Culture, tradition, and taboo: Understanding the social shaping of fuel choices and cooking practices in Nigeria

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Abstract

Wood fuel remains the most widely used domestic fuel amongst resource poor groups in many low-income countries, despite the environmental and health problems associated with exposure to wood smoke. Studies on household air pollution concentrate predominately on socio-economic and behavioural factors and health with little emphasis on socio-cultural factors. The study contributes to the understanding of household air pollution (HAP) and wood fuel harvesting for domestic activities in low-income countries from a cultural perspective that draws on householders' wood fuel selection and cooking practices in Ado Ekiti, Nigeria. In this paper, we explore how cultural norms influence households' cooking practices, energy choices and perceptions of the causes of ill health and misfortune. The research draws on household surveys, participant observation and semi-structured interviews with householders of four different ethnic origins in nineteen villages. Key findings reveal low levels of awareness of HAP-related illness coupled with high levels of attachment to traditional biomass-fuelled cooking systems for a range of cultural and pragmatic reasons. It is argued that 'ethnic-specific' traditional norms and taboos provide a more important influence on fuel choice, wood fuel harvesting and cooking practices than the lived realities of exposure to household air pollution.

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Key words: HAP; socio-cultural context; woodfuel; Nigeria

1. Introduction

Around 80 percent of rural households in sub-Saharan Africa rely on biomass fuel for cooking which, when burned on traditional three stone open fireplaces, contributes to high levels of indoor and local air pollution [1]. In many countries, it is not only rural people that live close to forest lands that subsist on biomass fuels. Resource poor households in urban, peri-urban and non-forested rural areas frequently also make use of biomass fuel (wood, charcoal, agricultural wastes, sawdust, wood chip, and animal dung) for cooking, lighting and heating [2,3]. The near-universal use of traditional three stone fires further worsens air quality levels in dwellings, causing it to exceed World Health Organisation (WHO) guidelines. The incomplete combustion of biomass fuels releases high quantities of harmful pollutants into the atmosphere which cause an estimated 600,000 deaths per year in Africa [4]. It can also have negative health impacts on biomass users and their neighbours including chronic obstructive pulmonary disease, acute respiratory infections, low birth weight, high blood pressure, infant mortality and pneumonia [5-13]. Women and children are generally assumed to be most vulnerable to the impacts of household air pollution [11-17] due to their greater exposure to biomass smoke during cooking. In addition to these health-related effects, the burning of biomass fuel has been linked to deforestation and, more recently, to climate change resulting from carbon emissions [18].

Efforts to ameliorate these problems brought forth a range of different initiatives including schemes promoting the adoption of improved cookstoves. These initially tended to focus on fuel-efficient stoves to help address perceived fuel wood demand-supply gaps associated with the ‘other energy crisis’ [19]. Later initiatives focused more on the development of ‘clean’ stoves that reduce emissions of carbon monoxide, hydrocarbons, particulate matter and black carbon; all of which have been linked to high levels of household, community and global air pollution [20-22]. An important assumption shared by both sets of initiatives is that with time and rising socio-economic status, households will move up the ‘energy ladder’ from biomass fuels to cleaner and more efficient fuels for domestic activities [11, 23-26]. Nevertheless, it is widely recognised that households frequently ‘stack’ (use a range of) different fuels according to consideration like fuel prices, the food being cooked or seasonal influences on fuel availability or cooking practices [27-29]. Socio-economic factors including income, family size, gender, age, occupation, education are recognised as particularly important influences on energy choices [30-32] although the role of user priorities and supportive government policies is also acknowledged [33].

In an effort to combat HAP and bring about changes in the living conditions of resource poor populations that subsist on biomass fuels, the Global Alliance for Clean Cookstoves (GACC) is planning to deliver clean cookstoves and fuels to 100 million households by 2020 [34]. Particular emphasis has been placed on improving the adoption and diffusion rates of improved cookstoves (ICS) and non-solid fuels as a means of preventing local environmental problems associated with HAP from shifting to community and global levels [11, 35-40]. While some significant declines in the proportion of households relying on solid fuels have occurred in Southeast Asia and the Western Pacific, less progress has been made in Africa with two-thirds of the population relying primarily on solid fuels in many countries [2, 41]. Elsewhere, the uptake of clean fuels and ICS has often been slow amongst resource poor populations [42] with key barriers including the expense of clean stoves and alternative fuels and the failure of ICS and non-biomass fuels to meet user priorities [18, 43].

In Nigeria, ICS interventions have included the promotion of more efficient and cleaner burning wood stoves (e.g. 'Save 80' and rocket stoves), solar cookers, LPG and ethanol stoves [44-47]. In practice, however, the dissemination of information on the efficiency and health benefits of ICS compared to 'traditional stoves' and the health impacts of HAP has often failed to translate into increased uptake [48, 49]. This has been linked to concern about the cost and availability of alternative fuels including gas, kerosene, ethanol and electricity [44]. Also significant has been the failure of many ICS designs to meet locally-specific cultural cooking preferences relating to taste, fuelling practices, cooking location, stove size and flexibility to accommodate heating as well as cooking needs [45-47].

Recognising the failure of past programs to promote widespread uptake of ICS, Ezzati and Kammen [50] highlight the need for an interdisciplinary approach to understand which cookstove interventions will be effective in ameliorating HAP problems. This reflects the fact that traditional 'hardware-oriented' approaches (the promotion of pollution-reducing products and efficient technology to solve HAP problems) often failed to appreciate the value placed on traditional cooking methods and increased awareness of HAP-related health impacts is rarely sufficient to increase demand [18]. In response, increasing emphasis has been placed on the need for ICS interventions to combine hardware and 'software' approaches that place greater priority on considering and incorporating the social and cultural contexts of HAP interventions [43, 51]). In particular, software perspectives have helped to highlight the importance of local cooking practices (food locally cooked, utensils used, number of meals per day, family size) and more practical user priorities (affordability, ease of maintenance, use of ash combustion by-products for health and agricultural functions) that help to sustain the use of traditional stoves and biomass fuels [18, 25, 52-55].

To understand energy choices, it is necessary not only to consider the technical, economic, social and political context, but also to consider locally-specific cultural influences [4]. The frequently localised nature of domestic wood fuel use means that it is often linked to cultural heritage [55] with local wood harvesting practices reflecting and influencing ethnically and culturally-specific norms and preferences regarding food preparation [56]. Some of these knowledges reflect more pragmatic factors related to the uses and functions of different types of wood fuel, although others are linked more closely to taboos associated with the use of particular species [56]. As noted by Houehanou et al. [57] intercultural and intracultural differences along with ethnicity can affect the choice and use of a particular plant on the basis of factors like familiarity, local abundance, combustion properties and suitability for multi-purpose uses such as drying and fermentation [58].

Although the influence of socio-economic factors on energy preferences is well studied [31, 32] less is known about locally-specific cultural preferences for particular biomass fuels and understandings of ill health linked to inappropriate fuel wood use. Likewise, while cultural analysis has been undertaken to examine energy-related behavioural change linked to fire tending and proximity to fireplaces [39, 43, 51], the ways in which illness and misfortune are linked to the contravention of cooking norms (and the ownership of household assets more broadly) is poorly understood. At the same time, work on the role of local ecological knowledge in identifying natural resources for multipurpose uses [56, 57, 59] reveals little about locally-specific cultural influences on wood fuel choices.

In this paper, we use data from Ado Ekiti, Nigeria to explore how cultural norms influence households' cooking practices, energy choices and perceptions of the causes of ill health and misfortune. Section 3.1 focuses on ethnic-specific norms and taboos regarding the use of specific tree species for biomass cooking and how their contravention is associated with debilitating health outcomes. Community-wide cultural norms and taboos associated with cooking practices are also discussed in this section with attention being drawn to how ill health and misfortune are associated with a failure to observe these. Emphasis is also placed on respondents' low levels of awareness of HAP-related ill health and the value they place on traditional biomass-fuelled cooking systems for a range of cultural and practical reasons. Continuing this theme, section 3.2 explores local perceptions of smoke, highlighting how it is valued for both utilitarian and cultural reasons but is not widely associated with serious health problems. Drawing on these findings, we argue, in sections four and five, that uptake and sustained use of either ICS or modern energy sources amongst resource-poor households is unlikely to be achieved without closer attention to local differences in cultural norms and preferences surrounding cooking and fuel use. As a result, local user preferences and lived realities need greater prioritisation in initiatives seeking to promote the adoption of ICS and cleaner fuels.

The paper's originality and rigor lies in its use of in-depth qualitative research to understand and give voice to culturally-specific practices, priorities and norms surrounding cooking and wood fuel collection. Of particular significance are findings that highlight the range of benefits provided by traditional stove and woodfuel combinations (*aro meta*) in low-income contexts that cannot easily be replicated by ICS. The clear associations that respondents made between ill health, misfortune and the contravention of cooking-and fuel-related norms/taboos are also relevant for ICS and health intervention programs. These findings are likely to be of particular relevance to practitioners and researchers working in the ICS and energy sectors with responsibility for designing interventions seeking to promote respiratory health and reduce greenhouse gas emissions.

2. Methods and materials

2.1 Description of the study area

This study was carried out amongst low income migrants in peri-urban settlements of Ado Ekiti, Nigeria (Figure 1) which comprise of a mix of farms, villages and forested environments. Ado Ekiti is situated at latitude 7^0 40’ North and longitude 5^0 16’ East with a land area of 265km^2 and an elevation of 400m above sea level [60, 61]. The main periods of fieldwork took place between October 2009 and September 2014 with additional information obtained in 2016. The choice of location was based on the fact that the study area’s Yoruba cultural and administrative traditions have been influenced over time by in-migration of other ethnic groups including Ebira from central Nigeria, Tivs from the middle-belt region and Hausa from northern Nigeria.

Our survey of 350 households from nineteen peri-urban communities reflects this mixture with 76 percent comprising of Ebira households, 16 percent Yoruba, 7 percent Tiv and 1 percent Hausa. Although these communities are mostly situated in close proximity (distances range from 0.5 to 20 kilometres) to Ado Ekiti, they have not yet benefited from the provision of basic infrastructural facilities (e.g. electricity, drinking water, sanitation systems, health care). As a result, fuel use is less diverse than in Ekiti State as a whole where Demographic and Health Survey data for 2015 indicated that 33.7 percent of households depend primarily on wood fuel, 6 percent on charcoal, 49.4 percent on kerosene 6.7 percent on gas and 3.3 percent on electricity. Wood fuel and kerosene were the main fuel sources used in the study communities although many householders were found to ‘stack’ these fuels. The household survey indicated that 76 percent of households used wood on three stone fireplaces but relied on kerosene to help them light the wood while just 4.3 percent (mostly Yorubas) cooked exclusively with kerosene stoves. Just under 20 percent made exclusive use of wood fuel on either three stone fires (17.1 percent), with some Yoruba and Ebira households using U-shaped clay stoves (1.4 percent) or metal hearth stands (1.1 percent).

Air quality was found to be poor in the study area[2] in part due to the clustered layout of buildings and poor ventilation which allowed HAP to penetrate inside buildings even when people cooked outside. Cooking in open spaces away from buildings was the most widespread cooking practice (undertaken by 71 percent of households) across all ethnic groups while 19 percent (mostly Ebira households) had kitchens attached to an external wall of their home. Just 7 percent of households (mostly Yoruba and Hausa families) had inside kitchens and 3 percent (mostly Tiv households) cooked in a separate building.

In order to investigate culturally-specific fuel preferences and perceptions about household air pollution, the 350 sample households were selected from nineteen communities based on their heterogeneous cultural backgrounds and multi-ethnic composition. The majority of residents are migrant farmers from various communities within Nigeria but, irrespective of their place of residence, they maintain close links with their 'home' communities. Indeed a common expression amongst them is *ile labo isimi oko* ('home' is where to retire to no matter the length of stay in a foreign land), indicating that they do not feel disconnected from their 'roots' [62]. This is apparent through the continuation of social norms that connect them with 'home' including ethnic-specific architecture, construction materials, kitchen type/location and the avoidance of particular tree species for fuelwood. Cooking norms that intersected the different ethnic groups but connected them with 'home' rather than with prevailing practices in Ado-Ekiti included the use of '*aro meta*' (a simple three stone fireplace - Figure

[2] Household air pollution levels ($PM_{2.5}$) were measured during the study for nine weeks in different kitchen locations. It was apparent from the measurements that air quality levels in buildings were above WHO guideline values, although a discussion of these findings is beyond the scope of this paper.

2) and the use of smoke to preserve meat and crops (Figure 3). Households have developed a high degree of trust in and reliance on these practices over the years and many expressed concern about the socio-cultural and health related impacts of deviating from them.

2.2 Methods of data collection

Fieldwork in Ado Ekiti was undertaken by the lead author who, as a resident of Ado Ekiti State, was able to take advantage of her knowledge of the study communities and also of their neglect by the Nigerian government. As such, she was regarded as an 'insider' of the region although her ethnicity (Yoruba) and experience of having studied abroad marked her out as an 'outsider' within the Ebira-dominated study communities. Because of this, she was initially suspected of being a 'government spy' and it took time to convince people that she was working in their communities for research purposes and had no underlying political motive. On arriving in each community, permission was sought from community leaders to conduct research and the nature of the topic was outlined. Respondents were assured that they could withdraw from the research at any time and were given pseudonyms to protect their identities

In order to obtain diverse views on fuel choices and cooking preferences within this geographical location, a qualitative approach was undertaken to explore respondents' different lived experiences [63-65]. Household surveys, semi-structured interviews and participant observation over a period of five months followed by subsequent shorter visits were used to develop in-depth understandings of cultural norms and preferences regarding fuel wood collection, fuel choices and cooking practices as well as knowledge of HAP and broader causes of ill health. Efforts were focused gaining depth of understanding on the ethnographic and participatory elements of the study rather than producing generalizable results [66].

A total of 350 household surveys were undertaken during fieldwork in 2010 and 2011 with a non-probability convenience sampling technique being used to select participants that were readily available and willing to participate in the study [67]. In addition, thirty semi-structured interviews were undertaken with respondents being selected from the population of interest [68] on the basis of them belonging to a range of different ethnic group, and regularly walking between 0.5 and 10 kilometres from home to gather wood fuel from the forest. Individual interviews were conducted at respondents' homes. This qualitative approach allowed in-depth understandings to be gained within a specific geographical location [69]. The respondents comprised of 10 males and 20 females with ages ranging between 21 years and 50 years from among four ethnic groups (Ebira, Yoruba, Tiv and Hausa). The gender balance of the interviewees reflects the fact that women carry out the majority of cooking and fuel collection tasks although they are often assisted by children (girls and boys). The amount of time taken to collect wood fuel is usually determined by distance and the prevailing weather conditions but ranges between 20 minutes and 3 hours. Most collection occurs during the dry season as footpaths become slippery and dangerous in the rainy season and wet wood creates uncomfortable levels of smoke when burned. According to most respondents, it is easy (albeit time-consuming) to walk to the forest and collect wood fuel in the dry season, but the forest is wet, overgrown and difficult to navigate during the wet season.

The original intention was to interview an even higher proportion of women. This was not always possible as some men were keen to participate when their wives were not at home while in other cases, women indicated that they would prefer their husbands to respond to the questions. The latter scenario highlights local cultural norms linked to patrilineal marriage traditions and wider gender relations that give men greater control over decision-making in families [70]. Semi-structured interview questions focused on the cultural-contexts of wood fuel use and perceptions of household air pollution and were designed to allow respondents to express their views freely [69].

Interviews were conducted in the Yoruba language and transcribed into English with comparable responses checked for consistency [71]. The transcribed interviews were later manually coded and thematically analysed with interpretations being checked before validation [72]. Particular efforts were made to check whether participants from the same ethnic background expressed similar views regarding wood fuel harvesting and cooking preferences and taboos.

Participant observation in the different communities – 'hanging around' and 'watching the action' of the participants [71] – allowed lived-reality to be observed at close quarters over a sustained period of time. This approach was important for developing trust and gaining in-depth understandings of specific local environmental problems, cultural norms and different intra-community priorities as a result of being immersed in the day-to-day activities of the respondents [67]. Particular emphasis was placed on gaining insights into cultural understandings of cooking and wood fuel harvesting practices and the perceptions of different community members on the health impacts associated with burning biomass fuels. Key themes identified from these observations and interviews facilitated the analysis of local interpretations of the cultural norms surrounding local cooking practices including the value and drawbacks associated with using wood and biomass as a cooking fuel and perceptions of the causes of ill health linked to this.

Limitations of the study include the over-representation of Ebira and Yoruba respondents in the sample, given their numerical dominance and willingness to participate in the study. This meant that the voices and cooking norms of Tiv and Hausa respondents were less well represented, making it hard to capture a similar level of detail on their cooking norms and perceptions of the causes of ill health and misfortune. As the study involved the collection and analysis of site- and ethnic-specific data, the results have limited generalisability.

3 Findings

3.1 Socio-cultural Influences on Fuel and Stove Choices

A wide range of cultural norms were found to influence household decisions on the type of fuel used for cooking. Nevertheless, the different ethnic groups using wood as their main source of fuel demonstrated strong variations in the actual choice of species collected. Yoruba householders do not harvest *Akoko*[3] and [4]*Iroko* trees as a cooking fuel due to the significant cultural value attached to them. The *Akoko* tree is used by the Yoruba for the conferment of traditional titles and rites and during the traditional rites of enthroning a new King. Yoruba respondents therefore had a strong sense of reverence for this species:

> *The Akoko tree, nobody dare make use of it. That is our tradition, which has been passed on to us by our forebears and we strictly abide by that injunction, and we simply pass the same instructions to our children (Female Yoruba Householder 6).*

The harvesting of the *Iroko* tree is also traditionally forbidden for Yoruba households who believe that gathering such wood for cooking causes miscarriage or still birth. In a similar way, Ebira households are forbidden from harvesting *Ochuku*[5] trees for fuel wood as they associate it with causing ill health in Ebira children:

[3] Akoko tree – *Newboldia laevis*
[4] Iroko tree – *Milicia excela*
[5] Ochuku tree – *Lecaniodiscus cupanioides*

Women of childbearing age that used Ochuku trees to cook do have their children constantly falling sick (Female Ebira Householder 5).

In contrast, Hausa and Tiv householders harvest fuel wood from any tree from the forest and interviews indicated that there are no forbidden trees for these ethnic groups:

> *There are no cultural restrictions on harvesting any type of tree for domestic use (Female Hausa Householder 26).*
>
> *We do not have traditional [norms] on tree type harvested for domestic use… as long as the wood fuel is properly dried, there is no harm in its use (Female Tiv Householder 12).*

With regard to stove choice, respondents from all ethnic groups demonstrated a strong degree of trust in and reliance on '*aro meta*' (three stone hearths). These are used by 96 percent of respondents and are valued for being free of cost, easy to construct and very flexible as the three stones can easily be moved apart to accommodate different pot and fuelwood sizes. They also accommodate heavy traditional cooking pots that can withstand significant amounts of heat along with the force required to prepare cassava flour into edible food:

> *Our food types (beans, yam, rice, cassava flour) can take a longer time to prepare...not only that, we use big cast iron cooking pots that require much heating before cooking can be done...considering all these factors then, I think firewood will be faster during cooking (Female Yoruba Householder 17).*

The act of using wood fuel and '*aro meta*' for cooking is also widely regarded as a way of life passed to householders by their ancestors, representing 'all that they have known in cooking their food' (Female Ebira Householder 23). It also formed part of broader efforts to replicate practices that connected them to their 'home' communities:

> *The familiar cooking method is aro meta which has been in use even before I was born. It is the cooking method we have learnt from our parents and it dates back to generations of users (Female Yoruba Householder 16).*

> *Our ancestors used three stones and wood for cooking…it is the same cooking methods we're using today (Female Hausa Householder 26).*

Throughout the study area, there is a strong belief that *aro meta* should only be used for preparing food and that ill health and other misfortunes reflect the contravention of cooking norms. In tending hearths, a range of cultural practices are strictly observed including prohibitions on 'tampering' with fireplaces that are used for cooking or using them for non-cooking purposes including heating up metal or preparing traditional medicine; both of which require dedicated fireplaces:

> *...heating a knife or cutlass in a cooking fire place can cause high blood pressure, chest pain, fast heartbeat, hypertension and thunderstorms (Female Ebira Householder 30).*

> *The fireplace used in cooking herbs must not be tampered with; if this happens it reduces the efficacy of the herb in treating the proposed ailment(s) and further causes complications of such ailments without any cure (Female Ebira Householder 9).*

In addition, after cooking, cultural norms require that any unburned wood used for cooking is spread apart to cool naturally:

> *Water must not be used in quenching burning fire wood...if it happens; it can cause fever, respiratory problems (Male Ebira Householder 10).*

These examples illustrate how respondents' thinking about the causes of ill health and misfortune revolve around a failure to observe traditional norms and observance of taboos; often remaining disconnected from any form of medical diagnosis or assessment.

A small (2.5 percent) proportion of the sampled households use clay U-shaped stoves and metal stands as alternatives or additions to *aro meta*. Metal stands have the advantage of being easily movable and can accommodate minimally prepared fuelwood as well as allowing the fire to be tended easily. U-shaped stoves, meanwhile, are easy to construct and build using locally available materials. Kerosene stoves are used by just 4.3 percent of households but are considered rather small for family-based cooking and their owners expressed concern about regular kerosene shortages and associated price rises. Another perceived drawback with kerosene stoves which would also apply to a wide range of both clean and efficient ICS is that they cannot easily accommodate the large heavy pots typically used on *aro meta* that can withstand the force required to prepare cassava flour. Households wishing to switch from *aro meta* to kerosene stoves therefore usually have to purchase different cooking pots: a drawback that would also apply to the adoption of many ICS types.

During efforts to determine awareness of ICS and HAP-related health benefits in the study communities, it became apparent that although respondents were familiar with electric and gas stoves, they had no knowledge of HAP-related health impacts and had not been exposed to any ICS intervention programs. When asked whether they would consider adopting a cleaner or more efficient stove if ICS interventions took place in their community, several respondents expressed concern about 'jealousy' that could arise from interactions with outsiders and adopting technologies promoted by them:

You cannot just receive anything from visitors, because you don't know if everybody is happy, [...] our community is small. You can't hide anything [...] that is why one has to be very careful, that way you get along well with everyone (Male Ebira Householder 21).

This and similar comments seemed to reflect a fear that selective participation in intervention programmes could breed resentment relating to who accepts or buys the technology being promoted.

3.2 Local Perceptions of Wood Smoke

Significantly for initiatives seeking to promote ICS uptake and modern energy choices, findings from Ado Ekiti indicated that ethnic-specific cultural norms regarding fuel choice, cooking methods, food preservation and brick curing techniques tend to emphasise the pragmatic and culturally-rooted benefits of wood smoke rather its negative health implications. At the same time, respondents' knowledge, awareness of and concerns about HAP-related respiratory health problems were very limited, with many respondents invoking a strong sense of tradition as a justification for continuing to cook with biomass fuel on traditional stoves:

Our forefathers made use of firewood to cook and light their house […] they even lived longer […] (Female Yoruba Householder 14)

We are used to wood fuel in cooking. Even when we travel to our home state wood fuel is still used for cooking. That's what we have been brought up using for cooking, although we complement it with kerosene (Female Ebira Householder 11).

Wood smoke is particularly valued as a means of curing pre-salted fish or meat which is an important form of food preservation in the absence of electricity for refrigeration. To achieve this, meat is laid out on mesh trays over the fireplace or within rafters over the kitchen area (Figure 3) for an average of 2-3 hours. Cooks (usually women accompanied by children) normally spend this entire period in the kitchen area constantly turning fish or meat on the mesh tray as they cure. Wood smoke is also valued for drying and curing mud bricks during house construction with respondents explaining how the penetration of wood smoke into newly-constructed buildings helps to strengthen them and prolongs their life in a similar way to way to firing bricks.

In questions designed to explore smoke-related respiratory issues, few respondents expressed awareness of HAP-related ill health while most emphasised the benefits of smoke for local livelihoods:

> *…wood smoke enables smoked fish and meat to be preserved for some weeks […] (Female Ebira Householder 3).*

> *It solidifies the walls of the buildings (referring to the mud blocks building) […] the building will stand for several years. I can assure you that the walls cannot just collapse, unless you deliberately pulled them down (Ebira Male Householder 4).*

Respondents that did mention the harmful effects of smoke tended to associate it with short-term physical impacts and perceived longer term of mental effects rather than indicating awareness of its respiratory health risks:

> *The wood smoke is not good…we experience headaches, and tears in the eyes [but] these are problems that we can easily find solutions to (Male Ebira Householder 18).*

Those that inhale smoke have fuzzy perceptions about life…they can't reason very well, you can call it dull brain (Male Ebira Householder 25).

Other householders did not link any adverse health outcomes of burning of wood fuel, stating that:

We find it difficult to sleep very well at night… but can't link it with fuel wood used for cooking (Female Ebira Householder 24).

By contrast, they were quick to associate ill health and misfortune with the contravention of cultural cooking norms or harvesting fuel wood from ethnic-specific 'forbidden' trees:

The Iroko tree cannot be gathered for wood fuel. Any woman that does that will experience a miscarriage or still birth (Female Yoruba Householder 6).

The effects [skin damage, convulsion] of using this tree are largely only applicable to them [the Ebiras]. Other ethnic groups do not necessarily experience this type of problem (Female Ebira Householder 1).

In so far as household air pollution and poor ambient air quality was acknowledged, it tended to be linked to a belief that local houses were constructed and ventilated in a way that allowed wood smoke from outside to blow in.

These cultural interpretations have relevance for designing future interventions aimed at improving respiratory health, but don't necessarily indicate resistance to gaining a better understanding of public health issues. Indeed, many respondents were well-informed about malaria and sanitation-related health problems as a result of health initiatives that had covered these topics and had made requests in the past for improved water and sanitation infrastructure as well as insecticide-treated mosquito nets. They also seemed keen to know more about HAP-related health problems when these were described to them:

This information you have given us about the wood smoke is an eye opener for us all in this community...it never crossed our mind that it is an environmental problem that is as important as water, sanitation and malaria (Female Ebira householder 24).

4. Discussion

Households in the study area clearly articulated the importance of local socio-cultural norms on fuel choice and cooking practices while perceptions of wood fuel smoke reflected culturally-specific knowledge alongside more pragmatic emphases on its values in food and building preservation. These reflect the fact that people sharing similar ethnic and cultural backgrounds have beliefs, ideas, norms, values and behaviours that have particular validity to them and guide their actions [73]. Echoing Taylor et al.'s [74] findings that cooking methods are based on experience learnt over the years, food preparation in the study villages is strongly associated with the use of three-stone fireplaces '*aro meta*' fuelled with freely available wood. Characteristics of *aro meta* that are particularly valued in the study area include their ready availability (usually free of cost), durability, flexibility in accommodating different sized pots and fuelwood. The belief that food cooks more quickly on *aro meta* is also widespread:

With large quantities of wood fuel in the hearth, thermal efficiency is substantially achieved thereby reducing cooking time (Female Ebira, Householder 30).

Local preferences for the taste of food cooked on wood fuel are culturally deep-rooted [75] and in the study area are also combined with respondents' cultural bonds and connections to ways of life in their 'home villages.' These cultural influences together with economic imperatives and the utilitarian value attached to wood fuel smoke have tended to limit demand for 'clean' ICS of the type promoted by Global Alliance for Clean Cookstoves (GACC). This is especially true in cultures where the value of cooking smoke for food and building preservation are seen to outweigh what are viewed as relatedly minor nuisances such as stinging eyes, headaches, and in rare cases, poor reasoning. So, while respondents might possibly be tempted by the idea of efficient (but still smoke-producing) wood-fuelled ICS in situations where access to wood fuel becomes difficult or has to be purchased [66, 76], these stoves would also have to offer comparable taste, convenience and cooking time benefits as well as the ability to cook sufficient quantities of food [45-47]. Potential constraints surrounding the need to purchase different pots or prepare fuelwood to fit the stove would also need consideration [77]. 'Clean' stoves using non-solid fuels, by contrast, would likely have less appeal as they provide fewer of the utilitarian benefits associated with wood smoke and respondents would find it hard to justify initial stove cost or ongoing fuel payments (especially when fuel access and prices rises might be problematic) when the *aro meta* and wood fuel combination is considered a culturally appropriate, cost-free and highly flexible cooking system.

With regard to fuel choices, cultural restrictions on the use of *Akoko*, *Iroko* and *Ochuku* trees were strongly adhered to amongst Ebira and Yoruba households, while Hausa and Tiv traditions place less emphasis on this aspect of their daily lives; a situation that may reflect the fact that Hausa and Tiv migrants originate further from Ado Ekiti than Ebira and Yoruba migrants. Such heterogeneous cultural norms within a relatively small geographical area illustrate the locally specific ways in which 'lived realities' shape cultural life, behaviour and social interactions [78-82]. This has significant implications for the uptake of ICS and 'clean' fuels as cultural norms surrounding cooking plus ethnic-specific restrictions on harvesting particular species provide alternative explanations for common health problems. Indeed, most households were unaware of any link between the use of wood fuel, poor ambient air levels and HAP-related illness and poor health, relying instead on traditional norms in assessing and identifying causes of illness and explaining poor ambient air levels. At the same time, the practical value of smoke in local livelihoods encourages respondents to put up with the short-term discomfort it causes.

The need for resource poor households to prioritise immediate basic physiological needs (food, shelter, and water) over longer-term and hard to determine health risks, meanwhile, create further barriers to identifying and addressing HAP-related health problems [81]. As a result, localised perceptions of risk reflect prevailing social, economic, political, and cultural factors [81, 82]. So, on the one hand, correctly harvested biomass fuels and cooking smoke are seen as healthy as they provide additional benefits in the form of food preservation and brick curing despite the fact that Polycyclic Aromatic Hydrocarbons (PAHs) are likely to be inhaled from the wood smoke [83]. After being smoked, fish or meat is covered with a tray on a mesh and in the process PAHs penetrate inside these foods, but in the absence of electricity to power refrigerators, these 'local technologies' are vital for subsistence and can also create the basis for small scale social food enterprises [84]. Such positive associations between wood smoke, food security and cultural norms are likely to be hard to challenge in the absence of sustained engagement with local community.

5. Conclusion and Implications for Clean Fuel Use

In highlighting a range of ways in which socio-economic status, culture and energy preferences intersect in Ado Ekiti, we illustrate how embedded ethno-specific norms and taboos guide local fuel choices, wood harvesting and cooking practices, creating in the process, an alternative set of knowledges regarding wood smoke and *aro meta*. Inherited traditions of wood fuel and harvesting practices are ethnically specific and reflect both cultural links with ‘home’ villages as well as socio-economic realities and user priorities. Most respondents depend heavily on cost (but not time) free access to wood fuel as a socio-economically and culturally appropriate way to meet domestic energy needs and cooking preferences [85] whilst wood smoke is associated with valuable additional benefits in the form of food preservation and building longevity. Key barriers preventing associations being made between smoke exposure and HAP-related health impacts include long time lags before the appearance of symptoms and their widely varied nature [81, 86]. By contrast, alternative, culturally-rooted explanations for many common health problems appear much more immediate and obvious.

Nevertheless, the health implications of exposure to cooking smoke are significant for all community members as particulates are regularly higher than the prescribed WHO limit for buildings. With the majority of householders cooking at the same time in areas with clustered building patterns, both household and neighbourhood pollution levels adversely affect air quality but significant improvements are unlikely to occur unless all households simultaneously make a shift towards cleaner fuels [87]: a situation that has health and environmental implications well beyond the study area [88, 89].

Findings from this study suggest that emphasis on behavioural change as a means of stimulating shifts in energy and stove use is unlikely to succeed unless accompanied by broader understandings of the lived realities, cultural beliefs and cooking preferences of resource poor households [11, 36-40, 51, 90, 91]. The low levels of awareness about HAP-related health impacts in the study area also indicate a need for public health programs to disseminate information on these. Whilst recognising that increased awareness of public health issues frequently fails to translate into behaviour change [11, 36-40, 49, 51, 90], respondents in the study area demonstrated good knowledge of water, sanitation and malaria-related health risks and took action (including drain clearing, rubbish disposal and use of mosquito nets) to reduce these. They also seemed keen to know more about HAP-related health issues when these were explained to them.

In attempting to scale up the use of clean fuels and ICS, there is a need to close gaps between the priorities of ICS manufacturers and promoters and those of end users whose context-specific cooking and energy preferences reflect their socio-economic status, ethnically-specific cultural norms and access to environmental resources. Without this, capital intensive innovations aimed at resource poor communities are likely to have limited uptake. At the same time, proposed solutions need to avoid shifting environmental problems from household to community levels, whereby community pollution re-enters buildings to re-create poor air quality at the household level [40].

4 Acknowledgement

The authors are grateful to Nigeria Tertiary Education Trust Fund for providing funding for doctoral research at the University of Nottingham, United Kingdom on which this study is based. The authors are also very grateful to the anonymous reviewers whose comments have been extremely useful in improving the paper.

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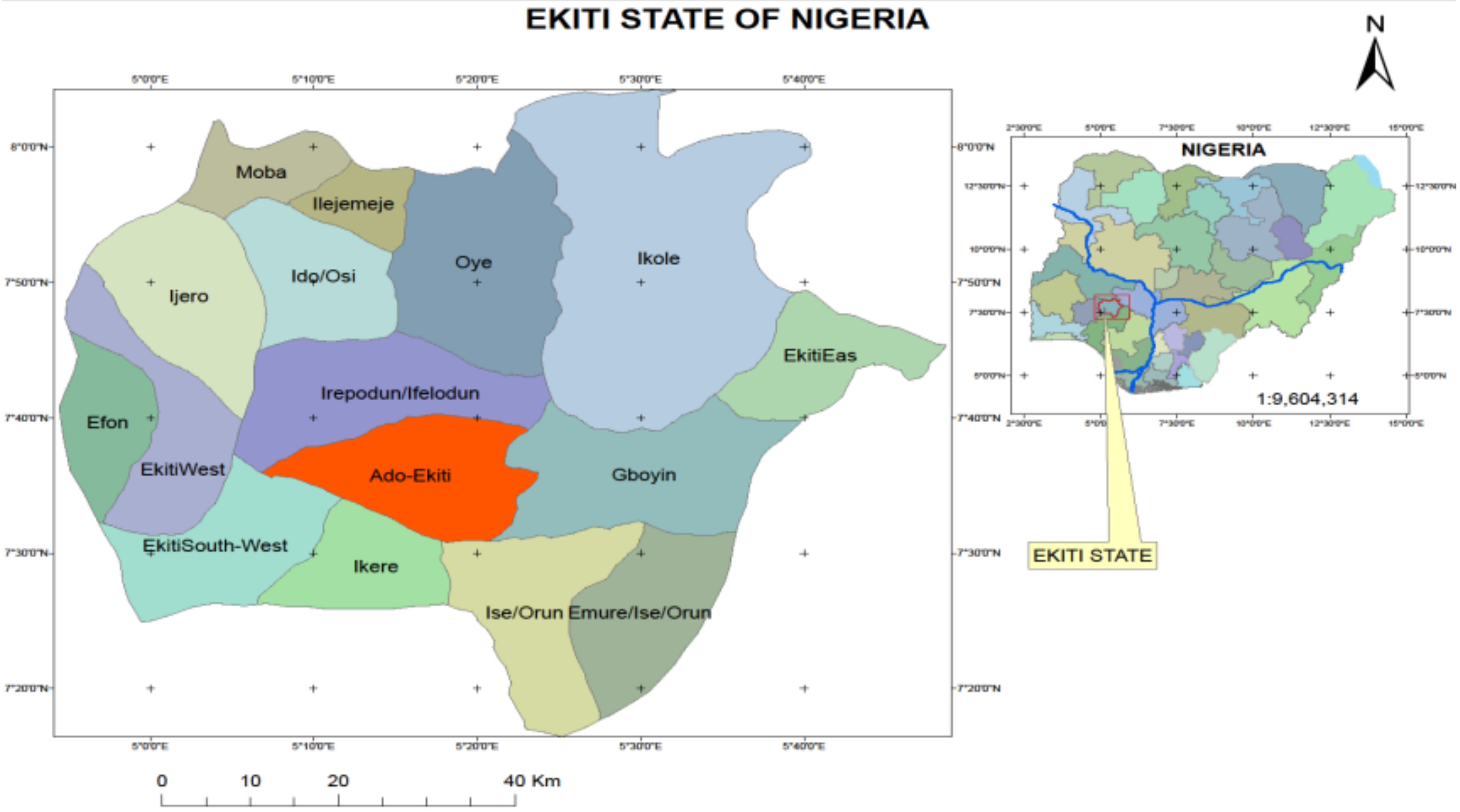
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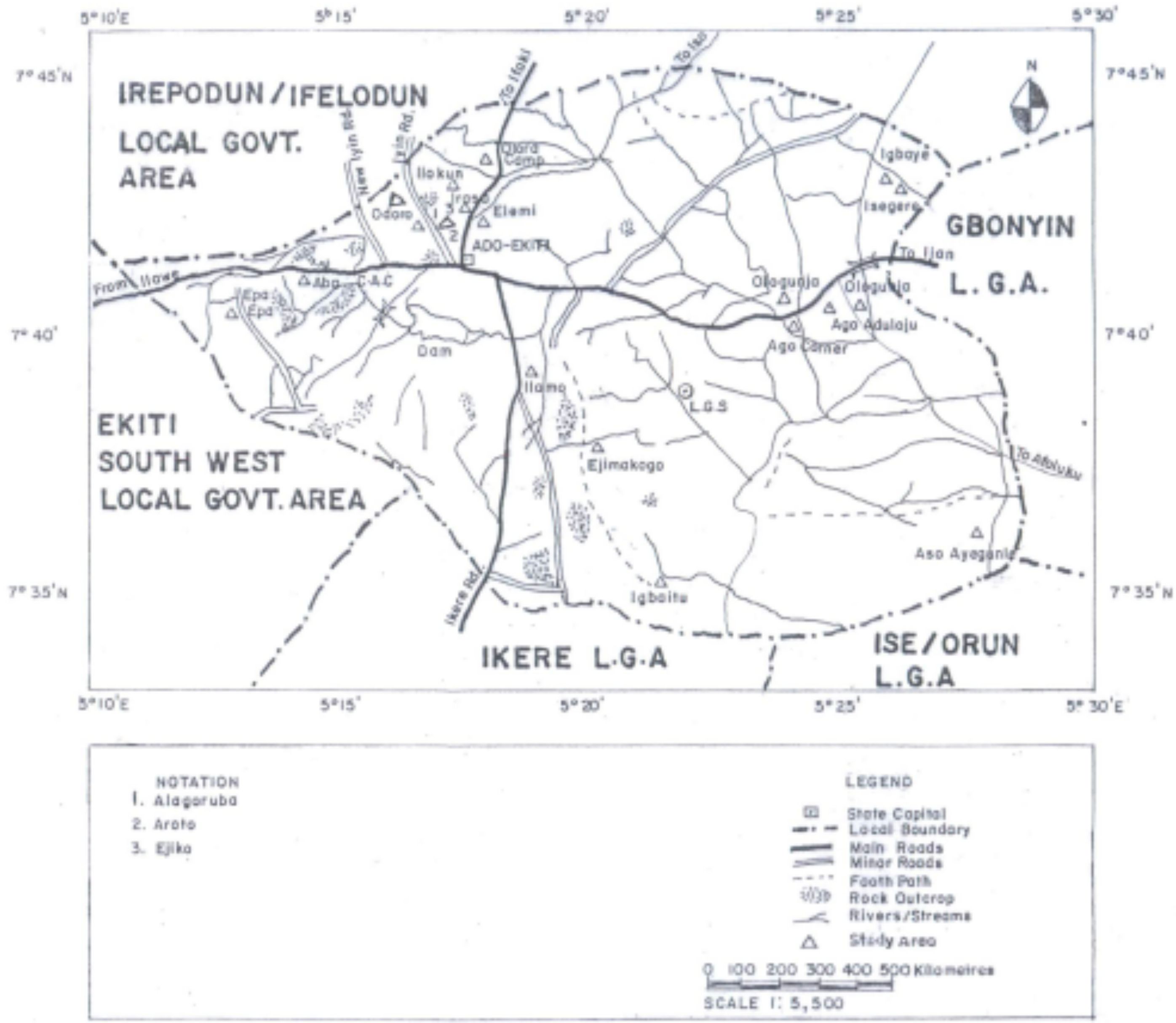

Figure 1: Maps of Ekiti State and communities that participated in the study

Figure 2: Three stone fire cooking place

Figure 3: Food processing on a mesh tray and food preservation above kitchen area