Original Article

Content of a novel online collection of traditional east African food habits (1930s – 1960s): data collected by the *Max-Planck-Nutrition Research Unit*, Bumbuli, Tanzania

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Background: Knowledge of traditional African foods and food habits has been, and continues to be, systematically extirpated. With the primary intent of collating data for our online collection documenting traditional African foods and food habits (available at: www.healthyeatingclub.com/Africa/), we reviewed the *Oltersdorf Collection*, 75 observational investigations conducted throughout East Africa (i.e. Tanzania, Kenya, and Uganda) between the 1930s and 1960s as compiled by the *Max Planck Nutrition Research Unit*, formerly located in Bumbuli, Tanzania. Methods: Data were categorized as follows: (1) food availability, (2) chemical composition, (3) staple foods (i.e. native crops, cereals, legumes, roots and tubers, vegetables, fruits, spices, oils and fats, beverages, and animal foods), (4) food preparation and culture, and (5) nutrient intake and health status indicators. Results: Many of the traditional foods identified, including millet, sorghum, various legumes, root and tubers, green leafy vegetables, plant oils and wild meats have known health benefits. Food preparatory practices during this period, including boiling and occasional roasting are superior to current practices which favor frying and deep-frying. Overall, our review and data extraction provide reason to believe that a diversified diet was possible for the people of East Africa during this period (1930s-1960s). Conclusions: There is a wealth of knowledge pertaining to traditional East African foods and food habits within the *Oltersdorf Collection.* These data are currently available via our online collection. Future efforts should contribute to collating and honing knowledge of traditional foods and food habits within this region, and indeed throughout the rest of Africa. Preserving and disseminating this knowledge may be crucial for abating projected trends for non-communicable diseases and malnutrition in Africa and abroad.

Key words: Tanzania, Kenya, Uganda, indigenous, staple foods, beverages, diet, culture

Introduction

Over the past several decades, sub-Saharan Africa has been experiencing a *nutrition transition* whereby traditional foods and food habits have been progressively replaced by the *globalized food culture* of the multinational corporations.[1] The impact has been disastrous. The *nutrition transition* has been directly implicated in the recent upsurge of non-communicable diseases (NCDs) throughout sub-Saharan Africa. The World Health Organization has recently revealed that NCDs currently account for 40% of deaths in developing countries, and this proportion is expected to increase significantly in the years ahead.[2] Within the next twenty years, sub-Saharan Africa can expect a three-fold increase in deaths due to cardiovascular disease (CVD),[3] and a near three-fold increase in the incidence of type 2 diabetes.[4]

Investigations conducted in Okinawa Japan,[5,6] the Mediterranean,[7,8] and China,[9,10] have provided robust evidence that traditional foods and traditional food habits are inextricably linked to vitality and longevity. To gain an insight into the factors potentially responsible for increased quality and quantity of life among these cohorts, it is therefore essential to evaluate the commonalities of their respective cuisines.

Fundamentally, the foods and food habits of these cultural groups overlap with regard to: (1) the utilization of fresh, whole foods, prepared according to traditional, often ancient, practices (2) the absence of corporate influence, which includes the lack of genetically engineered foods, highly processed foods, trans-fatty acids,

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preservatives, and common excitotoxic additives (e.g. aspartame, monosodium glutamate), some of which are known to induce metabolic abnormalities and hasten the genesis of obesity-related disorders.[11]

Historically, food habits flourish as an understanding of the food environment and the relationship between food choice and health status improves. Cultural beliefs and cultural practices also influence food habits; however health and survival inevitably remain at the forefront of food choice. For example, Johns *et al*[12] recently reported that the *Maasai*, who live in the northern district of Tanzania and the southern parts of Kenya, routinely eat almost double the recommended dietary intake of animal fats, yet their CVD risk remains negligible.[12,13] This paradox may be partially explained by the fact that the *Maasai* are extremely active, and consume a diversified diet including over twenty-five local plant species that contain antioxidants more powerful than vitamins C and E.[12]

The complete eradication of the corporate (i.e. political) domination of traditional foods and food-growing resources may be of utmost importance in averting projected NCDs trends and alleviating malnutrition in Africa. With respect to NCDs, the trends in Africa, and indeed the whole world in general, have been driven by the *scarcity-through-abundance* philosophy of the multinational corporations, which can be summarized as: a lack of quality food choices (scarcity) amongst the massive, insidious web of available options (abundance).

Unfortunately, today, the corporate masters of the so-called *New World Order* and their agenda for global hegemony, have largely succeeded in creating a *globalized food culture* that has been invariably linked to dire health consequences, including diabetes, obesity, CVD, and various cancers. This *globalized food culture* undeniably stands in marked contrast to the food culture Hippocrates spoke of when he stated: "Let food be your medicine and let medicine be your food." Global statistics on the incidence and prevalence of NCDs speak for themselves.

African culture has been, and continues to be, systematically extirpated. This extirpation includes the loss of traditional food habits. The faster people adapt to the *New World, globalized* food patterns, the less likely traditional knowledge will be transferred to the next generation.[14] Inevitably, the loss of knowledge leads to reduced culture-specific food activity, reduced dietary diversity, malnutrition and/or NCDs, and reduced cultural morale.[15]

According to a survey we conducted at the 18th International Congress of Nutrition (ICN) in Durban, South Africa, 2005, experts in the nutritional sciences (n=92) were unanimous (84%) in believing that traditional African foods and food habits were superior to the *globalized* food habits currently underpinning the *nutrition transition*. Further, these experts believed that knowledge of traditional African food habits is being lost, and that there is a critical need for documentation.

With a strong rationale for initiating a project aimed at preserving knowledge of the traditional foods and food habits in Africa, we conceived the idea of collating data for an online collection (available at: www. healthyeatingclub.com/Africa/).[16] Our online collection currently presents information pertaining to traditional foods and food habits of East Africa (i.e. Tanzania, including Zanzibar and Pemba Islands, Kenya, and Uganda). These data were amalgamated by reviewing a series of observational studies collected by the *Max Planck Nutrition Research Unit*, formerly located in Bumbuli, Tanzania. This unique and precious collection of studies has been stored at the *Federal Research Centre for Nutrition and Food at the University of Karlsruhe, Germany*, and has remained largely inaccessible to researchers and the public. The official caretaker of these studies, Professor Ulrich Oltersdorf, who was also involved in some of the research at the *Max Planck Nutrition Research Unit*, graciously made the collection available to our investigative team with the purpose of contributing significantly to our novel project.[17] We have therefore entitled this series of studies the *Oltersdorf Collection*.

The purpose of this report is to present our review of the *Oltersdorf Collection* with the primary intent of extracting data for our novel, online collection of traditional African foods and food habits. Our specific objectives in reviewing this historical collection were four-fold:

(1) To systematically categorize and extract data pertaining to traditional African foods and food habits
(2) To provide a general overview of these data, with specific emphasis on traditional staple foods, and food preparation practices
(3) To discuss the health implications of these traditional foods and food habits
(4) To propose areas for further investigation and documentation.

Methods

The Oltersdorf Collection

The *Oltersdorf Collection* consists of 75 observational reports of nutritional outcomes collected by the *Max Planck Nutrition Research Unit*, in Bumbuli, Tanzania. The investigations were conducted throughout Kenya, Uganda, and Tanzania, including Zanzibar and Pemba Islands, from the 1930s to 1960s. The entire collection of documents has been scanned and converted into PDF-files, which are now available for free download.[16]

Data extraction and classification

The 75 reports of the *Oltersdorf Collection* were investigated by the principal researcher (V.R.). All co-investigators were consulted in creating an appropriate classification system. The co-investigators include 4 experts in the field of nutritional sciences (U.O., I.E., M.L.W., and A.K.). Relevant data were classified as follows:

1. *Food availability data*
2. *Chemical composition of foods*
3. *Staple foods*, including native crops, cereals, legumes, roots and tubers, vegetables, fruits, spices, oils/fats, traditional drinks, and animal foods
4. *Food preparation and culture*, including traditional dishes, food taboos and rituals, cooking methods and preparation, food habits among women, infants and children, agricultural practices, and local markets
5. *Dietary intake and health status indicators*

Table 1. Online data availability by region

Web-page topic	Country			
	Tanzania	Kenya	Uganda	Zanzibar Island & Pemba Island
Literature content by ethnic groups	X	X	X	
Food balance sheets (1950-1962)	X	X	X	
Chemical compositions of traditional African foods	X	X	X	X
Nutrition transition	X	X	X	
Foods and beverages				
Staple crops	X	X	X	
Cereals	X	X	X	
Legumes	X	X	X	
Root and tubers	X	X	X	
Vegetables	X	X	X	X
Fruits	X	X	X	X
Spices	X	X	X	X
Oils and fats	X		X	X
Traditional drinks	X	X	X	
Animal foods	X	X	X	X
Food habits				
Diet and dishes	X	X	X	X
Taboos and ritual foods	X	X	X	
Cooking methods and preparation	X	X	X	X
Women	X	X	X	
Children	X	X	X	
Agriculture	X	X	X	
Local markets	X	X	X	
Nutrients and health				
Calories	X	X	X	X
Protein	X	X	X	X
Vitamins and minerals	X	X	X	
Health and disease	X	X	X	

The online collection

The index page (at: www.healthyeatingclub.com/Africa/) provides a general overview of the online collection, including the background and aims of the project. The index page also provides data related to food availability and the chemical composition of foods in East Africa during this period.

Region-specific web pages provide the data related to foods, food habits, and dietary intake and health status indicators within various ethnic groups in Tanzania, Kenya, Uganda, and the Zanzibar and Pemba Islands. Availability of online data by region is presented in Table 1.

Results

1. Food availability

Food availability data (i.e. food balance sheets) have been collected, and are available for Tanzania[18, 19], Kenya[18] and Uganda.[20-22]

2. Chemical composition of foods

Chemical composition data has been presented in eight publications.[23-30]

3. Staple foods

Investigations documenting traditional food habits in Tanzania, Kenya, Uganda, and the Zanzibar and Pemba Islands are summarized in Table 2.

Crops

During the 1960s, plantains were a common staple crop around the Lake Victoria region of Uganda, and in the west and Kilimanjaro regions of Tanzania.[31-33] Millet was common in the eastern and northern parts of Uganda, in the Nyanza region of Kenya, and the south side of Lake Victoria up to the Central Region in Tanzania.[34-37] The remaining regions produced maize as a primary staple crop, including the West Nile region in Uganda, the Rift Valley, the Central Region, large sections of the Eastern Region of Kenya, and a belt which stretches from the Pare and Usambara mountains in the north to the central parts of Tanzania. Rice was grown along the coast, on the islands, and in some riverine areas such as Tana in Kenya and Rufiji in Tanzania. Cassava also played an important role in many parts, though primarily as a reserve food.[33, 38-40]

Cereals

The main cereal staples of East Africa were millet and sorghum. They were an important energy source, and in certain seasons of the year they supplied 80 to 90% of the dietary protein intake, and virtually all the vitamin B1, nicotinic acid, vitamin A, calcium and phosphorus intake. Millet is one of the oldest grains and possibly the first

Table 2. Data extracted from Tanzania, Kenya, Uganda, Zanzibar and Pemba Island (1930s-1960s).

I. Traditional foods and beverages	
• Staple crops Tanzania[31-38] Kenya[39-42] Uganda[43-46]	• Fruits Tanzania[33, 34, 36, 47, 48] Kenya[33, 40] Uganda[43, 44, 55, 57, 58] Zanzibar & Pemba Island[53, 56]
• Cereals Tanzania[47] Kenya[47] Uganda[47]	• Spices Tanzania[33, 34, 59-61] Kenya[33, 60-62] Uganda[44, 55, 61] Zanzibar & Pemba Island[53, 56]
• Legumes Tanzania[23, 26, 33, 34, 36, 48] Kenya[40, 41, 49] Uganda[50]	• Oils and fats Tanzania[47, 63] Kenya[47] Uganda[44, 47, 55, 64] Zanzibar & Pemba Island[47, 53, 56]
• Root and tubers Tanzania[26, 34, 36, 47, 51-53] Kenya[40, 49] Uganda[47]	• Traditional drinks Tanzania[33, 34 62, 48, 65 48, 66] Kenya[39, 40, 49, 54] Uganda[45, 46, 55, 67, 68]
• Vegetables Tanzania[19, 31, 33, 34, 36, 37, 48, 52] Kenya[40, 54] Uganda[55] Zanzibar & Pemba Island[53, 56]	• Animal foods Tanzania[34, 26, 31-33, 36, 37, 48, 52, 59, 66] Kenya[40] Uganda[43, 55] Zanzibar & Pemba Island[53, 56]
II. Cultural food habits	
• Diet and dishes Tanzania[31-33, 35, 34, 36, 38, 65, 69] Kenya[41, 54, 62, 70, 39, 40, 49, 71] Uganda[43-46, 50, 55, 64, 68, 72, 73] Zanzibar & Pemba Island[53, 56]	• Children Tazania[32, 66, 69] Kenya[39-41, 54, 62, 70, 79] Uganda[32, 44, 58, 64, 67, 68]
• Taboos and ritual foods Tanzania[33, 74-76] Kenya[74, 76] Uganda[44, 55, 64, 74, 77]	• Agriculture Tanzania[34, 38, 65, 69, 80, 81] Kenya[30, 39, 78] Uganda[20, 44, 55, 68, 82]
• Cooking methods and preparation Tanzania[33, 34, 36, 38, 48, 69, 78] Kenya[39, 40, 49, 54] Uganda[44, 50, 73] Zanzibar & Pemba Island[53, 56]	• Local markets Tanzania[63] Kenya[49]
• Women Tanzania[32, 36, 66, 69, 75] Uganda[32, 44, 57, 58, 64, 67, 68]	
III. Nutrients and health	
• Calories Tanzania[33-35, 37, 38, 69, 83-85] Kenya[27, 30, 39, 86] Uganda[64, 73, 77, 87] Zanzibar & Pemba Island[56]	• Vitamins and Minerals Tanzania[33-35, 37, 38, 69, 83-85] Kenya[27, 30, 39, 86] Uganda[64, 73, 77, 87]
• Protein Tazania[33-35, 37, 38, 69, 83-85] Kenya[27, 30, 39, 86] Uganda[64, 73, 77, 87] Zanzibar & Pemba Island[56]	• Health and disease Tanzania[38, 52, 65, 69, 83, 85, 88-90 13, 19, 34, 80] Kenya[30, 39, 86, 91-95] Uganda[45, 46, 55, 64, 68, 96]

used as a staple food. It is believed to have originated in Uganda, a region considered by some to have been the *Breadbasket of Africa*.[41] Millet is known for its high calcium content. It can grow in poor soil and mature quickly if adequately irrigated.[42] *Sorghum bicolor* was reportedly drought resistant.[42] These cereals are high in calcium, carotene and protein.[42]

Legumes

Kidney beans, cowpeas (*Vigna unguiculata*), groundnuts (*Arachis hypogaea*) and bambara groundnuts (*Vigna subterranea*) were commonly consumed throughout Tanzania.[23, 26, 32, 40, 43, 44] In Kenya, legumes consumed among the *Kikuyu* included several bean and pea varieties, including a European dwarf bean called *mboco*, pigeon pea (*njugu*), black bean, brown or white bean varieties (*njahe*), red bean (*kunde*), small peas (*thoroko or chirok*), small green pea (*thuu*), and small round green pea (*podzo*).[45-47] In Uganda, approximately one sixth of the total 6.3 mil-

lion cultivated acres were occupied by grain legumes, of which groundnuts and kidney beans were the most prevalent, followed by cow peas, pigeon peas, and field peas.[48]

Root and tubers

The most common root and tubers cultivated in East Africa during this period included tannia (*Xanthosoma sagittifolium*), taro (*Colacasia esculenta*) and various yams (*Dioscorea*). More recently introduced roots and tubers include cassava and sweet potato.[26, 32, 38, 40, 42, 49]

Vegetables

Thirty-nine wild, indigenous and edible vegetables were identified in Tanzania including twenty-one on Ukara Island[32], three in the Tabora region[40] and fifteen among the *Sukuma* in the Lake Province.[43]

Common traditional leafy vegetables that formed an essential part of the East African diet included amaranth (*Gynandropsis gynandra*), baobab (*Adansonia*), African nightshade (*Solanum species*), hibiscus (*Hibiscus sabdariffa*), spiderplant (*Basella alba*) and taro (*Colacasia esculenta*). [19, 32, 34, 40, 43, 44, 50, 51] Leaves of introduced vegetables such as sweet potato, pumpkin, cassava, beans and cowpeas were also consumed when in season.[38]

Fruits

Among the *Bahaya*, who occupied the northwestern corner of Tanzania, locally grown fruits included oranges, tangerines, lemons, limes, pineapples, pawpaw, passion fruit, mangoes, tree tomatoes, sweet and yellow bananas, plantain and bitterberries.[44] Sixteen wild and edible fruits of the *Sukuma* in the Lake Province have also been documented.[43] The pawpaw and cape gooseberry were a favorite snack for women and children in the Kiberege division of the Ulanga Valley in Tanzania.[42,50] On Ukara Island, fruits including unripe lemons were eaten by children.[52] Wild fruits on this island included *mfiru, sungwa, ndobe, mamonyi, mande, buyeko,* and *buhunda*.[52] In Uganda, figs, tamarinds, shea butter fruits and the fleshly part of borassus palm fruits were commonly assimilated into the regular diet.[53] Among the *Baganda*, the largest ethnic group in Uganda during the 1960s, pawpaw and passion fruit were the most common fruits.[31] *Ntula*, berries of *Solanum sp.*, were considered a snack food for children.[31]

Spices

Spices were an integral part of the food culture in coastal regions due to longstanding Islamic and Indian influence. The most common varieties used were black pepper, chili pepper, capsicum annum (*pilipili kali*), cinnamon, curry powder (*bizari*), and tamarind.[54, 55] Seven surveys reported that use of salt was widespread in East Africa.[31, 32, 34, 43, 56-58] Reeds were burnt and salt was obtained from the ashes by a process of solution and reprecipitations.[43] In Teso, Uganda, salt was obtained by dissolving it from the ashes of *echuga* (*Leonolis meptifolia*), *epungula* (*Coreopsis ugandensis*), *elokile* (*Sonchus bipontini*), *epopong* (*Euphorbia candelubra*), *essege* (*Pennesentum sp.*) and *eliloto* (*Sesamum Macranthum*).[31] Besides salt, the ripe fruits of *elamai* (*Ximenia americana*) and the pods of *epiduru* (*Tamarindus indica*) were used to flavor the foods.[34]

Oils and fats

The main sources of vegetable fats used in East Africa included the oil of *simsim* (*Sesamum indicum*), cottonseed, shea butter nut (*Butyrospermum parkii)*, coconut, groundnut and palm fruit.[31, 34, 42] Oyster nuts (*Telfairia pedata*) called *kweme* in Kiswahili or *nkungu* in Kisambaa, were highly esteemed for pregnant women among several ethnic groups in East Africa.[59] This particular nut was believed to promote lactation due to a high content of protein and fat.[59]

Traditional drinks

Eleven reports[34, 44, 60-62 32, 36, 43, 46, 63, 64] described the use, preparation and importance of native beer in East Africa. Beer was prepared from a variety of constituents, including millet, sorghum or maize, and sugar cane or honey.[34, 44, 60-62 32, 36, 43, 46, 63, 64] The preparation and use of other native drinks were reported in five publications including the descriptions of a raw defibrinated blood and milk drink in Karamoja, Uganda[65], banana wine in the Bukoba district of Tanzania[44], *usawo*, a mixture of cow's blood, sour milk and honey consumed by the *Chagga* mothers of northern Tanzania, after delivery[66], and *ucuru*, a thin gruel prepared from finger millet or maize and consumed by the *Kikuyu* in Kenya.[45, 64]

Animal foods

Most groups in East Africa ate meat only occasionally.[53] Where fish was available, generally only around the lake regions and the coast, it was consumed both fresh and dried.[53] Various species of birds, rats, mice, locusts, grass hoppers and white ants, generally relished as delicacies, were also consumed.[53] Meat and milk were more significant among pastoral people such as the *Maasai*, *Samburu* and *Turkana*, who live in the dry steppes.[17] Milk was obtained from cows, goats and occasionally sheep. It was taken fresh or was fermented in containers, mainly gourds (*kibuyu* in Swahili) or hollowed-out wood, as in the case of many pastoralists in the north and east.[13] The milk was churned to make sour milk or butter, popular among pastoralists.[13, 53, 57, 67]

4. Food preparation and culture

Examples of traditional dishes and meal patterns in Tanzania, Kenya, and Uganda are presented in Tables 3-5.

Taboos and ritual foods

Food taboos most commonly existed among women. These could include the avoidance of eggs, chicken, mutton and several species of fish.[68, 69] Clear indications of why these foods were ritually avoided were not always collected by the researchers.

Cooking methods and preparation

Unique utensils used for food preparation in East Africa have been documented in several publications.[64, 32, 48, 70] Most foods were boiled, and occasionally roasted.[36] Food preparation techniques have been described for cereals, roots and tubers, legumes, vegetables and animal foods in Tanzania[43, 50, 67, 71, 32, 37, 40, 63, 70], Kenya[36, 45, 46, 64] and Uganda.[31, 34, 35, 48, 53, 61, 62, 65, 72, 73]

Women and infants

In Tanzania, modifications of the diet in pregnant and lactating women, as well as the diets of infants were investigated in four studies.[37, 40, 66, 67] Moller[74] reported on the different customs and beliefs involved in pregnancy and delivery of newborns or twins among several ethnic groups in Tanzania, including the *Wahehe, Wagogo,*

Table 3. Main dishes of different ethnic groups in Kenya.

Author[Ref.] (year)	Location (Ethnical group)	Main dishes
Callanan[36] (1926)	Nyanza Province (*Luo*)	• *Kuon* (*ugali* in Swahili): A doughy substance prepared by boiling *mtama* (sorghum flour) or flour of finger millet (*kal* in Swahili) in water until a doughy substance was formed - eaten with meat or native vegetables, buttermilk (*buyo*), blood, fish, chicken or eggs • Wimbi (Finger millet - *Eleusine coracana*), was chiefly consumed by the *Luo* near the Kisii border • Less frequent: A mixture of beans (*oganda*) and maize (*oduma*) termed *nyoyo*
Orr et al[67] (1931) Farnworth[44] (1937)	Central Province (*Kikuyu*)	• *Irio*: A mixture composed of maize, various kinds of beans and mashed bananas • Gruel (*ucuru*) made from millet flour and water (or other beverage) • Women's dishes were distinguished by containing: a. Green leaves b. Special millet varieties (e.g. red millet varieties: *mugimbi* or *mwimbe*) c. Salt or salt substitutes
Allen[46] (1955)	Costal region (*Giriama*)	• *Sima*: A porridge made from maize and *tui*[*] • Porridge made from brown rice, cassava and banana • *Kitowea:* A mixture made from *kunde* (read bean), *podzo* (small, round green bean) stewed beef or goat, boiled fish or shark, prawns or chicken • Bananas - boiled, eaten raw, or fried in ghee • Sweet potatoes roasted in ashes or boiled
Shaper et al[68] (1961)	Northern Kenya (*Samburu)*	• Staple food: milk - warriors usually drank milk twice a day • Other major dietary item: meat • Meat and milk were never consumed on the same day • Supplementary food: blood - only used during the dry season
Gerlach[69] (1961)	Kenyan coast strip (*Digo*)	• *Breakfast:* cold remains of supper or thin gruel, tea and raised cake - made of maize meal or imported wheat flour • *Midday*: same foods as for breakfast or roasted corn, bean soup or roasted, baked bananas • *Evening:* Digo (>8 years old) consumed one quart of a thick mixture of rice, plantain, sweet potatoes (*chakuria*) and 1 half pint of meat, fish, sour milk or wild greens (*chitoweo*) excluding beans and bananas

[*]Extract obtained through washing and squeezing grated coconuts

Waluguru, *Sukuma*, *Wanyakyusa*, *Wachaga*, and *Bahaya*.

In Uganda, seven publications have provided an insight into the cultural and anthropological factors in maternal nutrition, lactation and child feeding practices among the *Baganda*[68], *Buganda*[31], *Luo*[75], *Acholi*[35], *Hadza*[67], *Karamojong*[61] and *Bahaya*[60] in Uganda.

Children

In Tanzania, the feeding of children has been described among the *Hadza* hunters[67], *Gogo*[37]and *Chagga.*[66] In Kenya, the feeding of children has been described amongst the *Luo*[36, 64], *Kikuyu*[45, 47, 64, 76], *Maasai*[77], and *Samburu.*[78] In Uganda, such descriptions have been collected amongst the *Buganda*[31], *Baganda* and *Luo*[75], *Acholi*[35], *Hadza*[67], *Karamojong*[61] and *Bahaya.*[60]

Agriculture

Agricultural practices have been documented in Tanzania among the *Wangoni*[79], *Bahaya*[32], *Gogo*[37, 63], *Sukuma*[63], *Wachaga*[70], *Shambala*[80], in Kenya among the *Kikuyu*[30, 64], *Luo*[64], *Wakamba*[64], *Digo* and *Daruma*[81] and in Uganda among several unnamed tribes.[20, 31, 34, 61, 82]

Local markets

Descriptions of traditional foods offered at local markets, including seasonal variations, supply and demand, and variations in prices have been provided for Bumbuli, Tanzania[59] and the *Kikuyu* market in the Central Province of Kenya.[46]

5. Dietary intake and health status indicators

Nutritional and health status, as well as dietary intake was evaluated in 19 publications.[16]

Discussion

Our investigative group systematically reviewed the *Oltersdorf collection*, 75 observational studies conducted between the 1930s and 1960s and collected by the *Max Planck Nutrition Research Unit*, formerly located in Bumbuli, Tanzania. Our primary intention was to extract data pertaining to traditional East African foods and food habits. This data extraction revealed several important findings which may have profound implications for averting current NCDs trends and malnutrition throughout sub-Saharan Africa.

The earliest food crops used by most agriculturalists in East Africa included sorghum, finger and pearl millets, hyacinth (*lablab*) beans, bambara groundnuts, bottle gourds, cowpeas, and yams.[83] According to our data

Table 4. Main dishes of different ethnic groups in Tanzania.

Author[Ref.] (year)	Location (Ethnical group)	Main dishes
Culwick et al[49] (1939)	Ulanga, Kiberege Division	• Boiled rice or porridge (made from maize, cassava, finger millet) with a relish of fish or meat and wild green vegetables
Laurie et al[32] (1951)	Bukoba district (*Bahaya*)	• Plantains, beans and *ningu* (*Labeo victorianus*) or other fish
McLaren[62] (1960) Tanner[42] (1956)	North-West Tanzania (*Sukuma*)	• 2 main meals/day - at noon and around sunset • Stiff porridge made from sorghum, millet, maize flour or cassava - eaten together with a relish of green vegetables, a meat or fish (dried) stew • Maize on the cob, cassava, ground nuts, tomatoes and other fruits were eaten raw
Schaffer et al[37] (1963)	Central Province (*Gogo*)	• *Ugali*[*] was made from millet, maize or sorghum - eaten with at least one sauce (made from soured milk, legumes, leafy vegetables or meat) • Most favourite sauce was prepared from sesame, cowpea leaves, tomatoes, onions and aloes • Meat was on average consumed once a week • Soured milk was served with 50% of the meals • Sweet potatoes or pumpkins were served as *soul food*
Jelliffe et al[66] (1962)	North Tanzania (*Hadza*)	• Food was eaten after it was obtained through hunting or gathering • Meat and yams were barbecued - only older women were permitted to have cooking pots to boil the meat in • Wild fruit, berries and seeds were eaten raw
Nguma[70] (1969)	Kilosa district (*Wasagara, Wakaguru, Wavidunda, Waluguru*)	• 1-3 meals/day • *Ugali*[*] was made from maize and sorghum flour and was consumed with beans, cowpeas, pigeon, peas and meat, fish or green leaves • Snacks: banana, cassava and corn
Tanzania National Nutrition Unit[40] (1967)	Tabora region (*Nyamwezi*)	• *Breakfast:* tea or coffee with sugar and sometimes milk • *Midday/Evening: ugali*[*] was made from cassava, maize or sorghum flour and eaten with a side dish prepared from green leaves or legumes • *Foods for special occasions:* rice served with meat or chicken as a side dish • *Foods consumed during work:* boiled cassava, tea, groundnuts, *makande* (maize and bean mixture), *ugali*[*], vegetables, *uji*[**], fresh or dried cassava
Zanzibar Protectorate[54] (1937) Smith et al[53] (1935)	Zanzibar and Pemba Island[+]	• *Breakfast:* tea - if affordable, small amount of tinned or fresh milk with sugar added, white bread or otherwise *makake wa kusukuma* (gruel of millet), fresh fruits or dates • *Midday:* *a.* Fish with one of the following foods: cassava, plantain, sweet potato, yam, breadfruit *b. Mseto* (i.e. rice and *dhal* boiled together with *tui*[#]) *c. Kiwanda* (eggs beaten up and fried - eaten with rice and raw green leaves) • *Evening:* fish or meat curry with rice or bread - main meal of the day • Boiled green leaves were sometimes eaten as a 3rd dish • *For a feast: pilau* - a dish made with beef, mutton or goat's meat, ghee, gamti rice and bread

[*]Mixing flour from a starchy food in hot water and cooking as one mixes the substance to a paste that varied in consistency
[**]Porridge based on cereals, its consistency varied among the areas as well as the flavoring (salt, sugar, lemon, tamarind, baobab, coconut, cow ghee/butter or milk)
[#]Extract obtained through washing and squeezing grated coconuts
[+]Zanzibar and Pemba Island were inhabited by 5 ethnic groups

extraction, several of these food crops remained part of the diet in various parts of East Africa between the 1930s and 1960s. Many have recently been validated for their significant health benefits. For example, sorghum has recently been identified as containing significant amounts of polyphenols and antioxidants,[84] while millet has been shown to reduce risk factors for CVD.[85, 86] According to Mossanda *et al*,[87] the Bambara groundnut (*Vignea subterranean*) possesses anti-oxidative and anti-mutagenic activities.

Uncultivated and wild edible fruits, vegetables and other plants species could supply significant amounts of micronutrients to the diet of the Africans.[88] Green leafy vegetables are high in beta-carotene,[89] contain significant amounts of polyphenols and have free radical scavenging abilities.[90] The *Luo* people of Western Kenya have suggested that the leafy vegetables that form an important part of their diet protect against gastro-intestinal disturbances. In particular, *Solanum nigrum* is effective against the protozoan gut parasite *Giardia lamblia*.[91] Okra (*Hi*

Table 5. Main dishes of different ethnic groups in Uganda.

Author[Ref.] (year)	Location (Ethnical group)	Main dishes
Courcy-Ireland et al[34] (1937)	Teso Ajuluku and Opami village (*Iteso*)	• 2 main meals/day (midday and evening) • *Breakfast*: drink of beer, a baked sweet potato or cassava - eaten in fields during work • Fish was consumed on a regular basis in Opami compared to Ajuluku • *Atap:* ground and cooked wimbi (finger millet) • Milk was used for *atap* instead of water by wealthier families and the curds were mixed with greens or other relishes
Rutishauser[31] (1963)	Buganda (*Baganda*)	• *Breakfast:* left-over food from the night before which was also given to children as a midday meal • *Midday/Evening:* one staple (i.e. *matoke* or other types of bananas, sweet potato, cassava, maize or yams) and one or more sauces made from gathered insects, fish, meat, beans, sesame, groundnuts or wild vegetables
Jelliffe et al[35] (1963)	Acholi district (*Acholi*)	• Stiff dough-like preparation of finger millet (*kwon*) - eaten with *dek*, a variable mixture of: beans (*Phaseolus vulgaris*), cowpeas *(Vigna unguiculata*), congo peas (*Cajanus indicus*), simsim (*Sesami indicum*) and meat or fish • When available, mushrooms, termites, wild edible leaves, honey and fruits such as mangoes were eaten

biscus esculentus) has been identified as a cholesterol lowering food.[92] Its ability to reduce total cholesterol and low density lipoprotein cholesterol may contribute to the prevention of CVD.

Edible wild roots and tuber species have been reported to be an important energy and water source for pastoralists and hunter-gatherers and were well-recognized for their medicinal properties by several ethnic groups throughout East Africa.[67, 78, 93, 94] A recent investigation by Hou *et al*[95] has revealed that the storage protein of yam tuber (*Dioscorea batatas Decne*) may have antioxidant properties.

Traditionally, plant oils were used for cooking in East Africa. These included the oil of shea butter nut (*Butyrospermum parkii)*, sesame seed (*Sesamum indicum*) and red palm. These particular plant oils are associated with nutrition and health benefits.[96-99] Sesame oil, for example, improves hypertension, lipid profiles, and lipid peroxidation and increases enzymatic and nonenzymatic antioxidants.[96] Owing to its high content of phytonutrients and antioxidant properties, the possibility exists that palm fruit offers health benefits by reducing lipid oxidation, oxidative stress and free radical damage.[97, 98] The use of palm fruit or its phytonutrient-rich fractions, particularly water-soluble antioxidants, may confer some protection against a number of disorders and diseases including CVD, cancers, cataracts and macular degeneration, cognitive impairments, and Alzheimer's disease.[97, 98]

Animal foods played a significant role in certain East African communities throughout this period. Although the diet might have been high in animal foods, the evidence suggests an absence of NCDs and a low CVD risk profile.[13, 100] A combination of factors, including the lack of processed meats, low energy intake, and deep-rooted cultural practices which included ample amounts of physical activity may have been essential in averting CVD. By contrast, the processed meats saturating markets today have been directly associated with an elevated CVD risk profile.[101] Recent evidence suggests that the regular chewing of *Commiphora* and other species of myrrh *sensu lato*, high in hypoglycemic,[102] antioxidant,[103] anti-inflammatory, and antibiotic properties[104] offers health benefits. The antioxidant activity of phenolics[105] and the cholesterol-binding activity of saponins[100] in *Maasai* food may further modulate the effects of a high-lipid diet.[106]

Between the 1930s and 1960s, most foods in East Africa were boiled or roasted, whereas many foods today are fried or deep fried.[36, 107] Frying and deep frying in particular, have been associated with adverse health outcomes including elevated concentrations of pro-inflammatory cytokines and homocysteine.[101]

A diversified diet combined with traditional knowledge of food preparation may advance our understanding of health by complementing current scientific knowledge of micronutrient density and nutrient absorption.[108] A diet consisting of a diversity of wild, edible plants, legumes, condiments, wild game meat, milk, fish and cereals such as sorghum and different varieties of millet is likely to be associated with significant health benefits and longevity.[109-111] In Kenya, Onyango and colleagues have recently demonstrated that a diversified diet enhances the development of young children.[112]

Governmental (i.e. corporate) policies and their major socio-economic and environmental repercussions have fundamentally destroyed human health in Africa.[113] In addition, the simplification of a now *globalized* diet has presented the global population with unprecedented obstacles. Health implications of dietary simplification include nutrient deficiency and an increased prevalence of NCDs.[114] These trends are occurring worldwide, in both developed and developing countries, including the countries of East Africa.

Knowledge of traditional food habits in Africa is being lost. There is clearly an imperative need for documentation, compilation, and dissemination of this rapidly

eroding wealth of information. Knowledge of traditional African food habits could be used to improve the lives of African residents and African migrants, including the recent surge of African migrants entering Australia and New Zealand. Further, such information can and should be utilized by the global community for improving the current *globalized food culture*, which has largely been responsible for the obesity and diabetes epidemics currently plaguing the world. Our online collection,[16] could be instrumental in disseminating information related to traditional African foods and food habits.

In summary, it appears that potential did exist for a rich food culture in East Africa from the 1930s to the 1960s, despite years of imperial occupation. Many of the traditional foods we have presented in this review have known health benefits according to the latest annals of scientific inquiry. The knowledge which has evolved and remains at the heart of this *Cradle of Civilization*, including incredible knowledge of the relationship between food, food habits and longevity, should not be ignored and should indeed be investigated further. Such inquiry may be required for the human species to transcend current NCDs epidemics, and move toward a paradigm based upon holistic health and well-being.

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Original Article

Content of a novel online collection of traditional east African food habits (1930s – 1960s): data collected by the *Max-Planck-Nutrition Research Unit*, Bumbuli, Tanzania

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新線上收集傳統東非飲食習慣目錄(1930 年-1960 年)：坦尚尼亞 *BumbuliMax-Planck-營養研究單位*收集的資料

背景：傳統非洲食物及飲食習慣的知識已經持續而系統性的消失中。為了核對四個經由線上收集紀錄傳統非洲食物及飲食習慣資料(可見於 www.healthyeatingclub.com/Africa/)的主要目的，我們檢閱由先前位於坦尚尼亞 Bumbuli 的 *Max Planck 營養研究中心*所彙編的 1930 年代-1960 年代期間 75 個在東非(即坦尚尼亞、肯亞及烏干達) 執行的觀察性研究的 *Oltersdorf collection* 。方法:資料按以下原則分組：(1)食物可獲性 (2)化學組成 (3)主要食物(例如天然作物、穀類、豆科植物、根莖及塊莖、蔬菜、水果、香料、油脂、飲料及動物性食物) (4)食物製備及文化(5)營養素攝取及健康狀況指標。結果：找出很多傳統食物，包含小米、高粱、各種豆類、根莖及塊莖、綠葉蔬菜、植物油及被認為對健康有益的野生肉類。在這段期間食物的製備方式，包含煮沸及偶爾的烤焙均優於油煎及油炸。整體來說，我們的檢閱及資料萃取提供了理由讓我們相信在這個期間(1930-1960 年代)東非人可能有多樣化的飲食。結論:在這個 *Oltersdorf collection* 有關於傳統東非食物及飲食習慣豐富知識。這些資料目前可以透過我們的線上收集獲得。未來應該致力於貢獻在這個區域的傳統食物及飲食習慣知識的核對，確實貫穿非洲其他部分。保存及傳播這些知識，對於減弱預期中非洲及其他國家國非傳撥性疾病及營養不良的趨勢是具決定性的。

關鍵字:坦尚尼亞、肯亞、烏干達、土著、主食、飲料、飲食、文化。