The Influence of Food Traditions and Cooking Methods on Energy Transition: High Demand for Charcoal in Kampala, Uganda

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This study aims to investigate the influence of food culture on the choice of cooking fuel by verifying the locality of food and cooking methods using a case study from Kampala, Uganda. It has been suggested in previous studies that when socio-economic status improves, households generally upgrade their cooking fuel, shifting from woodfuel to LPG (liquefied petroleum gas) or electricity. Although Uganda's economy has grown for decades, charcoal has been the main cooking fuel in 80% of the households in Kampala. The food culture and cooking habits in Central Uganda are unique. Bananas have high cultural value in the area as staple food and are consumed in large quantities. Observations of the cooking process show that bananas are often steamed for 2–4 hours over a very low heat, which cannot be achieved using advanced fuels such as LPG. Even in high-income households, charcoal is still the main source of fuel despite advanced alternatives being available and affordable. Therefore, residents of Kampala positively choose charcoal over other sources of fuel for reasons inherent to local cooking traditions. Not only socio-economic status but also local food traditions also have an important impact on the choice of cooking fuel.

Key words: cooking fuel, food culture, woodfuel, banana, Uganda

1. INTRODUCTION

Woodfuel such as firewood and charcoal has been an important energy source for cooking since man's discovery of fire between 240 and 380 thousand years ago. In Europe, cooking fuel sifted from woodfuel to LPG and electricity in the 19th century (Wilson 2012). However, in tropical areas such as Sub-Saharan Africa, woodfuel is still the main cooking fuel, with 80% of the population in Sub-Saharan Africa relying on biomass (IEA 2010).

It has been predicted since the 1970s that woodfuel will be exhausted in the near future in tropical areas. This prediction was made around the same time as the 1970s' oil shock. Tropical countries have attempted to move their energy source for cooking from woodfuel to advanced fuel with the assistance of developed countries (Anderson 1986, cf. Dewees 1989, Cline-Cole *et al.* 1990).

The energy ladder model was proposed in the 1980s, which states that as the socio-economic status of a country improves, cooking fuel shifts from a primitive level—firewood, agricultural waste, and animal waste—to a transition level—charcoal, kerosene, and coal—and finally to an advanced level—LPG and electricity (see Figure 1). Therefore, national governments should implement policies to

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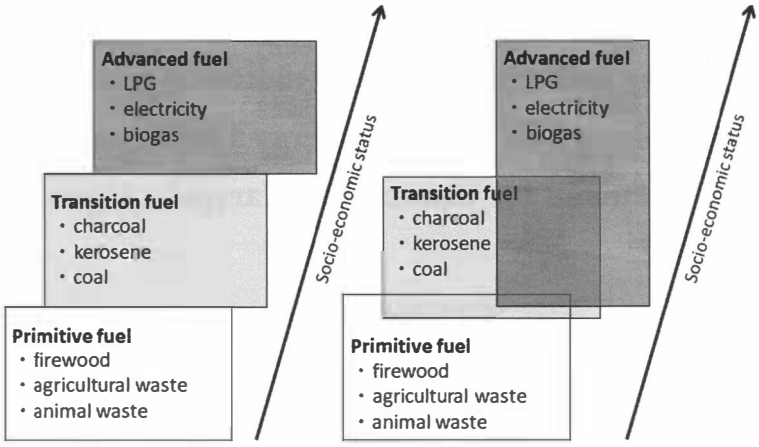


Figure 1. Energy ladder (left) and energy stacking (right)
Source: Schlag and Zuzarte (2008); van der Kroon *et al.* (2013)

advance the linear transition of cooking fuel (e.g. Hosier & Dowd 1987; Schlag & Zuzarte 2008). Moreover, because of the health consequences of particulates and other emissions from the combustion and the exposure risk of women and children when collecting and using firewood, the use of clean and advanced fuel was recommended (Barnes *et al.* 2005).

Empirical studies have shown that socio-economic status is not the only deciding factor concerning the choice and transition of cooking fuel. Masera *et al.* (2000) suggested a multiple fuel use model from their four-year fieldwork-based study in rural Mexico. The study found that firewood and LPG were the most commonly used cooking fuels in the area, and many households continued to use firewood or shifted back to using it, even after installing LPG. Although some factors such as the improvement of socio-economic status, convenience, and cleanliness encourage cooking fuel transition, others—such as lack of devices and new skills for using advanced cooking fuel—hinder transition. Therefore, some people are using traditional, transition, and advanced fuel simultaneously. This multiple fuel use is called energy stacking (see Figure 1).

Other studies supporting the energy stacking model have also pointed out that livelihood strategies for the poor, limited availability, the unstable price of advanced fuel, and local food culture influence people's choice to use different cooking fuels at the same time (van der Kroon *et al.* 2013). Murphy (2001) claimed that people in East Africa prefer food cooked with firewood and charcoal to food cooked with electricity, indicating that the grid expansion does not directly influence people to shift to advanced cooking fuel using a case study in Kenya.

African countries have experienced rapid economic growth for decades, but woodfuel is still the main cooking fuel even in urban areas. For instance, cooking energy usage has not shifted to advanced fuel in Kampala, the capital of Uganda, despite the general improvement of the economy in the country. The main cooking fuel in Kampala is charcoal, and other fuels such as firewood, LPG, kerosene, and electricity are only used on certain occasions. According to a household survey conducted by the Uganda Bureau of Statistics, 79.4% of households in Kampala used charcoal as their main source of energy for cooking in 2016/17. Of this percentage, 66.4% of the households are in urban areas and only 15.5% of these households are in rural areas (UBOS 2018). Firewood is the main source of cooking fuel in rural areas at 80.8% (see Table 1). In 1989/90, 63.3% of households in Kampala used mainly charcoal (Ministry of Energy 1990). This rate is still high at 77.7% in 2005/06 (UBOS 2006), 74.5% in 2009/10 (UBOS 2010), 80.2% in 2012/13, and 79.4% in 2016/17. Charcoal has been the main source of energy in Kampala for almost 30 years, although Uganda has experienced drastic economic growth during the same period—with an annual average GDP growth rate of 5.4% between

Table 1. Transition of the main cooking fuel at household level in Kampala, urban areas, and rural areas

Area	FY	Charcoal (%)	Firewood (%)	Kerosene (%)	Electricity (%)	Others* (%)
Kampala	1989/90	63.3	11.3	6.8	16.6	2.0
	2005/06	77.7	5.8	5.2	1.4	9.9
	2009/10	74.5	2.4	7.8	3.4	11.9
	2012/13	80.2	2.1	7.6	2.1	8.0
	2016/17	79.4	0.6	—	—	20.0
Urban	1989/90	62.1	13.6	6.1	16.3	1.9
	2005/06	66.1	22.9	3.5	0.8	6.8
	2009/10	69.8	15.4	4.9	1.6	8.2
	2012/13	54.4	36.4	2.8	1.4	5.0
	2016/17	66.4	22.3	—	—	11.3
Rural	1989/90	2.6	69.5	1.3	0.6	26.1
	2005/06	8.2	89.4	0.8	0.1	1.6
	2009/10	10.4	86.3	1.7	0.3	1.3
	2012/13	8.2	89.4	0.2	0.2	2.0
	2016/17	15.5	80.8	—	—	3.7

* Including LPG, animal waste, sawdust, biogas etc., in 2016/17 it includes kerosene and electricity
Source: Ministry of Energy (1990); UBOS (2006; 2010; 2014; 2018)

2008 and 2017 (World Bank 2018).

This study aims to clarify the factors that encourage people to continue using charcoal as their main source of energy in Kampala by verifying the locality of food, the cooking method, cooking environment, and availability of cooking fuel. In Central Uganda, cooking bananas (plantains)[1] are one of the primary starchy foods. The empirical research concerning the relationship between the choice of cooking fuel and local food culture—people's methods and preference in the kitchen—has not been significantly explored in previous studies. This study aims to demonstrate the benefit of woodfuel cooking in the context of daily practice in the kitchen in Kampala and the influence of food culture on the choice of cooking fuel.

After an explanation of the research site and methods in Chapter 2, general information about types and usage of cooking fuels in Kampala is explored in Chapter 3. In Chapter 4 the unique food culture and cooking process in Central Uganda are explained in detail. In Chapter 5, we discuss the adaptability of cooking fuel considering the local cooking methods by observation data of the cooking process in Kampala, and argue whether cooking fuel in Kampala would modernize from records of the choice of cooking fuel in high-income households. Finally, a general discussion of factors that determine cooking fuel in Kampala—what makes people continue using charcoal—and the influence of food culture on the choice of cooking fuel is explored in Chapter 6.

2. RESEARCH SITE AND METHODS

Kampala is located in Central Uganda, East Africa. The majority of people in Kampala are the Ganda people (*Baganda*), and they have a great cultural effect in the country. The Ganda people account for 17% of the total population of Uganda (UBOS 2016) and the capital of the Buganda Kingdom—or the kingdom of the Ganda—has been located in Kampala since before the British protectorate. The people of Kampala speak English and Luganda (language of the Ganda), and it is necessary to be able to speak and understand Luganda to live in Kampala. A previous study on langu-

age use in Kampala indicates that 95% of people there—including those of ethnic groups other than the Ganda—speak Luganda (Miyazaki 2009). There are also people of other ethnic groups, including Bantu people from the Southern Uganda and Nilotic people from the Northern Uganda.

In Uganda, two main policies have been enforced to stimulate the cooking energy transition. The Energy Policy for Uganda adopted in 2002 aims to improve the accessibility of advanced fuel such as LPG and electricity (MEMD 2002). In 2007, the Renewable Energy Policy for Uganda was implemented, which aimed to increase the use of renewable energy from 4% to 61% by 2017 (MEMD 2007).

Charcoal consumption in Kampala is increasing because of population growth. According to the national census, the population of Kampala increased from 1.2 to 1.5 million people between 2002 and 2014 (UBOS 2016). The quantity of wood burnt for charcoal production in Uganda was 13 million tons in 2017, a drastic increase from 5 million tons in 2002 (UBOS 2004; 2017). These consumption quantities are for urban areas including Kampala.

This study conducted a survey in Kampala for 11 months intermittently between October 2012 and March 2014. The methods employed were participant observation and semi-structured interviews concerning the usage and choice of cooking fuel during the cooking process of housewives and housemaids (domestic workers). The information about cooking fuel such as price, devices, and frequency of use, was obtained from interviews and observation in some households and local markets (in Chapter 3). The food culture of Central Uganda and the cooking process of *matooke amanyige*, the most common way of cooking bananas, were obtained from interviews and participant observation (in Chapter 4). The relationships with daily food and choice of cooking fuel in low- and high-income households were obtained from the interviews, records of the author and respondents, and participant observation (in Chapter 5).

3. TYPES AND USAGE OF COOKING FUELS

3.1. Charcoal

Charcoal is sold per small bucket (approximately 1 kg) or per sack[2] (approximately 75 kg) in Kampala. The price is about 1,000 Uganda shillings[3] per bucket, and 50,000–70,000 shillings per sack in local charcoal shops in 2014 in Kampala. In general, 1 kg of charcoal is used to cook one or two meals, which is equivalent to between 500 and 2,000 shillings per day. However, the cost varies according to the family size and the menu. A sack of charcoal lasts approximately two to three months. Therefore, the cost of cooking fuel can be estimated at 400–1,000 shillings per day when bought by the sack. Charcoal shops are located on every block in Kampala, and it is quite easy for people to visit a charcoal shop on foot daily. For instance, there were 44 charcoal shops within 0.7 sq. km in Nakulabye and Kikoni A zones, a residential area for middle- and low-income households (see Figure 2).

Portable cooking stoves are used when cooking with charcoal. There are three main types of stoves used in Kampala: metal, clay, and improved stoves, which are relatively new. Clay stoves are currently the most used and cost between 1,500 and 2,000 shillings each. Metal stoves are used more for bigger families and restaurants. Elderly people have stated that metal stoves have been in use for longer than clay ones. The price of a metal stove is at least 5,000 shillings and varies according to size. Clay stoves keep heat longer than metal stoves, but break easily. Metal stoves, on the other hand, are strong but consume more charcoal as it burns out faster. Improved stoves (also called "energy-saving stoves") are metal stoves with clay kilns inside them. These contain heat for longer and do not break easily and they cost between 15,000 and 35,000 shillings.

Some of the advantages of charcoal—in addition to its reasonable price—are that cooking is smokeless and a smaller space is needed. Cooking with charcoal means that people do not easily get lung and eye diseases since it does not produce smoke like firewood does. Additionally, cooking utensils last longer and do not turn black with soot, as there is no smoke. Compared with firewood,

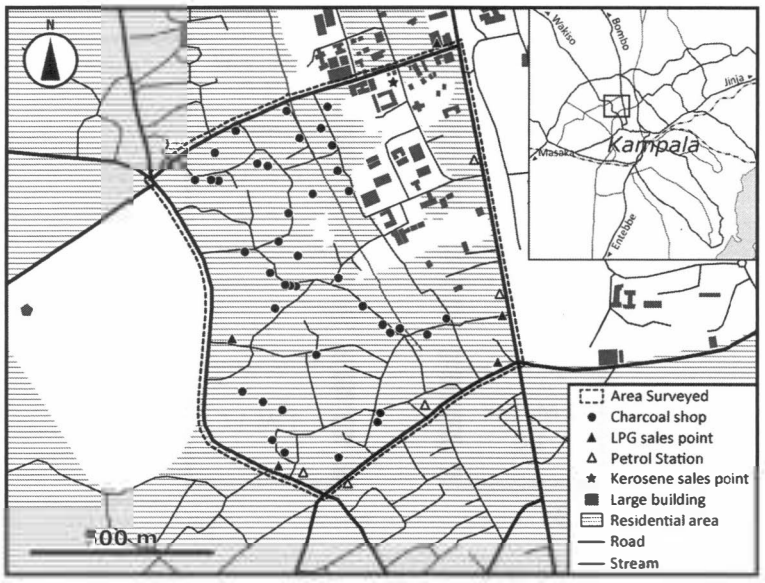


Figure 2. Locations of charcoal shops, LPG sales points, petrol stations, and kerosene sales points in the Nakulabye-Kikoni A zone
Note: Both LPG and kerosene are sold at petrol stations.
Source: Field data from October 10–12, 2017

which is usually burnt in three-stone stoves, cooking with charcoal only needs space for a portable stove, which is about 30 cm in diameter. Charcoal cooking also improves safety, because people do not have to watch the fire continuously because it does not have flames. For instance, people were working on other chores while cooking a meal with charcoal during my observations.

3.2. Firewood

Firewood is the main cooking fuel in rural areas, but in the city of Kampala, it is difficult to obtain since there is not a ready supply (like a forest) near the residential areas. Used timber from construction sites and wood from surrounding areas are sold at 1,000 shillings per three or four pieces. Three big stones—called a three-stone fire or three-stone stove—are used to burn firewood; three pieces of firewood are set between the stones and a saucepan is put on them. Since it uses stones and bricks as the "stove," this type of stove can be obtained for free.

Although less time is spent when cooking with firewood, it is difficult to keep a space to cook in this manner in an urban area where population density is high. Kampala's population density was 9,204 people per sq. km in 2014 (UBOS 2016)[4]. People generally live in tenements with one or two rooms each and it is fairly common for families of more than four to occupy one tenement. Shelters are often used as kitchens in tenements (see Figure 3 and Picture 1), where a three-stone stove does not fit. Also, smoke should be prevented from entering the rooms, including the neighbors'[5].

Soot is another problem. People living in tenements have limited storage space for cooking utensils, which are usually kept in a corner in their living room or bedroom. The residents need to scrub the soot from a saucepan after every meal if they use it for their daily cooking, since saucepans with soot will make the floor black[6].

3.3. LPG and electricity

In Kampala, LPG is not easy to access, especially for lower-income people. LPG is sold in 6 kg, 12 kg, or 24 kg cylinders at shops and petrol stations. A burner or a stove is needed to connect to an LPG cylinder. The price of LPG is between 50,000 and 100,000 shillings for 6 kg, and a burner or

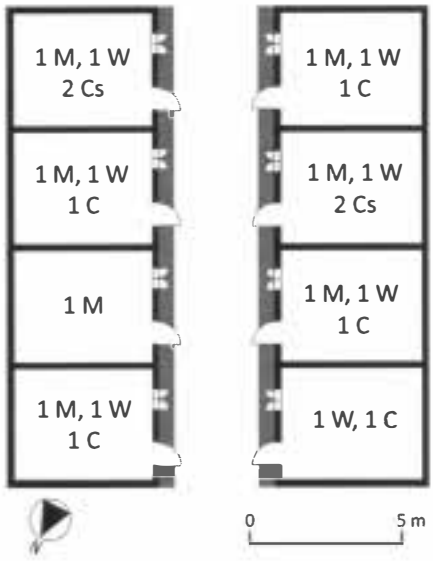
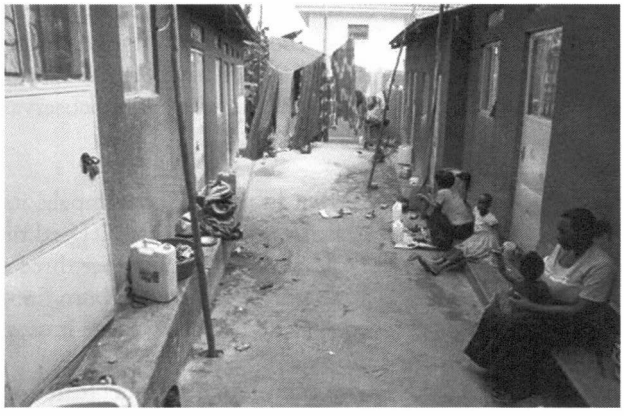


Figure 3. Size, location, and number of residents of tenements in Kampala
Note: The grey parts are shelters in front of each room. The size of each building is 5 m × 15 m, and a building has four rooms each.
Source: Field data from March 16, 2014



Picture 1. A tenement in Kampala
Note: This picture corresponds to Figure 3. The place where a woman sits on right is the shelter that people use for their chores.
This photograph was taken by the author on July 21, 2013.

stove costs at least 90,000 shillings. A woman using LPG for boiling water for tea every morning reported that she consumes 6 kg of LPG in less than a month, which is equivalent to 1,600 shillings per day, even though she uses it in the mornings only. Additionally, LPG is sold in fixed quantities and cannot be sold in smaller quantities like charcoal, which means that only high-income people can afford to use such an expensive fuel.

Electricity is also not commonly used for cooking meals because of its price and availability. An electric cooker with a coil plate is most often used when cooking with electricity. Some high-income

households have microwaves for cooking. The price of an electric cooker is at least 50,000 shillings and that of microwave is 200,000 shillings. The price of electricity in Uganda was approximately 686 shillings per kWh in 2017, which is more expensive than in the surrounding countries[7]. Frequent power outages also make cooking with electricity challenging.

4. FOOD CULTURE AND THE COOKING PROCESS

The three main features of food culture in Kampala are the variation of staple foods and side dishes, the much-consumed and highly-valued bananas, and the steaming process of cooking. In Uganda, a standard meal often contains a starchy staple food and side dish with vegetable and protein.

Staple foods and side dishes vary greatly in Uganda. Steamed and mashed bananas[8]—called *matooke amanyige* in Luganda—is one of the main staple foods. In Luganda, the word "*matooke*" refers to both the banana itself and a cooked banana dish (to avoid confusion in this paper, the term "*matooke*" is used for the dish, and "banana" is used for the fresh fruit). Other staple foods often eaten in Kampala are maize, usually ground and mingled with hot water as posho[9] (commonly known as "*ugali*" in Kiswahili)[10], rice, cassava, sweet potato, Irish potato, pumpkin, and cocoyam. All staple foods (except rice) are cooked without any salt or seasoning. Stew, called "*enva*" in Luganda[11], is a side dish cooked with every meal—usually with tomatoes or groundnuts—and usually contains vegetables as well as beef, goat, chicken, fish (Nile perch and tilapia are common in Kampala), or tiny silver fish. Staple foods and side dishes are served separately in a formal way (see Picture 2), but at home, it is more common to serve staple food and stew on one plate[12]. *Katogo* in Luganda, a boiled staple food (usually bananas, Irish potatoes, or cassava) with stew, is a dish of staple food and stew cooked together in one saucepan. For daily meals, one stew and at least one or more staple foods are cooked for one meal. At ceremonies and festivals, more than two kinds of staple foods and more than two kinds of stew are prepared for one meal. This type of dish is called "*kitoobero*" in Luganda.

Bananas are consumed in large quantities in Central Uganda. In 2016, about 3.4 million tons of bananas (including produce for manufacturing alcohol) were produced in Uganda, which is much more than other crops such as maize (2.5 million tons) and cassava (2.7 million tons) (UBOS 2017). In Uganda, bananas are cultivated on a much larger scale when compared with other African countries where maize and cassava are the main crops (Fujimoto & Ishikawa 2016). Average per capita

Picture 2. Food in Uganda

Note: Staple foods are on the left plate: *matooke* (top-left), pumpkin, sweet potato, cassava, cocoyam, posho (center), stir-fried greens. Side dish (*enva*) is on the right: groundnut stew with dried fish in a banana leaf (*luwombo*)

This photograph was taken by the author on March 4, 2014.

annual consumption of bananas in Uganda is estimated at about 1 kg per person per day, which is the highest in the world (Edmeades *et al.* 2006).

Bananas are mainly produced in Central and Western Uganda. In Central Uganda 1.0 million tons of banana (24% of the total production in Uganda) were produced, and 2.9 million tons (67% of the total production) were produced in Western Uganda in 2008/09 (UBOS 2017). In the early 1960s the main production area of banana was Central Uganda, but it has shifted from Central to Western (mostly Southwestern) Uganda since the 1970s because of the decrease in the labor force, increased incidence of pests and other diseases, and so on (Sato *et al.* 2018).

Matooke has a high cultural value in the Ganda society (Roscoe 1911; Bennett *et al.* 1965; Sato 2012). *Matooke* will—without fail—be served at ceremonies such as weddings, funerals, and Christmas. Traditionally, Ganda girls must learn how to cook *matooke amanyige* from their aunt on the paternal side (called "*ssenga*"[13]) before becoming adults.

The process of cooking *matooke amanyige* is as follows: (1) First the bananas are peeled; about 30 bananas are peeled at one time and vascular bundles are peeled with the skin to stop the food from turning black after cooking. (2) The bananas are wrapped in banana leaves by putting the fruit in the center of a folded banana leaf, wrapping them, and tying it with two pieces of banana fiber. This bag of banana leaves is called "*muwumbo*" in Luganda. (3) The *muwumbo* is steamed in a big saucepan. The banana stalk and fibers are placed in the bottom of the saucepan, the water is poured over them, the *muwumbo* is added, and then covered with more banana leaves and another saucepan. This is to stop the banana from sinking into the water. After setting up the saucepan, it is placed on a stove with a strong fire. When all the water in the saucepan has evaporated, more water is added through the gap between the saucepans. This process (cooking the bananas first) is called "*ku-tokosa*" in Luganda. (4) The bananas are mashed: when the color of the leaves changes to dark green, the saucepan is removed from the stove and the *muwumbo* is taken out from the saucepan. The *muwumbo* is put in a basket and mashed by hand, not leaving any banana un-mashed. (5) Then the bananas are steamed again: when the mashing has been done, the *muwumbo* is placed back in the saucepan with some water and banana stalks, and steamed on a low flame. To cool the fire down, ash is poured over the charcoal or firewood. This phase of cooking is called "*ku-boobeza*" in Luganda and it is distinguished from the first steaming. When the color of banana leaves changes to brown, the food is ready (see Picture 3). Ganda women say that it is important to control the fire's temperature for *ku-boobeza* to cook *matooke amanyige* properly. When the fire is not controlled properly, the *matooke* becomes hard. This cooking method currently used in Kampala is similar to methods mentioned in an ethnographical book written in the beginning of the 20th century (Roscoe 1911).

This steaming process is another feature of the Kampala food culture. It is only the people of Central Uganda that steam food—especially bananas—in East Africa (Sato 2012). Steamed stew in banana leaves is called *luwombo* in Luganda (see Picture 2). Sometimes posho, a staple that is widely cooked in Africa, is also steamed in banana leaves, although it can be eaten without steaming. People prefer the flavor (*kawoowo*) of posho that has been steamed in this way. Cassava, sweet potatoes, and pumpkins are also steamed in a *muwumbo* when they are cooked together with *matooke* to improve the aroma.

5. CONTROL OF FIRE AND CHOICE OF COOKING FUEL

5.1. Cooking time and fire control

This section addresses the time people spend and how they control the fire when cooking *matooke amanyige* in Kampala. The case study of Ms. Sr, a Ganda woman living with her 1-year-old daughter and 18-year-old sister in a tenement in Kampala, is utilized. The Sr household corresponds to a low-income level[14] as defined by the African Development Bank (AfDB). She has two clay charcoal stoves for cooking food. On February 22, 2013, she cooked *matooke amanyige* and beef stew on these stoves.

Picture 3. Procedure of cooking *matooke amanyige*
Note: (1) peeling bananas, (2) wrapping the fruit in banana leaves, (3) putting in a saucepan for the first steaming (*ku-tokosa*), (4) mashing over banana leaves (*ku-nyiga*), (5) second steaming (*ku-boobeza*), and (6) finished.
These photographs were taken by the author between November 2, 2012 and April 21, 2013.

Ms. Sr started cooking lunch at 9:32 am. After taking 9 minutes to make a fire using 0.3 kg of charcoal, she "dried" the beef[15] for 60 minutes in a small amount of water in a small saucepan. During this drying, she peeled 33 bananas (5 kg) and wrapped them in banana leaves to make a *muwumbo*. At 10:30, she lit another stove filled with 0.3 kg of charcoal. After 10 minutes, she chopped vegetables—tomatoes, onions, green peppers, and carrots—and added them to the pot to fry them. After frying them for 7 minutes, she then added the beef cooked on the other stove, after which (at 10:49) she added some water to the ingredients on the stove. She added 0.2 kg of charcoal for boiling the water at 10:58. The beef stew was ready at 11:45. While the stew was cooking, she boiled drinking water on the other stove (which was free after drying beef).

At 11:26, she added about a half of handful of charcoal to stoke the fire in the stove used for boiling the water, and put the saucepan with the *muwumbo* on the fire. She steamed the *muwumbo* on a strong fire (*ku-tokosa*) for 92 minutes. At 12:57 pm, she took the saucepan of *muwumbo* off the stove, mashed the banana in the banana leaves by hand, and put it back in the saucepan as before. After adding 0.3 kg of small charcoal pieces to the stove to decrease the fire, she put the saucepan back on the fire for another steaming (*ku-boobeza*). After 60 minutes—at 2:13 pm—the *matooke amanyige* was ready (when the banana leaves turned brown). In total, 1.3 kg of charcoal was used to cook.

The menu, amount of cooking fuel, and cooking time spent for 7 days (February 14–20, 2013) at Ms. Sr's home was recorded by the author and Ms. Sr. According to the record, she used between 0.6–2.0 kg of charcoal (1.3 kg on average) daily for preparing meals for her family and neighbors[16] (see Table 2). At Ms. Sr's home, the family cooks once a day and they eat the same food for lunch and supper[17]. Ms. Sr spent between 51–248 minutes (168 minutes on average) on cooking. The cooking time exceeded 180 minutes when she cooked *matooke amanyige* or bean stew. It was quicker to prepare meals when she cooked *katogo*, which took 51 minutes (on February 20) and 64 minutes (on February 17). *Matooke amanyige* needs to be cooked twice, taking at least 60 minutes for the first cooking phase (*ku-tokosa*) and between 60–180 minutes for the second phase (*ku-boobeza*). Beans are brought from the market dried, and need to cook for approximately 120–240 minutes to soften. To cook these meals, a cooler simmering fire is preferred to a hot fire used for boiling. For simmering, a long-burning fire is better, and it does not have to be very hot. For boiling, a hot fire is needed to be faster.

Table 2. Menu, cooking time, and charcoal consumption for 7 days at Ms. Sr

Menu		Cooking time (mins.)	Charcoal consumption (kg)	Numbers of stoves	Date
Staple food	Side dish				
Rice	Bean stew	248	2.0	3	2/16/2014
Posho	Bean stew	240	1.3	3	2/14/2014
Rice	Bean stew	225	0.6	3	2/19/2014
Matooke	Fish stew	202	1.2	2	2/18/2014
Rice	Stir-fried cabbage	149	2.0	2	2/15/2014
Groundnut *katogo* with bananas		64	1.2	1	2/17/2014
Groundnut *katogo* with bananas		51	0.6	1	2/20/2014
	Total	**1,179**	**8.9**		
	Average	**168**	**1.3**		

Source: Field data from February 16–20, 2014

5.2. Choice of cooking fuel in high-income households

Some Kampala households have different types of cooking stoves that use different kinds of fuel, especially high- and middle-income ones. For my case study, the menu, cooking time, and cooking fuel of two high-income households were recorded by the author and respondents for 7 days to observe people's different choices of cooking fuel. In both households, housemaids prepared the meals, which is a similar situation to other high-income households that have a monthly fixed income. The respondents of this survey were Ms. Pr and Ms. Jp.

Ms. Pr is a housemaid that works in a household with a family of seven people. The father is a Member of Parliament while the mother works for an international company. Their income level corresponds to high income[14] as defined by the AfDB. They have three sons and two daughters and one of the sons is over 18 years old. Both daughters go to a boarding school. They have a security guard who takes care of the garden, vehicles, and the gate. The family members are of the Ganda people, and Ms. Pr is the Soga[18]. The family owns three cars and a five-bedroom house, and they were building another house in the suburbs of Kampala. In the kitchen, there are metal charcoal stoves, an LPG gas cylinder and burner, and a microwave to cook food.

Ms. Pr uses LPG or the microwave to prepare breakfast and charcoal to prepare lunch and supper (see Table 3). It should be noted that charcoal is used only to prepare lunch and supper. In the morning, Ms. Pr spent 10 to 60 minutes to boil milk with LPG and 15 minutes with the microwave. For lunch, she cooked *katogo*, *pilau* (rice cooked with onion, tomato, and meat (optional)), posho, cassava, and sweet potato. For supper, she cooked *matooke amanyige* for 5 of the 6 days per week that she works, which took 2–3 hours. On Wednesday July 10, she boiled milk for morning tea using LPG, which took 10 minutes to boil, and served it with bread. For lunch, she cooked boiled sweet potatoes and bean stew for her and the gatekeeper, because the family members were all at work or at school. The cooking process—using charcoal—took 2 hours. She cooked *matooke amanyige* and chicken stew for supper, which took 3 hours using charcoal.

Ms. Jp works in a household where the head of the household is a woman working as a senior lecturer at a national university, earning enough for the household to be considered a high-income household[14]. The woman lives with her brother in a house with four bedrooms. They are all of the Nyoro[19] people who also eat *matooke* as their daily staple food. The head of the household owns a car and leases three tenements. In the kitchen, there is a charcoal stove, a firewood stove, and an LPG cooker for cooking food.

Ms. Jp used LPG to cook breakfast, charcoal or LPG to cook lunch, and charcoal only for supper (see Table 4). During the 7-day observation period, she boiled water or milk for tea and cooked

Table 3. Menu, type of cooking fuel, and cooking time for 7 days at Ms. Pr's place

Date	Breakfast			Lunch			Supper		
	Menu	Fuel	Cooking time	Menu	Fuel	Cooking time	Menu	Fuel	Cooking time
Wed. 7/10/2013	Milk tea	LPG	10 min.	Sweet potatoes, bean stew	Charcoal	2 hrs.	*Matooke*, chicken stew	Charcoal	3 hrs.
Thu. 7/11/2013	Milk tea	Electricity (microwave)	15 min.	*Matooke*, fish stew	Charcoal	2 hrs.	—		
Fri. 7/12/2013	Milk tea	LPG	10 min.	*Katogo* of bananas and beans	Charcoal	30 min.	*Mugoyo**	Charcoal	3 hrs.
Sat. 7/13/2013	Milk tea	Electricity (microwave)	15 min.	Posho, bean stew	Charcoal	2 hrs.	*Matooke*, beef stew	Charcoal	3 hrs.
Sun. 7/14/2013	Milk tea	LPG	1 hr.	Cassava, stir-fried cabbage	Charcoal	1 hr.	*Matooke*, groundnut stew, stir-fried cabbage	Charcoal	2 hrs.
Mon. 7/15/2013	Milk tea	LPG	10 min.	Pilau	Charcoal	1 hr.	*Matooke*, beef stew	Charcoal	2 hrs.
Tue. 7/16/2013	Milk tea	LPG	5 min.	Cassava, bean stew	Charcoal	2 hrs.	*Matooke*, chicken stew	Charcoal	3 hrs.

* Mixture of mashed sweet potatoes and boiled beans
Source: Field data from July 10–16, 2013

Table 4. Menu, type of cooking fuel, and cooking time for 7 days at Ms. Jp's place

Date	Breakfast			Lunch			Supper		
	Menu	Fuel	Cooking time	Menu	Fuel	Cooking time	Menu	Fuel	Cooking time
Mon. 7/8/2013	Black tea	LPG	10 min.	*Karo*, chicken stew	Charcoal	1 hr.	*Matooke*, sweet potatoes, groundnut stew	Charcoal	2 hrs. 15 min.
Tue. 7/9/2013	Black tea, *katogo* of bananas and cow peas	LPG	1 hr.	*Karo*, Bean stew	LPG Charcoal	4 hrs.	*Matooke*, rice, cow pea stew	Charcoal	2 hrs.
Wed. 7/10/2013	Black tea, *katogo* of bananas and cow peas	LPG	1 hr.	Sweet potatoes, bean stew	Charcoal	3 hrs.	*Matooke*, rice, fish stew	Charcoal	2 hrs.
Thu. 7/11/2013	Black tea, *katogo* of bananas and fish	LPG	30 min.	Chips	LPG	2 hrs.	*Matooke*, rice, groundnut stew	Charcoal	3 hrs.
Fri. 7/12/2013	Black tea, groundnut *katogo* of bananas	LPG	30 min.	*Karo*, bean stew	Charcoal	3 hrs. 30 min.	*Matooke*, rice, pork stew	Charcoal	3 hrs.
Sat. 7/13/2013	Black tea	LPG	10 min.	Sweet potatoes, bean stew	Charcoal	2 hrs.	*Matooke*, rice, beef stew	Charcoal	3 hrs.
Sun. 7/14/2013	Milk tea	LPG	15 min.	*Matooke*, rice, beef stew, stir-fried greens	Charcoal	3 hrs.	*Matooke*, rice beef stew	Charcoal	3 hrs.

Source: Field data from July 8–14, 2013

katogo with LPG every morning for breakfast. For lunch, she often cooked *karo* (sorghum and cassava flour mingled with hot water), sweet potatoes, and Irish potatoes (which are easier to cook than *matooke*), and rice, as she eats lunch with the householder's brother. She used LPG on July 9 to cook *karo* and on July 11 to cook deep-fried potatoes, and used charcoal to prepare lunch on other days. It took between 1 and 4 hours to cook lunch. For supper, she cooked *matooke amanyige* every day along with another staple food such as rice or sweet potatoes. She used charcoal every day for preparing supper and took 2–3 hours. She did not use firewood at all. On Tuesday, July 9, for example, she boiled water for tea and cooked *katogo* with the leftover stew with bananas for breakfast, using LPG and taking 1 hour. For lunch, she used LPG to cook *karo* and charcoal to cook bean stew. The cooking took 4 hours in total. For supper, she cooked *matooke amanyige*, rice, and cow pea stew, using charcoal and taking 2 hours.

Both Ms. Pr and Ms. Jp stated that they use charcoal for preparing "*emmere*" (meals). *Emmere* refers to food with longer preparation time and more work, which is different from "*byokulya*" (snacks or light meals). Their householders instructed them to use charcoal to prepare *emmere*. They generally cook using a steaming or boiling process, preparing meals such as *matooke amanyige*, rice, and stew, which needs more cooking time but does not need a very hot fire. The food and fuel records show that Ms. Pr often cooked *matooke amanyige* and bean stew spending 2–4 hours. Ms. Jp also spent 2–3 hours to cook *matooke amanyige* and 2–4 hours to cook bean stew. They always used charcoal for cooking these meals.

5.3. Preference and comparison of cooking fuels

Many people in Kampala believe it is better to cook *matooke amanyige* with woodfuel, rather than advanced fuel. Advanced fuel such as LPG and electricity are used in very few households and *matooke* is cooked by boiling with a small amount of water and is then mashed. This cooking method is more used in single households or when cooking time is limited, but people say that *matooke* cooked in this way is tasteless. A man living in Kampala stated: "If my wife cooks *matooke* in this way, we would get divorced immediately!"

According to the people of Kampala, the main factors of flavorsome *matooke* are color, aroma, taste, texture, and warmth. A vivid yellow (*kyenvu*) is preferred for the color. The *matooke* turns black when it is not peeled properly because of the vascular bundle, and remains white (*kyeru*) when it is not well steamed. The smell of banana is supposed to come out when opening the *muwumbo* (bag of banana leaves). The cooked meal is supposed to be sweet and not too hard or too soft. It is also supposed to stay hot until the meal is finished.

To compare the difference in food cooked with different cooking fuels, *matooke amanyige* was prepared by wrapping with banana leaves cooked on charcoal, firewood, and LPG respectively. All the cooking processes of a Ganda housewife were observed and recorded and the food was tasted by the researcher, the chef, and two Ganda people. The charcoal cooking was observed on February 22, 2013, the firewood cooking on February 26, 2014, and the LPG cooking on March 9, 2014.

The *matooke amanyige* that was cooked with charcoal became a little hard, vivid yellow, and had a satisfying texture and smell. It did not get cold until people finished eating. The banana leaves turned a dark green before mashing and brown when the food was ready. It took 88 minutes to steam before mashing, and 60 minutes after mashing.

When cooked using firewood, the matooke became sweet and a vivid dark yellow, with a tender texture and a pleasant aroma. It was very hot to eat in the beginning and stayed warm until the meal was finished. The color of the banana leaves changed similarly to the charcoal-cooked meal before and after mashing. It took 56 minutes to cook before mashing and 48 minutes after mashing.

When the *matocke amanyige* was cooked with LPG, it turned a subdued yellow and was quite hard with a bad texture with lumps. It did not have a great aroma or taste and became hard and cold in the middle of the meal. The banana leaves did not change color and the housewife had to add water for steaming several times. It took 55 minutes to cook before mashing and 23 minutes after mashing.

Matooke does not remain soft once it gets cold. As mentioned before, the meal should be served

hot in Ganda society. Ganda people prevent the *matooke* from turning cold and hard by steaming it over a low flame, which is accomplished by pouring ash on firewood or charcoal when keeping the leftover food. A low flame does not always need added woodfuel, but LPG or electricity needs extra energy, which is expensive and too hot for keeping *matooke* warm and soft.

6. DISCUSSION

6.1. The demand for charcoal and its preference as cooking fuel

Three reasons for the preference of charcoal as cooking fuel were highlighted by this fieldwork survey in Kampala: economy, residential environment (in Chapter 3), and food culture (in Chapter 4 and 5).

First, the cost of charcoal is reasonable as a daily cooking fuel compared to LPG and electricity. Charcoal can be bought in small amounts in small buckets (about 1 kg) at approximately 1,000 shillings, while it costs more than 50,000 shillings to buy an LPG cylinder. Additionally, charcoal stoves cost about 2,000 shillings. This also makes it easier for people to use charcoal rather than LPG or electricity.

Second, the high population density in Kampala necessitates using cooking fuel that does not need a large cooking space to cook and does not produce too much smoke. Although people in rural areas generally have a small building that serves as the kitchen, people in urban areas have limited living space such as tenements, which do not have specific kitchen space. Cooking with charcoal does not make the living space and cooking utensils dirty with smoke and soot. Charcoal is readily available everywhere in the residential areas of Kampala, as opposed to firewood, which is not readily available because of limited supply in the city.

Third, food culture has a significant impact on the choice of cooking fuel according to the survey on food preference and local cooking methods. Bananas are a staple in Uganda and are consumed in large amounts. As shown by Roscoe (1911), people have sustained the traditional cooking method with banana leaves since around 1900 or maybe even earlier. The dish cooked by using bananas, *matooke amanyige*, has high socio-cultural value in the area. The cooking method involves steaming for long hours over a very low flame. This steaming process is called "*ku-boobeza*" in Luganda. Our field observations have showed that the *matooke* becomes hard and tasteless when it is cooked with LPG, since the heat is too high. Steaming with banana leaves can be used for cooking other food as well, such as posho and stew. People enjoy the aroma and flavor of cooking with banana leaves over a low flame.

Most people of the Ganda—especially women—are regarded as mature adults when they can cook delicious *matooke amanyige*. This is important in order to get married and be a good housewife.

According to the meal and fuel surveys conducted in this paper, *matooke* was not cooked every day in lower-income household. At Ms. Sr's household it was cooked 3 times in a week, and two of them were cooked as *katogo* (see Table 2). This was because cheaper staple foods such as posho and rice are available. On the other hand, *matooke* was more frequently cooked in higher-income households. It was cooked 6 times in a week at Ms. Pr's household (see Table 3), and every day for supper at Ms. Jp's place (see Table 4). It can be indicated that *matooke* is something that people would like to eat every day if they can afford to buy them.

6.2. The correlation between economic growth and choice of cooking fuel

The energy ladder proposed in the 1980s states that people shift their choice of cooking fuel from a lower to a higher level upon the improvement of the socio-economic status of the country. Charcoal is regarded as transition fuel used in societies where the economy has not improved sufficiently to afford advanced fuel (Shively *et al.* 2010). There are high-income households in Uganda—especially in the capital of Kampala—where the economy and urbanization are developing. However, even these households are still using charcoal as their main cooking fuel although they also have devices for advanced cooking fuel at home. This is because *matooke* is eaten every day in most of these house-

holds, which lower-income households cannot always afford every day. Charcoal is deliberately chosen to cook tasty *matooke amanyige* every day, not because of their inability to afford advanced fuel.

If there is a system within a household with two or more women doing household chores, it also enables people to spend longer hours on cooking. Housemaids are hired in many households where both the husband and wife work in town, which facilitates more time being spent on cooking than before when women's participation in the workforce was only starting to increase. In other households, it is quite common to have younger women from rural areas helping with chores. All these factors contribute to people being able to keep using charcoal for cooking.

6.3. The influence of food culture on the choice of cooking fuel

The energy ladder model shows that a country's socio-economic status has a great impact on the choice of cooking fuel of the population. On the other hand, other factors also have an impact on the choices of cooking fuel in energy stacking (van der Kroon *et al.* 2013).

Masera *et al.*'s (2000) study stated that the frequency and cooking method of tortillas influence people's choice of cooking fuel in Mexico. People once started using LPG but reverted to using firewood, because they were not able to cook as many tortillas as they need and make them as tasty with LPG as they did with firewood.

This study's field observations in Kampala adds another case study proving that local food culture has a great effect on the choice of cooking fuel. Bananas are a staple of the region and are cooked in a traditional way, which needs low and long burning fire. Modern fuel is not suitable for cooking bananas to people's preference. When focusing on the choice of cooking fuel, factors such as infrastructure, the livelihood strategy for the poor, the fuel cost, and socio-economic status are considered, but the effect of local food culture also needs to be emphasized.

NOTES

(1) The term "plantain" is used in a dual sense. It refers to cooking bananas in general, but also represents the subgroup of banana species possessing the genome type of AAB. Cooking bananas in Uganda belong to the AAA group (JAICAF 2010). In this study, the term "banana" is used to represent cooking banana, and the term "fruit banana" is used for the raw-eating type.

(2) The bag is used for distribution of various commodities such as rice, maize flour, sugar, and beans. The size of a bag is approximately 60 cm wide and 100 cm deep.

(3) The exchange rate between the US Dollar and Ugandan shilling was USD 1 = 2,600 shillings in 2014 (UBOS 2017: 212).

(4) The population density is high in Kampala compared with other East African cities, for instance 4,500 people per sq. km in Nairobi, Kenya (Population Reference Bureau 2011) and 3,133 people per sq. km in Dar es Salaam, Tanzania (National Bureau of Statistics & Office of Chief Government Statistician 2013).

(5) In rural areas, it is common for sleeping and cooking buildings to be separate. This style has been followed since when people were living in huts. Houses are separated by at least 10 m to prevent smoke from bothering the neighbors.

(6) When there is a kitchen in the homestead, people do not have to worry about soot and smoke, since saucepans are not brought into the living room or bedroom.

(7) A hydropower plant has been in operation since 1960s in Uganda using water resources from Lake Victoria. Since Uganda is a landlocked country, it sells electricity to Kenya and Tanzania in return for using their ports and roads to import commodities from other continents (Kimbugwe *et al.* 2012). The price of electricity is higher than the surrounding countries because generated electricity is sold rather than being provided to the population (UPDEA 2009).

(8) There are many varieties of bananas in Central Uganda, including those used for staple food, fruit, and alcohol. Many varieties of bananas for staple food are planted in rural areas, but people in urban areas cannot distinguish the varieties, and the price of bananas is decided according to size, not the variety. More information about the varieties of banana in Uganda can be found in JAICAF (2010).

(9) The word "posho" is English according to the English dictionary (e.g. "Oxford Dictionary of English"). Its

origin is Kiswahili, meaning "daily rations." In Luganda posho is called "*kawunga*."

(10) Posho is also called "*ugali*" in Kenya and Tanzania, "*nsima*" in Zambia, Malawi, and other surrounding countries, "*too*" in Mali, and "*fufu*" in West Africa (Ogawa 2004: 95; Ankei *et al.* 2016: 33–34).

(11) In Uganda, "*enva*" translates to "sauce" in English, but it is not always poured on staple food. For the purposes of this study, it is called stew, since it contains vegetables and meat.

(12) In the same family, people tend to serve the staple foods and stew separately for adult men and the head of the house. This is because the Ganda is a paternal society.

(13) An aunt on the maternal side is called "*maama*," as well as mother, since the clan of a maternal aunt is the same as mother.

(14) The AfDB define people whose daily expenditure is below USD 2 as low-income, between USD 2 and USD 20 as middle-income, and above USD 20 as high-income (Kingombe 2014).

(15) Drying meat, called "*ku-kaza nyama*" is a process that pre-cooks meat before boiling it to make it softer when the food is ready. Originally, people used to grill meat, but when they do not have the time or utensils, they boil it with a little water until all the water evaporates.

(16) Food is frequently shared with visitors and neighbors in Ugandan society, which makes difficult to tell how many people food is cooked for every day apart from the family size. Ms. Sr and her family live in a tenement (See 3.1), and she shares their food with her neighbors (including little children) when they want it.

(17) In Ms. Sr's household, the family eats a light meal—such as bread and chapati with tea—as breakfast and the food left over from lunch as supper.

(18) The Soga people (*Basoga*) live east of the Ganda area, and their language—Lusoga—is closely related to Luganda.

(19) The Nyoro people (*Banyoro*) live to the northwest of the Ganda area, mainly in the Hoima, Masindi, Kibaale, Buliisa, Kiryandongo, Kakumiro, and Kagadi districts. The Nyoro people also eat banana, posho, rice, cassava, sweet potato, and sorghum as staples.

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