternative product use. The aim of this study was to evaluate the impact of ripening stage and drying on the physico-chemical quality and sensory acceptability of Apple mango fruit grown in the upper Athi River region of Kenya. Moisture, crude ash, crude fibre, titratable acidity, total soluble solids, colour, total carotenoids and ascorbic acid of the unripe and ripe fresh mangoes were determined. Subsequent experiments involved drying of ripe and unripe mango cubes (8 mm) in a windy oven (at 60 °C) and, in parallel, drying of ripe mango puree (mixed with sucrose-glucose solution, citric acid and pectin) in a windy oven at three different temperatures (50, 60 and 70 °C) which resulted in mango leathers. Analysis of total carotenoids, ascorbic acid content and colour was done for all dried samples, followed by sensory evaluation using the nine-point hedonic scale. The moisture content, crude ash and total soluble solids increased significantly ( $P < 0.05$ ) with ripening while titratable acidity decreased significantly ( $P < 0.05$ ). Ascorbic acid content decreased from 98.03 to 86.45 mg/100g with ripening while total carotenoids content approximately doubled from 768 to 1436  $\mu\text{g}/100\text{g}$ . Drying resulted in high retention of total carotenoids whereas ascorbic acid content decreased. The mango samples became darker and redder in all cases. Dried mango cubes and leathers derived from ripe mangoes had higher scores in the sensory analysis compared to those obtained from unripe mangoes. In conclusion, the stage of ripening and drying technique employed are critical in determining the nutritional and sensory characteristics of dried Apple mango cubes and leathers. Drying Apple mango leathers at 60 °C is the best method that can be adopted.

**Key words:** Apple mango, drying, ripening, fruit leather, fruit cubes, physico-chemical, sensory

**Please cite this article as:** Elizabeth N. Wafula, Daniel N. Sila and Michael M. Wawire (2015). Impact of Ripening Stage and Drying on Selected Quality Attributes of Apple Mango Cubes and Leathers. *African Journal of Food, Agriculture, Nutrition and Development*, 15(5): 10368-10385.