

Afrique One SPIRE News

Using One Health to address food and nutrition related diseases



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COVID-19 and food and nutrition related diseases...



Prof. Bassirou Bonfoh, Director of Afrique One-ASPIRE

Addressing malnutrition in all its forms – undernutrition, micronutrient deficiencies and increasing overweight and obesity – is at the heart of “Agenda 2063” and the bold target set by the Malabo Declaration to reduce malnutrition in Africa by 25 percent by 2025. To effectively move forward with this, African governments and international organisations are increasingly building on the global momentum and thinking of a holistic food systems approach for improving dietary diversity and delivering safer and healthier food environments and diets to all. Despite the increased presence of policies, programs, and strategies, Africa continues to face multiple burdens of malnutrition. This is due to many underlying challenges that include the biased agricultural policies and strategies toward staple foods; limited value chain development for nutrient dense foods; food safety significantly challenged (pesticide/chemical residues, AMR, water quality, etc.); inadequate food and environmental safety systems; the heavy dependence on rain fed agriculture and imports; and difficulties in a sustainable transformation of agriculture. Malnutrition is aggravated by multifaceted risks and crises facing Africa, including the novel Coronavirus (COVID-19) pandemic.

The COVID-19 pandemic has created an increased risk of malnutrition due to the economic impact of social distancing, full or partial lockdowns, and quarantining. From the end of the first quarter of 2020, governments in Africa adopted several more or less rigid suppression measures that affected jobs, income of households, shift in availability and accessibility of foods, as well as dietary practices of the populations. The consequences of COVID-19, which from the beginning was perceived as a zoonosis, a disease transmissible from animal to human and vice versa, deserves to be studied from a transversal discipline, namely One Health. The COVID-19 pandemic

has also created a conducive environment to the proliferation of food and nutrition-related diseases. Conversely, those diseases, due to their propensity to weaken the immune system, exposed their victims to COVID-19.

The implementation of the One Health approach within the framework of COVID-19 is already evident in the different scientific outputs of our researchers. Therefore, in this document, we begin to make an incursion into the field of food in the informal sector, and its health consequences, within the context of the COVID-19 pandemic. Rather than focusing on the more laboratory and molecular biology based cutting-edge research on COVID-19, the case studies presented in this document highlight food production and consumption systems, the food environment in both rural and urban contexts, and also considering food safety and food related illnesses. When necessary, we make a discursive analysis of the multifaceted impact of the pandemic on food practices and food-related illnesses. Studies presented in this newsletter are taken from at least four research streams: 1) The microbiological, social and economic factors of production and consumption of food in the urban informal sector (choukouya, garba, dibi); 2) Incidence of non-communicable diseases (NCDs) in the context of pandemic and importance of targeting food-related illness in interventions; 3) Importance of food in integrated management of neglected tropical diseases (NTDs); 4) resilience to food security and nutrition in times of pandemics.

The key elements of discussion we present in this document are that despite the negative effects of COVID-19, some side outcomes in term of scientific production and the capacity of our fellows to support their respective institutions and countries to fight COVID-19 with preventative measures prescribed by governments have contributed to the improvement of hygiene conditions in urban informal eating outlets (presence of hand washing facilities in “maquis”, “garbadromes”, and “dibiteries”). Moreover, the pandemic context is a pretext for more innovation and creativity in health interventions (e.g introduction of e-wound management in Taabo, Côte d’Ivoire).

Far from having exhausted the substance of the theme, the various contributions aim to raise awareness and stimulate scientific debate for a greater understanding of the subject with a view to finding solutions that promote the full development of the food system for humans in their changing environment.

Towards improving Food Safety in Africa: Current Evidence and Way Forward



Journalists and Afrique One–ASPIRE scientists working on food after a press conference at the “Institut Africain des Médias” in Abidjan, Côte d’Ivoire

As every year, the World Food Safety Day (WFS) 2021 was celebrated on 7 June 2021. The annual theme was ‘Safe food today for a healthy tomorrow’. The WFS 2021 aimed to draw attention and inspire action to help prevent, detect, and manage foodborne risks, contributing to food security, human health, economic prosperity, agriculture, market access, tourism, and sustainable development. Afrique One–ASPIRE, through the thematic of food safety and nutritional illness (TTP–Food), contributed to the debate on the importance of the production and consumption of safe food and its immediate and long–term benefits for people, the planet, and the economy. This was possible through a series of scientific and engagement activities.

On the scientific level, TTP–Food members organised a virtual symposium, on the 7th of June 2021. Discussions during that event were structured around the theme: «Towards improving Food Safety in Africa: Current Evidence and Way Forward” and aimed at opening room for dialogue between scientists and policy makers on the challenges and opportunities facing food safety in Africa. The symposium gathered some 62 participants from academia, policy, and the media. This was an opportunity for scientists from Afrique One–ASPIRE to show some research results and open a discussion with other scientists and practitioners on the issue of food safety in Africa to help ensure nutritional health and quality of life.

Food safety assurance is a responsibility shared between governments, producers, and consumers. Therefore, everyone, including communities, has a role to play from farm to table to ensure the food consumed is safe and healthy. Engaging communities is a guarantee of “safe food today for a healthy people tomorrow”. A community engagement activity was organised in Ahondo, a rural community in the Taabo

administrative District, in the South Centre of Côte d’Ivoire, on 4 June 2021. The aim of this event was to raise awareness amongst community members of the importance of food safety in the reduction of the burden of foodborne diseases. This activity gathered around 50 people, mainly composed of women, to discuss: (i) knowledge and perception of the community regarding food safety; (ii) food safety practices and how people ensure quality of the food they eat; and (iii) socio–cultural norms, barriers, taboos and food health risks in Côte d’Ivoire.

Apart from community outreach, communicating with media is also critically important in the search for food safety and to fight against malnutrition and foodborne diseases. In that regard, Afrique One–ASPIRE organised two major media events in the framework of the WFS 2021. Firstly, a radio broadcast and podcast were organised in Djekanou, Adijan, Côte d’Ivoire on 3rd of June 2021. Food safety researchers and community and public engagement experts (Drs Adou Djané, Koffi Yao Didier, Dindé Arlette, and Koné Bognan Valentin) interacted with the listeners, taking questions based on their respective areas of expertise (social, medical, nutrition, policy). Key points of interaction were: (i) diseases related to food safety in rural areas; (ii) local technologies for food processing; and (iii) food safety for quality of life.

In addition, a press conference was organized on the 11th of June 2021 c to interact with the media regarding the issue of food safety. This activity gathered around 30 participants, including 10 journalists. Afrique One–ASPIRE was represented by: four TTP–Food fellows (Dr Koné Bognan Valentin, Dr Dindé Arlette, Dr Hounbédji Clarisse, and Mr Sanhoun Aimé); the co–coordinator of the Community and Public Engagement department (Dr Adou Djane); and the Director of the consortium (Prof Bonfoh Bassirou). During interactions with journalists,

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Dr Dindé highlighted the importance of food safety, Dr Koné emphasised the importance of understanding sociocultural norms (food taboos) and their risks on food safety, while Dr Adou Djané elaborated on the food policy and the role of women in food safety. The key messages in these communication activities were:

Food safety does not only mean food that is safe from pathogens and harmful chemical. A meal that lacks nutrient diversity and balance can also lead to diet related diseases such as diabetes, cardiovascular diseases, and poor development in children.

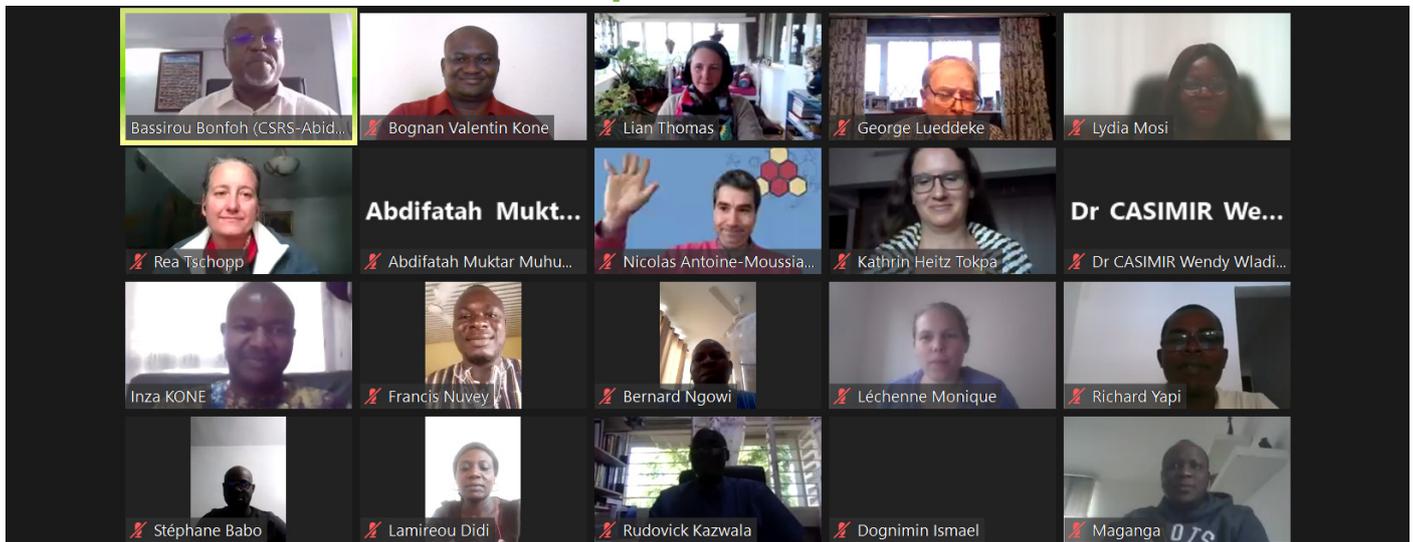
There is an indissociable link between safety, security, and the nutritional quality of food.

Food safety must combine food hygiene, sociocultural aspects and the contribution on women who are an essential pillar when processing food.

Based on local and endogenous knowledge, the mobilization of cultural food restriction and taboos helped to understand how the population assess and manage food risks and sometime how this can compromise the nutritional health of YOPIs (Young, Old, Pregnant, Immunocompromised).

One cannot talk about food safety without the involvement of women, who are the heart of the food value chain.

5th Annual meeting and summer school of Afrique One-ASPIRE



Some participants of the 5th Annual meeting of Afrique One-ASPIRE

Because of travel restrictions due to the COVID-19 pandemic, the 5th annual meeting of Afrique One-ASPIRE took place online from 27th to 29th of January 2021. The theme of the meeting was “Impact pathways of One Health research on zoonoses in Africa”. The event was an opportunity for the fellows to share their findings on One Health research implemented over the past 4 years (2016–2020). During the meeting, Prof Bassirou Bonfoh, the Director of the programme, highlighted the main achievements in science and presented the contribution of the consortium to the capacity building of young African researchers. Discussions during the meeting centred around capacity building efforts, career pathways, research impact, and training of fellows.

A total of 72 postgraduate African fellows have been trained, mentored, and supervised through the Afrique One-ASPIRE programme since 2016. Additionally, the programme so far

reached more than 7,600 external trainees from our academic institution partners. To date 126 publications have been produced, of which 45% are from the fellows directly, with the rest by the co-applicants.

Afrique One-ASPIRE aims to contribute to building a critical mass of local capacity, and to train world-class researchers to address health challenges. The goal of the programme is to conduct research that is impactful and contributes to solving societal problems. Afrique One-ASPIRE has made significant effort in paving the way towards the control and elimination of several diseases in Africa including rabies, brucellosis, improving wound management, and efforts towards improved nutrition and disease surveillance.

In Tanzania, a low-cost tool for the storage of rabies vaccine at ambient temperatures without electricity was developed. This was

complemented by vaccination campaigns and a novel vaccine delivery strategy for hard-to-reach areas as well as a strong collaboration between animal and human health practitioners. In zoonoses control, sniffer rats show promise in detecting *Brucella* bacteria in blood and milk samples. In Chad, new tools for an integrated community based One Health Syndromic Surveillance-Response system are being designed and are under validation. This will be linked to the existing District Health Information System in the country. In Côte d'Ivoire, a link was established between the consumption of a combination of orange-flesh sweet potatoes and soy, and the reduction of wound healing

time and related cost.

An important part of this event was a four-day online training for fellows based on the assessment of their capacity needs and tailored-made training modules. It consisted of a one-day training session on “assessing the scientific and social impacts of research in disease intervention projects”. This was followed by a three-day hackathon event took place, which was an online teamwork event where all fellows, divided into small groups, worked towards the goal of “developing feasible, effective and original disease interventions using the One Health approach”.

Lessons from 12 years of operationalizing the One Health approach in Africa

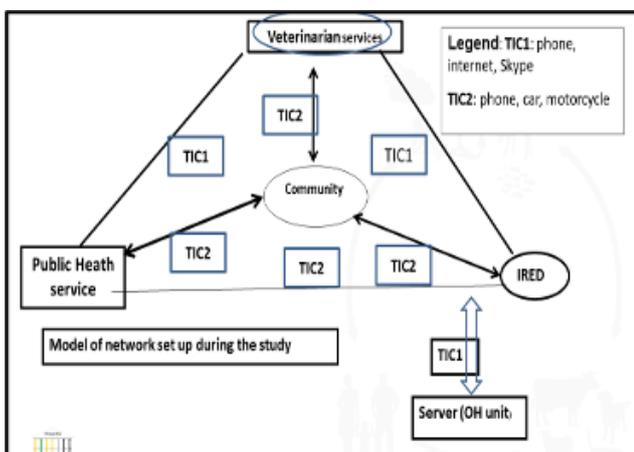
From December 2nd to 3rd, 2021, the Afrique One-ASPIRE research consortium organised a web-conference on One Health. The title of the conference was «Lessons learned in 12 years of capacity building and operationalization of 'One Health' in Africa». Through this theme, the programme presented the achievements of its research conducted within the framework of One Health and discussed One Health approaches in relation to the challenges of global health.

The first day was devoted to three panels. They focused respectively on (i) the operationalization of One Health in Africa, (ii) the tools and methods used, as well as (iii) the awareness-raising actions and interventions. The implementation of the One Health approach in Africa by Afrique One-ASPIRE has enabled the establishment of regulatory mechanisms adapted to the scientific requirements of different countries. In the following, we have picked out some highlights.

“More than 30 community health workers and livestock auxiliary workers have been trained to report symptoms in human or animal populations to health professionals by cell phone,” said Dr. Fayiz Abakar, post doc Afrique One-ASPIRE, a specialist in zoonotic disease surveillance.

“Based on our studies, animal handlers are more exposed, and most are in remote areas. Using a One Health approach, integrated surveillance can sample both humans and livestock. This approach will reduce costs in terms of laboratory space,» said Dr. Gloria Ivy Mensah, Africa One-ASPIRE post doc, a zoonotic TB specialist based in Ghana. In Ghana, to fight against antimicrobial resistance, awareness campaigns have been carried out. A network against antimicrobial resistance has been established. This network involves researchers and practitioners in the fields of veterinary, environmental and human health.

In Tanzania, the AfyaData application was designed to diagnose and report brucellosis. This electronic tool appears to be an efficient and affordable solution for low-income areas. “The AfyaData App is an effective electronic tool for reporting brucellosis cases in institutions and the community. With the AfyaData App, brucellosis reporting and surveillance is faster and more comprehensive,» said Mr. Mwampashi, who completed his Master’s degree under the Afrique One-ASPIRE programme.



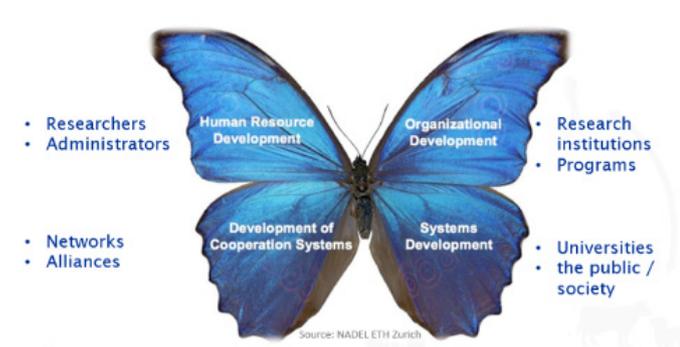
In Chad, integrated surveillance systems have been implemented in concert with rural populations to monitor human and animal health diseases with a focus on zoonotic diseases such as bovine tuberculosis, brucellosis, rift valley fever and rabies.



Adoption of One Health research project management strategies

Capacity building, adaptation of training curricula, global partnership and engagement of media, public and policy makers were addressed during the second day of the conference.

For Afrique One–ASPIRE, the issue of capacity building refers to the metaphor of a butterfly that needs all four wings representing the different components in which investments



have been made: people, institutions, networks, and systems. « These four aspects are key to the success of a capacity building program and allow a butterfly to fly or the research ecosystem



to perform well,» said Dr. Kathrin Heitz–Tokpa, Coordinator of Afrique One–ASPIRE

Afrique One–ASPIRE successfully engaged communities, policy makers and the media through strong communication to communities, researchers, and policy makers.

Identifying barriers and limitations to the implementation of research findings, mobilizing the community for sustainable collective action, and capitalizing on community and policy needs were the pillars of this successful engagement. In terms of capacity building, Afrique One–ASPIRE has established about 20 training modules. Since 2009, more than 130 researchers and practitioners have been trained at the Master, PhD, and post-doctoral levels. More than 275 articles based on the « One Health » approach have been published. The One Health e-learning courses have reached over 5,000 learners worldwide.

Having enjoyed the conference, some participants were willing to share their satisfaction on Twitter. For instance, Nicolas Antoine–Moussiaux, Professor at the Faculty of Medicine of the University of Liege «It was amazing to discover in more details the great work achieved by this new generation of African One Health scientists thanks to Afrique One–ASPIRE! Congratulations!»

Pleased with the results and the smooth running of the conference, Professor Bassirou Bonfoh, Director of Afrique One–ASPIRE, called for collective action to end certain zoonotic diseases. «We still need political and community commitment for collective action on issues related to rabies, brucellosis, tuberculosis, food-related diseases, livelihoods and syndromic surveillance,» he said.



Food, Nutrition in the time of Pandemic...

Focusing on food borne diseases and nutritional illness, AfriqueOne–ASPIRE have been addressing the epidemiological links between food and human health, including both infectious and non-infectious diseases. They also contributed to show how these linkages will influence the effectiveness of control interventions based on risk. Selected case studies conducted by fellows during the last 5 years are presented here. They emphasised: food choices and sociability; food consumption and microbiological risks; cost-benefit of food quality and hygiene; food practices and non-communicable diseases; the importance of food in integrated management of chronic wounds; and the importance of targeting food-related illness in interventions and the resilience to food security and nutrition in the context of pandemics. As food in sub-Saharan Africa is mainly produced and consumed in the informal sector, those studies investigated the dynamics of food habits and consequences in the context of the COVID-19 pandemic.

Benefits and risks of foods in west Africa: Spiced braised meat “Choukouya” in Abidjan Armel Yapo

One of the most important dishes in Ivorian street food cuisine is a dish commonly known as Choukouya, made of beef, mutton, or chicken cooked on the grill, generally sold and consumed in the open air, sometimes at the roadside, and/or near refreshment stands. Its consumption is usually accompanied with a spice powder called Kankankan and onion, fresh tomato and fresh chilli. The choukouya sale environment can favour the spread of pathogens due to poor hygiene conditions. Similarly, kankankan, is produced in the traditional way in an unhygienic environment. It is composed of 70 or 80% peanut cake, rice, or maize flour mixed with garlic, ginger, dry chilli pepper, and annatto seeds (*Bixa orellana*) and sold in retail markets, then used for seasoning braised or grilled meat. Choukouya is the most common form of protein supplement consumed outside of the household. It has the advantage containing a rich supply of micronutrients and minerals due to the combination of meat, vegetables, and spices. However, these ingredients are also known to harbour many pathogens representing a risk for consumers. Inadequate disinfection and sanitation of food contact surfaces, non-food contact surfaces, cleaning equipment and tools, and close contact of food handlers with staff and customers are risk factors not only for the handlers themselves, but also for their customers. The COVID-19 outbreak, ongoing in the country since March 2020, has tremendously

affected the production and consumption of Choukouya, as well as other street foods. In Côte d’Ivoire, the government decided on several measures affecting the restaurant sector such as the closure of businesses (e.g. restaurants, “maquis” and other drinking establishments), physical distancing and restricted mobility; and the ban on the consumption of bush meat, etc. These measures aimed at reducing contacts, ensuring food safety, and protecting the health of consumers, food producers and sellers.

To ensure food safety and control the spread of the novel coronavirus in the catering sector and during the sale of braised/grilled meat, local authorities, through their hygiene services, have promoted hand washing and disinfecting, distancing and the use of protective face masks, which could help to improve the hygiene in the Choukouya value chain.

Cost and benefit of quality and hygiene in the Dibiterie value chain in Dakar Malik Orou Seko



Dakar in Senegal is undergoing accelerated socio-economic and demographic changes that lead to the transformation of eating habits. One result of this socio-economic and demographic change is the proliferation of informal fast-food outlets, such as “dibiteries”, serving braised mutton. The consumption of dibiterie meat has become particularly prevalent in the food habit of the Senegalese population.

High-risk practices have regularly been observed in these informal restaurants, including the sheep carcasses generally being picked up directly from the slaughterhouses and then transferred to the *dibiteries* by public transport, without cold chain storage. Actors also display pieces of meat in the open air, use recycled

packaging, and operate a poor handwashing system. Evidence previously indicated that these risky practices result in half of meat produced and sold in *dibiteries* being contaminated with pathogens. The prevalent hygiene deficit adversely affects the quality of the products and poses a substantial risk of foodborne infections to consumers, and also leads to a loss of market value and income for the operators of *dibiteries*.

The *dibiterie* business was found to be highly profitable with a cost-benefit ratio estimated, on average, at 1.26 and a rate of return of 26% on investment. But the economic assessment of *dibiteries* shows that the lack of ownership of the premises, and access to long-term rented premises, represents an obstacle to sustainable investment. This in turn, has an impact on the hygiene and quality of the products sold. Therefore, while the current business model of the *dibiteries* is very profitable, the investment deficit makes hygiene and public health interventions difficult to implement. Improving the quality and hygiene management in the *dibiteries* is a major challenge, especially during the crisis period of the COVID-19 pandemic.

It has been observed that when hygiene training-based interventions are implemented, they improve the quality of the products sold, with relatively low costs, while not affecting the income of the *dibiteries*. Studies indicate that hygiene-related expenses were very low, with findings indicating an outlay of less than 1% of the total cost of production. In addition, the level of sustainable investment for the quality and hygiene management was very low (3% of the total production cost) and strongly dependent on the ownership of the business premises, with the main constraints being a lack of secured spaces. The cost of improving hygiene was estimated at 1,200 CFA francs / month (40 CFA francs / day). This cost is very low considering the profitability of these establishments, and would, therefore, militate for the implementation of this kind of interventions adapted to the context of the *dibiteries* where benefits are generated in terms of economic gain and public health.

In conclusion, the production cost of quality and hygiene in the *dibiteries* is sustainable with the income from the business, although shocks such as the restrictions in the context of the COVID-19 have resulted in lower profits. Therefore, cost-effective hygiene interventions based on training sessions could allow better profitability of this business and yield safe food for the population.

Socio-economic and cultural roles Cassava couscous known as “Garba” in Abidjan Judicaëlle Koffi

One of the most popular street foods consumed in Abidjan is unquestionably “*Garba*”, an Ivorian “fast-food” composed of “*attiéké*” (steamed cassava semolina), accompanied by fried tuna fish, raw vegetables (chili, onion and tomato), and oil. The three main things valued by consumers are: taste, satiety effect, and affordability. This food is also recognized as a dish around which social ties are built. It is generally consumed in small groups with and eaten directly with the hands. The shared experience that emerges makes this dish popular, especially among the low-income population. Their feeding practices aim to satisfy their food needs but also to raise their energy levels for hard work, and to build a social group identity. The choice of *garba* by consumers is linked to the fact that it is «low-cost food» and is accompanied by a remarkable satiety effect. These attributes of *garba* constitute the cement which consolidate fraternal and friendly relationships in consumers’ networks, and this is translated into practices of donation and counter-donation. *Garba* consumers make donations within their extra-family relationships through support clubs set up around *garba*. *Garba* consumers also mobilize donations in their intrafamilial relationships through the symbolic pledge (money) that they manage to set aside through the consumption of *garba*.

Beyond its social function, *garba* also plays an economic role. The growing demand for *garba* is also pushing up the supply chain with the creation of jobs for women producers, and all types of sellers. Indeed, *garba* selling was initiated around 1990s by young people from Niger commonly called “*Garba*” (which is a common name in Niger). For several years, this activity was exclusively their business. Nowadays, young Ivorians who used to look at this activity with disdain are increasingly investing in the selling of *garba*. *Garba* has, therefore, become a provider of employment for all socio-economic strata.

Despite the social and economic advantages linked to *garba*, some players in this sector are still criticized for not observing appropriate hygiene measures. As is the case with many other street foods, hygiene conditions of the “*garbatigui*” (*garba* seller), the “*garbadromes*” (food kiosk where *garba* is made and consumed), and cooking practices, are still questionable. Hygiene is a concern not only for municipal authorities and governmental agencies in charge of food safety, but also for consumers themselves. Some Ivorian residents are reluctant to buy and eat *garba*, as by one of them described: “99.99% of *garbadromes* are dirty, which is why I am not going to sit in a

garbadrome to eat; except in very specific cases, and then it's rare. It rarely happens, I can count the times I have sat in a garbadrome to eat". However, other people hold a different view regarding hygiene conditions during preparation and selling of *garba*. According to one: "at the beginning of this business, if you had to rate hygiene conditions in the *garbadrome*, they would score one out of ten, because the only thing that attracts people to *garba* is the taste and smell. The rest, we don't care. Things have evolved and today, even though a lot of *garbadromes* are still very dirty, some of them have improved and are very clean".

Despite the negative impact of the COVID-19 pandemic on the production and consumption of *garba*, important positive effects have also been noted in relation to the *garba* business. The pandemic has contributed to the disruption of the social and economic order around *garba*. Eating habits of consumers were impacted by the restriction measures affecting their lifestyle. It was not easy to consume food at an affordable price, or to save money, because of the high cost of living. The sociability that was built around *garba* was also deeply affected. However, important conditions for the reopening of businesses in Côte d'Ivoire after the lockdown and partial confinements, were the observance of hygiene conditions, one of them being the setup of hand washing stations. To comply with governmental prescriptions, hand washing devices were placed in front of most *garbadromes* in Abidjan. These new measures have contributed to improve the hygiene conditions in those areas and increase their attractiveness and reduce hesitancy amongst consumers.

Nutrition mediating the link between NCDs and infectious diseases

Thérèse Gboko

With the rapid spread of COVID-19, the ability of countries to address and respond to Non-Communicable Diseases (NCDs) has been impacted. The virus has caused broad disruptions to health services while at the same time drawing attention to countries' NCD burden, as those living with NCDs are at increased risk of becoming severely ill with the virus. Also referred to as chronic illnesses, NCDs are long-term diseases resulting from a combination of genetic, physiological, environmental, and behavioural factors. NCDs are clustered into major groups including cardiovascular diseases, chronic pulmonary diseases, diabetes, obesity and cancer.

In many case reports and systematic reviews currently available on people suffering

from COVID-19 infection, one of clinical characteristics most commonly observed amongst infected people is the high prevalence of NCDs. Hypertension, diabetes, and other NCDs are common comorbidities observed in both COVID-19 patients and deaths from COVID-19. Moreover, these comorbidities are also identified as risk factors for the severity of COVID-19 infection. In addition, immune system deficiency, and other physiological dysfunctions related to these health conditions could potentially increase the vulnerability of the population to COVID-19 disease. Mechanisms of the potential relationship between NCDs and the COVID-19 infection are not clearly established. Nevertheless, people affected by NCDs are considered at high risk for COVID-19 infection and should be subject to extra attention.

People's daily routine and lifestyle behaviour can also be risk factors for developing a range of NCDs. To curtail the COVID-19 virus spread among populations, lockdown was adopted as a preventive measure in many countries worldwide in combination, with other preventive measures. Online surveys conducted since implementation of these measures suggest deep changes in dietary patterns (quantity and quality), and the increased screen time and physical inactivity of people. In-depth investigations are still needed to fully assess the real impact that these barrier measures had on populations' health. In the meantime, the population should be encouraged to maintain a healthy lifestyle despite the restrictive measures and reduce exposure to NCD risk factors by adopting a balanced and healthy diet including plenty of vegetables and fruits, staying physically active, and reducing the harmful use of alcohol and smoking.

In parallel to the COVID-19 pandemic, it is well known that several countries worldwide are facing the emergence of NCDs identified as major public health issues in the last few decades. With the increasing prevalence of NCDs, it can be deduced that a high number of individuals could be at risk for COVID-19 infection or present with a more severe form of the disease.

Moreover, a particular attention should be paid to the impact of the COVID-19 pandemic on the management of other public health issues in many countries, including NCDs, which results in disruptions to the related services. This was the case in Côte d'Ivoire where a decline in the activities of both diabetes and tuberculosis care centers has been observed.

Nevertheless, both apparent accentuation of NCDs-related behavioural risk factors observed during this pandemic and the decline of services

for NCDs (which, in many countries were already facing difficulties due to the weakness of health systems before the COVID-19 pandemic) lead to fear of the recrudescence of morbidities and mortalities related to NCDs.

This relationship between COVID-19 and NCDs provide a clear illustration of the double burden of communicable and non-communicable diseases that many health systems worldwide are probably facing. Healthy eating and balanced nutrition could mediate the link between NCDs and infectious diseases.

Towards an Integrated Buruli ulcer and chronic wounds management centre in Côte d'Ivoire

Bognan Valentin Koné, Yao Didier Koffi and Bassirou Bonfoh

A wound is a physical injury that results in an opening or break in the skin that causes disturbance in the normal skin anatomy and function. Wounds may be classified as acute or chronic based on the source or causative agent, including surgical wounds, burns, traumatic wounds, pressure injuries, venous stasis ulcers, arterial ulcers, diabetic foot ulcers, and other atypical chronic wounds. Chronic wounds afflict millions worldwide, incurring significant health care costs and chronic suffering. Several traditional and clinical strategies for chronic wound management have been initiated in Côte d'Ivoire, but with limited success.

To fill the research and intervention gaps partner institutions in the framework of Afrique One-ASPIRE have implemented a wound management project in Côte d'Ivoire at the Taabo Health and Demographic Surveillance System (HDSS) since 2019. This project is developed in collaboration with the Taabo General Hospital (TGH), the national Buruli ulcer control programme (PNLUB), the Section of Clinical Tropical Medicine of the Heidelberg University Hospital (Germany) and the Molecular Immunology Unit (MIU) of the Institute of Tropical and Public Health (Swiss TPH) of Basel (Switzerland). The research focused on (i) wound epidemiology, (ii) chronic wound management, (iii) nutrition in chronic wound management, and (iv) socio-economic determinants of wound management. The project was funded by the Else Kröner-Fresenius Foundation, the Swiss TPH and the Afrique One-ASPIRE consortium/ DELTAS Africa I.

Field activities covered two rural health services (Ahondo and Sahoua health centre) and the Buruli ulcer treatment unit at Taabo General Hospital. The wounds treated so far are attributable to various causes such as infections,

trauma, snakebite, or diabetes. The principal challenge is to consider all the components of wound management, namely the clinical aspects of wounds, the socio-economic environment, and the nutritional status of patients, using a «One-Health» approach. Thus, in addition to the standard clinical activity of wound care (dressings, surgery, skin grafting, medication, etc...), nutritional, psychosocial, and socio-economic support are provided to vulnerable patients. Besides the epidemiological study, the socio-ecological approach allows the assessment of (i) the contribution of nutrition in wound healing improvement, (ii) the socio-economic cost-benefit of wound care, (iii) the environmental factors of wound aetiology and treatment and (iv) the community engagement approach to involve the communities of these localities.

Patients were actively recruited during wound surveys in the community and passively during visits to the local health centres. Care was free of charge and offered to all patients until they were fully healed. Initial results show that the groups of population most affected by wounds were children and women. From May 2019 to date, the project has enrolled 690 patients, 85% of whom have recovered. The wound prevalence was 10.5 %, of which the majority were children below the age of 14 years. At the time of the first interim analysis, 87 % of the patients had healed. Wound aetiology spanned from mainly traumatic wounds (82 %), to furuncles, burns, Buruli Ulcer (BU), yaws, and wounds based on chronic filarial lymphedema (18%).



Photo: A patient in the BU unit of Taabo General Hospital/
Credit Photo: Project Team (WM_Project)

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Accelerating wound healing with nutritional supplement and behaviour change

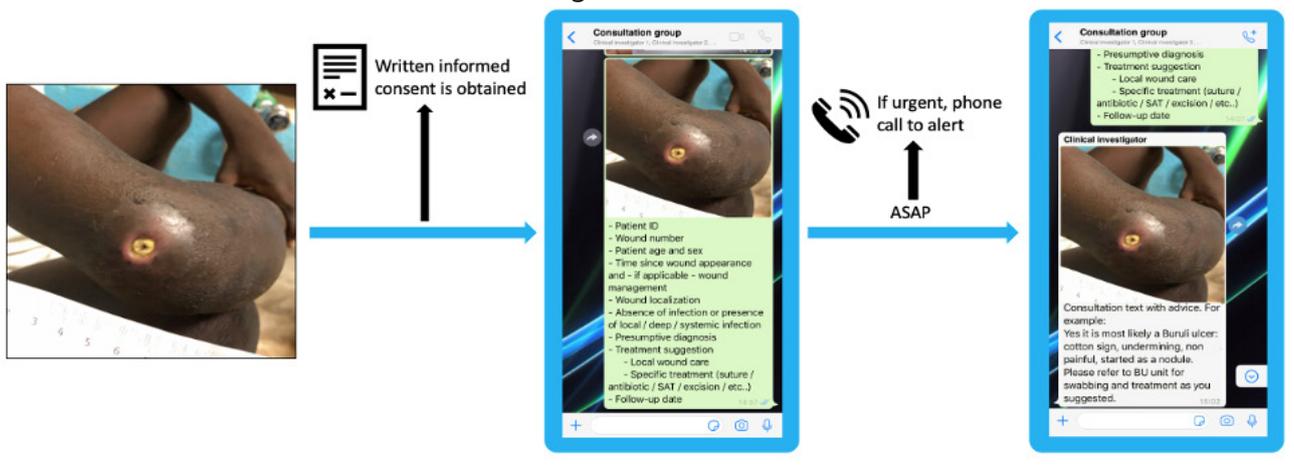
Yao Didier Koffi, Bognan Valentin Koné and Bassirou Bonfoh

According to the Taabo population's local knowledge, social representations draw a binary distinction between two categories of wounds. These are known as normal or «Kani», and abnormal/supernatural or «Kani têh». The «Kani» wound category includes traumatic wounds from machetes, wood, burns, and animal bites. As they are due to known causes, they are not considered as diseases and their severity is often underestimated. On the other hand, wounds with unknown causes are often described as «Kani têh», and are seen as serious wounds of metaphysical origin, and sometimes linked to witchcraft or mysticism. Buruli ulcers and chronic wounds are also commonly classified as «Kani têh» due to the unknown source of the pathogen as the local population may be unaware of the disease transmission dynamics. All these representations and perceptions lead to the trivialization of «Kani» and the use of traditional care for «Kani têh» contributing to

by up to 50%. Wound closure was more rapid in patients supplemented with OFSP and soybean than the control group.

Regarding accessibility to care, the early recourse of injured people visiting a health centre was severely hampered by the cost of treatment and local people social perceptions of wounds. The average total financial cost of wound care is 48,000 FCFA (~72 euro), representing 77% of the minimum monthly wage in Côte d'Ivoire. Indirect non-medical expenses such as transport, food, and production costs constitute nearly 60% of the total cost and are factors to be considered in wound care subsidy policies. In terms of the social aspect, the period of care leads to family instability, loss of social status of adult patients in the community, and school dropout and failure among school-age children. There are also problems of anxiety and depression related to the long duration (4–12 months) of treatment and the loss of use of certain body parts.

Development of an e-wound management during the COVID-19 pandemic



wounds becoming chronic, with huge associated social and economic costs. The healing of chronic wounds in such a context is also affected by food prescriptions and taboos, dictated by the belief system and the world view of local communities. Enrolled patients were frequently undernourished because of the impact of wounds and the existence of several food taboos set by traditional healers prohibiting the eating of coloured food (papaya, orange, red meat, etc.). These beliefs and practices lead to undernutrition and the development of anaemia. The nutritional study detailed here found that the consumption of certain foods could have a highly beneficial impact on wound healing. Orange Flesh Sweet Potatoes (OFSP) known for its high content of beta carotene and carbohydrates, was found to be a good nutritional rehabilitation supplement and useful in shortening wound healing times

Difficulties and external threats encountered during the implementation of the project paved the way to more innovation and creativity for a better wound management in times of crisis. The COVID-19 (lockdown and travel restrictions), and the socio-political unrest around the presidential election period in 2020 led to a review of the wound patient management strategy so as to reduce contacts and comply with regulations. A link has been established with trained project personnel (health post nurses and community health workers, CHWs) based in in Taabo and two researchers and practitioners' groups based in Abidjan (Côte d'Ivoire) and Heidelberg (Germany), respectively. There was a strong involvement of local actors in developing and implementing the strategies described here. A remote strategy was developed and implemented for the wound case identification

and treatment part of the project “Prevent, Identify, and Treat Wounds Early” to support the health staff on the ground and to digitize the process. With mobile phones, two e-Health functions were set up; one for consultation and the other for data collection. The function for consultation was based on the WhatsApp application (photos with short description) and a questionnaire on Open Data Kit (ODK) that the health worker had to fill in to enable the team based outside to conduct a remote diagnosis, in real time when possible. A discussion group on the WhatsApp platform was accessible to the project team members, the health care workers and the principal investigators.

- **Consultation and ordering of materials via secured app (operational – installation and training completed)**
- **Documentation via Open Data Kit and live quality control by clinical investigators (design and training completed; piloting planned for 2021)**

The clinical investigator then diagnosed the wound aetiology and guided the health workers via WhatsApp communication on the treatment required for the case and decided, according to the severity, on hospitalization or ambulant care. After consultation, and with the consent of the patient, the health worker collected data on each patient’s history, the current health status, the care received, the medical treatment, and follow-up of the wound. Data collected through ODK, were accessible only for project members, thus respecting the ethical requirements of the study. Data and photos were updated during each wound dressing change. All the staff of the project from nurses, mid-wives, and nurses assistants to community health workers, were trained to use, and work with, these new tools securely as health worker participants were also equipped with smartphones and supplied with internet data monthly. The system is now being expanded and could be used as a model for the monitoring wound surveillance and response system with the National programme of Buruli ulcer of Côte d’Ivoire.

Tackling the surge in non-communicable diseases in Africa: perspectives from east Africa

Ahmed Gharib Khamis and Sayoki Mfinanga

Why target food-related illness?

In low- and mid-income countries, cardiovascular disease and diabetes are one of the major killers of young adults. For policymakers and other stakeholders, interventions in different

vulnerable groups are of the highest priority, as many risk factors lie in habits starting at a young age. It has been documented that improved diet and increased exercise is effective in preventing non-communicable diseases (NCDs) but there is a lack of knowledge on how to modify behaviours, particularly in different vulnerable groups. It is critically important to consider the specific difficulties of each valuable group alone to change behaviours, adopting a multi-pronged approach, and targeting vulnerable groups such as street vendors and their clients in urban areas, livestock keepers, etc. The problem also involves the environment in which populations are exposed to poor diets and less physical exercise. This also implies working simultaneously with policymakers to provide them with evidence so that they may consider complementary structural or legislative interventions. In Tanzania, Afrique One-ASPIRE has been engaged in a transdisciplinary path with projects funded by the National Institute for Health and Care Research (NIHR) and the European Union (EU). This collaboration contributed to focusing on evaluating integrated management of (adult) HIV, diabetes, and hypertension. In terms of concrete outputs, a multi-disciplinary team has developed strong partnerships with communities, patient groups, health care managers, and policymakers. Being aware that the biggest challenge in NCDs control is their prevention, the research team has relied on their existing research platform to move into this area.

An intervention was developed to tackle NCDs and included health education and a dietary model. Components of the intervention were evaluated in a study conducted in Dar es Salaam, Tanzania. The study targeted eating habits of adults purchasing food from street vendors, through information and the provision of subsidized vegetables and fruits. This intervention package was proposed after observing a high magnitude of intermediate risks of non-communicable disease including overweight/obese (64%), raised blood pressure (43%), and raised triglycerides (14%) with raised blood pressure (7%). Preliminary analyses showed the effectiveness of this intervention in reducing the body weight of young adults over a short duration.

Eating habits of rural populations were also targeted through a study of NCDs among pastoralist communities in the northern part of Tanzania. Data on hypertension, diabetes, and anaemia were collected in Monduli district, in the Arusha region. The study mainly aimed to identify the prevalence and associated factors of some selected non-communicable diseases like

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hypertension and obesity, with more emphasis on looking at their dietary risk factors. Around 510 pastoralists were interviewed in this study. The first preliminary finding revealed that the prevalence of hypertension in this study population was 26%. Generally, the findings suggest that older age, higher body mass index (BMI), low physical activity, and consumption of fatty foods increase the risk of hypertension among the study population. Overall, most of the population consumed cereals (93%), vegetables (61%), and milk (44%), while a moderate proportion consumed meat (30%), and very few consumed fruits (16%) and eggs (4%). More than half (54%) of the population consumed a diet of adequate diversity.

More evidence needed in pastoral zones

A study conducted among the indigenous population (Maasai pastoralists) in the Northern part of Tanzania (Ngorongoro Conservation Area, Ngorongoro, Arusha), revealed that red meat consumption was positively associated with a high prevalence of hyperlipidaemia. There was a higher rate of red meat consumption in the study community, where almost all (99%) of the study participants, particularly men, reported consuming red meat excessively. Participants who reported consuming 251–750 and >750 grams/week had a significant prevalence of hyperlipidaemia as opposed to participants who reported consuming ≤ 250 grams/week of red meat. The observed association between high-level of red meat consumption and increased prevalence of hyperlipidaemia in the study population highlights the need for more research and the design of new strategies to reverse the trend of high prevalence of hyperlipidaemia, thereby minimizing the risk for cardiovascular diseases (CVDs) and NCDs at large.

Partnership matters for NCD and infectious disease control

A necessary partnership was developed with NIHR and EU-funded projects by engaging two researchers from Afrique One-ASPIRE in data analysis capacity building. They contributed to analysing some data for the integration service model work of HIV, diabetes and hypertension. Again, through the engagement of Afrique One-ASPIRE fellows, the Tanzania NCD alliance has been implementing a project aiming at empowering secondary school girls regarding NCD risk reduction. As part of the collaboration with NIHR and EU-funded projects, of which Prof. Sayoki Mfinanga is a Co-PI, the group has strengthened NCD services in the wider research programme, and identified raised glycaemia or raised blood pressure in People Living with HIV/

AIDs (PLWHA). To date, findings of this research activity have demonstrated that even in PLWHA, there is a high increase in glycaemia and raised blood pressure.

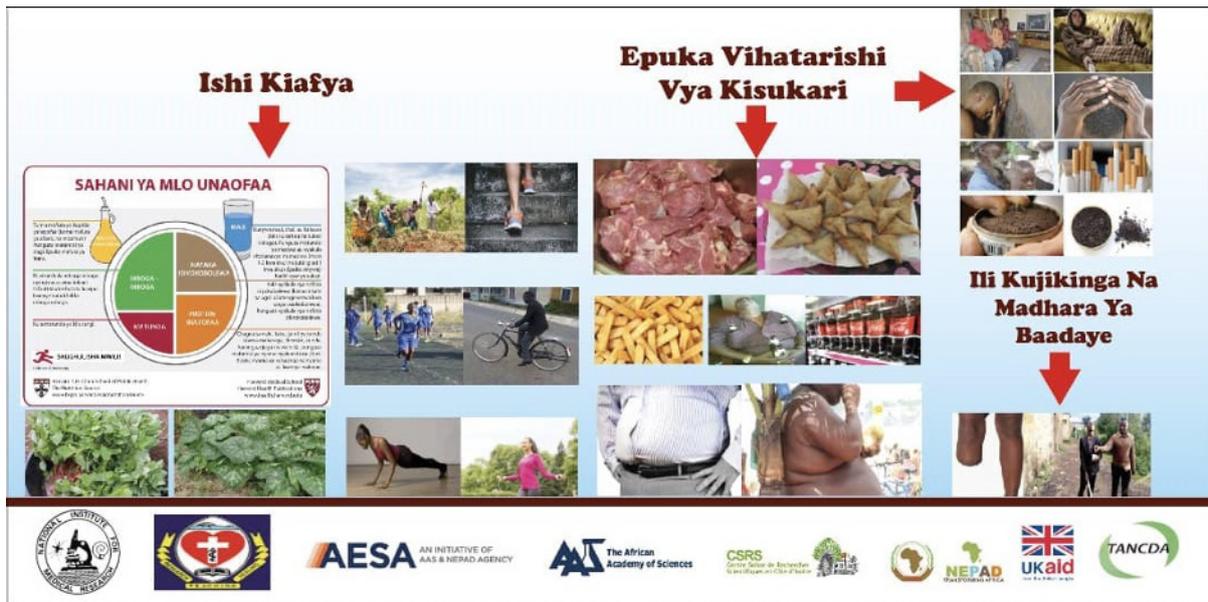
Planning: design and implementation of an intervention on NCDs



Research team and one member representative from Monduli district hospital, in December 2019

Based on research findings generated with established partnerships, an intervention package has been designed to be implemented in the future. The multiple components will be designed to be complementary and result in a synergistic effect as follows: i) education on diet focusing on reduced calorie intake, and reduced salt and sugar. There will be an increased emphasis on eating fruits and vegetables; ii) education around exercise: a minimum of 30 minutes of vigorous exercise at least 5 days a week; iii) street vendors, selling food, drinks and snacks. The intervention against environmental factors will focus on provision of subsidized vegetables and fruits to the vendors to sell to clients. The initial pilot work suggests that this would be feasible. The intervention will involve street vendors because research findings to date show that most of the food sources surrounding the schools' environment serve food with a poor nutrient balance and sugary drinks.

The implementation team will be guided by an ecological model that includes different levels and their influence in taking preventive measures to NCDs. This will be supported by a social science study to determine the



One of the burners designed for NCDs health education among street foods consumers

effects of behavioural change relating to diet and exercise. Also, the observed association between red meat and hyperlipidaemia calls for further follow-up studies to establish its temporal relationship. Additional studies should be conducted among the indigenous population to complement research findings from Maasai pastoralists so as to have a strong evidence base to inform policymakers and implementers. This will include sub-study among the town-dwelling population to have a comparison group which have a more westernized and urban lifestyle.

In this process, several stakeholders identified among governmental agencies, administrative authorities, civil society organisations (CSO) and communities will be involved. The list of stakeholders includes, among others, the Ministry of Education, Ministry of State in the President's Office Regional Administration and Local Government (PORALG), Ministry of Health, Community Development, Gender, Elderly & Children (MOHCDGEC) and Ministries of Agriculture and Livestock and Fisheries. Other important stakeholders include Tanzania NCDs alliance (TANCDA), Tanzania Diabetes Association (TDA), Tanzania teachers' association, and the Ngorongoro Conservations Area Authority.

Envisaged social impact of the intervention

Change of policy and practice is a key mechanism to enforce sustainable behavioural change which is important in changing habits at food selling points and schools and for physical exercise. Findings from Maasai pastoralists envision that intervention to control hyperlipidaemia should focus on advocating healthy lifestyle programs and regular community mass screening for early

detection and treatment of both hypertension and hyperlipidaemia among Ngorongoro Maasai pastoralists. The envisaged social impact of the project is the following: healthy food, dietary practice, physical exercising, cooking style in households, informing of the link of NCDs to eating habits, and determinants of quality of life. Finally, there is a need to strengthen the existing programs such as free food distribution to improve dietary diversity in this population (not to rely on animal product food only) due to the restriction of cultivation within the conservation area.

Resilience to food security and nutrition in times of pandemics Arlette Dindé

In recent years, many parts of the world have been hit by major shocks ranging from conflicts, erratic weather patterns, earthquakes, droughts, and floods leading to food price spikes. At the same time, poor people and communities remain vulnerable to smaller shocks such as emerging diseases and contaminated foods but are very devastating for affected people and households. The recent COVID-19 outbreak caused severe disruptions in food systems, increasing the vulnerability of African populations already living under permanent stress. Considering that building resilience is a set of mechanisms helping individuals, households, communities, and countries prepare for, cope with, and recover from these shocks and become even better off, one should examine the resilience of African populations to food security and nutrition in times of pandemics. This article briefly provides an insight into the resilience in food security and nutrition in this context of pandemic.

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Relationship between food security nutrition and health

FAO defined food security as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. This definition includes four dimensions including availability, physical and economic access, utilization of food, and stability in time relating to the three other dimensions. Thus, nutrition is one of the conditions for the achievement of food security even though this aspect is poorly considered within the concept of food security. The “utilization” dimension helps to better understand the interest in nutrition for food security. Utilization defines “the proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation”. A balanced diet with hygienic water and sanitation reduces the vulnerability to diseases. Undernourished people have weaker immune systems and may be at greater risk of severe illness. Having enough food to eat is among the first thoughts of families and governments, particularly during a crisis period. Beyond the conception of food to survive, nutrition focuses on healthy diets, those containing the nutrients humans need to thrive, not just to survive. This understanding of food becomes especially relevant during the pandemic, as good nutrition is a driver of immunity and good recovery.

How COVID-19 affected food security and nutrition?

To prevent the spread of the COVID-19 virus and preserve public health several measures were implemented, such as lockdowns, that caused disruptions of trade, and commercial activities. Thus, lockdowns and disruptions triggered by COVID-19 have disturbed the whole food system, from the primary supply to the final demand. Disruptions in food supply chains and closing of informal markets caused food price hikes while incomes have fallen or even disappeared due to layoffs caused by COVID-19. The sudden reduction of financial means forced many households to reduce dietary diversity and quality, leading them into food insecurity. Further, food system disruptions can cause major changes in the availability or accessibility of those foods, especially nutritious ones such as meat or milk. In addition to the financial impact of COVID-19 on the availability or accessibility of food, the state of anxiety and stress experienced by the population could also affect their nutrition as highlighted in a study conducted by Afrique One-ASPIRE in Côte d’Ivoire.

Mechanisms to improve nutrition and achieve food security

Resilient food systems should contribute to food security and its sustainability. In the case of the COVID-19 pandemic, food security is seriously affected showing that global food systems are not resilient enough to cope with severe changes (pandemics and wars). There is an urgent need for policy intervention. Shorter and diversified supply chains could potentially facilitate the availability of food products. In turn, it will offer more choices to consumers, and in particular favor healthy diets. Enhancing storage, processing, and distribution of food commodities is vital to ensure the stability of food provision and to mitigate food insecurity and nutritional impacts of crisis. More regulation of the ingredients, and actions to make fresh food more accessible and affordable could improve dietary patterns.

In the African context, characterized by a poor health system, it is necessary to maintain healthy eating patterns for consumers’ wellness based on traditional products in order to address food insecurity and malnutrition. Traditional foods, such as dried or smoked meats and fish, dried beans and maize meal, well adapted to their living conditions, are being increasingly replaced by modern ultra-processed foods typically higher in sugar, fat and salt than traditional foods. Sugared, fatted and salted diet expose consumers to metabolic diseases, obesity, diabetes and hypertension which have been found to be significant comorbidities of COVID-19. In addition, disruptions to the food system due to COVID-19 have less severely affected subsistence farmers (those producing most of their own food) than those producing mainly for the market. Furthermore, education of women in resilience for nutritive food has the potential to improve household food security. Indeed, African women play multiple roles, both in food production and utilization, as well as being caregivers for family members. This dimension of gender is important to consider when addressing the food security impacts of COVID-19.

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QUESTION TO:

Kristina Roesel on food safety



Kristina Roesel is a trained veterinarian. She has worked with the International Livestock Research Institute (ILRI) in Kenya and Uganda for more than 10 years. She also worked as a volunteer in a forest conservation project in Malawi, to help mitigate the effects of the human–elephant conflict. From that time, she became aware how the various dimensions of health were interconnected – the forest stored water, provided fresh air and shelter for endangered species. At ILRI, she started working on biomedical subjects, such as the epidemiology of foodborne diseases.

Afrique One–ASPIRE: How do you assess the current dynamics of food safety and nutrition–related diseases in Africa?

Kristina Roesel: A general observation I find quite concerning is that caloric imbalances (leading to under– or overweight) are found in a small geographical area like a capital city in Sub-Saharan Africa. While the problem of stunting and wasting is obvious and being addressed, it seems counterintuitive that an obese person can still be undernourished. But it happens if a person only drinks sodas and eats fast food! Obesity can lead to secondary health problems such as mobility, heart disease, diabetes; the latter is a much growing concern in Africa. The way our research addresses both issues is by a combination of approaches. First, we use the gold standard risk–based approach, meaning that just because food is contaminated with a pathogen (or hazard), it does not necessarily cause harm to its consumer. This largely depends on how the product is prepared before consumption (cooking kills most pathogens) and how often the food is consumed (it makes a difference if you drink contaminated milk in large quantities every day). Animal sourced foods are of high nutritional, bio–accessible value and this needs to be carefully evaluated against the presence of food–borne disease risk. Secondly, data on consumption and preparation patterns are missing for many animal–sourced foods consumed in Sub-Saharan Africa. Participatory epidemiology is helping to close these data gaps, so we know the common practices that reduce or mitigate food safety risks. Through human–centred research, we are trying to understand the behaviour of food handlers (could be a farmer administering drugs to food animals or a mother cooking a family meal), and how we can help them adapt better hygiene practices with the limited resources they have.

Afrique One–ASPIRE: How do you perceive the contribution of the One Health approach to enhance food safety in the context of emergence of non–communicable diseases in Africa?

Kristina Roesel: It is a good question, because we often focus only on infectious diseases when we talk about One Health, especially zoonotic

diseases, and spill–over events. Natural resource degradation (like deforestation) leads to climate change which affects farmers in Africa. A major problem is the rainfall, it is either too little or too much, or the timing is not right – planting and harvesting seasons are mixed up. If rain occurs around harvesting, damp storage conditions can cause fungi to affect grains, cereals, peppers, or groundnuts which contaminates the products with toxins. These toxins can reach the consumer directly or indirectly through milk if cows eat contaminated feeds. The control of aflatoxins requires the collaboration of different disciplines to understand and contain the problem but also collaboration between different sectors, e.g. policy and law enforcement, food and feed technology, and education.

Afrique One–ASPIRE: Knowing that the COVID–19 pandemic has created a favourable environment for the proliferation of food and nutrition–related diseases, how could you describe the resilience of communities (micro–level) and countries (national level) to food safety issues in Africa during the pandemic (first year)?

Kristina Roesel: In Africa, many governments acted very quickly to the emergence of the pandemic, and mostly with lockdowns, curfews, and movement restrictions. This led to many food and nutrition security related problems, especially in urban centres: People, lost income and could not buy food; popular ready to eat outlets in the cities were closed – this is a problem insofar, that many urban dwellers often only rent a room with no kitchen, therefore cannot cook, and dietary diversity is small. Many people fled the cities back to their rural homes where they could tend to their gardens and did not have to worry about food and rent in the city. Others had to give up their agriculture related businesses, because of movement restrictions which meant they could not transport products like chickens or eggs from rural to urban (or closed) markets. However, many governments have managed to quickly sensitize food handlers. For instance, hand sanitizers, hand washing facilities and face masks have become a common sight in many cities who acknowledged the pandemic as a problem.

PUBLICATIONS

- Dindé A. O., Mobio A. J., Konan A. G., Fokou G., Yao K., Easo E. L. J. C., Fantodji A., Koussemon M. et Bonfoh B. (2017). **Response to the Ebola-related bushmeat consumption ban in rural Côte d'Ivoire.** *Agriculture & Food Security*, 6(28), 1–9. DOI 10.1186/s40066-017-0105-9.
- Christoph Jans, Leo Meile, Dasele Wambua Mulwa Kaindi, Wambui Kogi-Makau, Peter Lamuka, Pierre Renault, Bernd Kreikemeyer, Christophe Lacroix, Jan Hattendorfe, Jakob Zinsstag, Esther Schelling, Gilbert Fokou, Bassirou Bonfoh (2017). **African fermented dairy products – Overview of predominant technologically important microorganisms focusing on African *Streptococcus infantarius* variants and potential future applications for enhanced food safety and security.** *International Journal of Food Microbiology*, Volume 250, 5 June 2017, Pages 27–36, <https://doi.org/10.1016/j.ijfoodmicro.2017.03.012>.
- Koné Bognan, V., Fokou, G., Kouadio, B. B., Obrist, B., Gnabali, R. Y., & Bonfoh, B. (2018). **Pratique d'interdits alimentaires: entre logique identitaire, enjeux sanitaires et conservation de la biodiversité chez les Agni De Bongouanou (Côte d'Ivoire).** *European scientific journal*, 14(27), 82–101. doi: 10.19044/esj.2018.v14n27p82.
- Gibson B. Kagaruki, Mary T. Mayige, Esther S. Ngadaya, Andrew M. Kilale, Amos Kahwa, Amani F. Shao, Godfather D. Kimaro, Chacha M. Manga, Doris Mbata, Godlisten S. Materu, Ray M. Masumo, Sayoki G. Mfinanga. (2018). **Knowledge and perception on type 2 diabetes and hypertension among HIV clients utilizing care and treatment services: A cross sectional study from Mbeya and Dar es Salaam regions in Tanzania.** *BMC Public Health*. 18:928. <https://doi.org/10.1186/s12889-018-5639-7>.
- Kaindi DWM, Kogi-Makau W, Lule GN, Kreikemeyer B, Renault P, Bonfoh B, Schelling E, Zinsstag J, Lacroix C, Meile L, Jans C, Hattendorf J. (2018). **Investigating the association between African spontaneously fermented dairy products, faecal carriage of *Streptococcus infantarius* subsp. *infantarius* and colorectal adenocarcinoma in Kenya.** *Acta Trop*. 178:10–18. DOI: 10.1016/j.actatropica.2017.10.018.
- Angui TKP, Kotaix, Kassin KE, N'goran KE, Pierrec ZK, Bonfoh B (2018). **Effects of organic fertilizer (NPK 5–9–19) and mineral (NPK 12–11–18) on soil chemical properties in tomato crop in the South and Mid-west of the Ivory Coast.** *Journal of Soil Science and Environmental Management* 9: 108–118. DOI: 10.5897/JSEM2018.0681.
- Wullschleger S, Jans C, Seifert C, Baumgartner S, Lacroix C, Bonfoh B, Stevens MJA, Meile L (2018). ***Vagococcus teuberi* sp. nov., isolated from the Malian artisanal sour milk fènè.** *Syst Appl Microbiol* 41: 65–72. doi: 10.1016/j.syapm.2017.11.003.
- Ahmed Gharib Khamis, Akwilina Wendelin Mwanri, Julius Edward Ntwenya and Katharina Kreppel (2019). **The influence of dietary diversity on the nutritional status of children between 6 and 23 months of age in Tanzania.** *BMC Pediatrics* 2019 19:518. DOI: 10.1186/s12887-019-1897-5.
- Jennifer Manne-Goehler, Pascal Geldsetzer, Kokou Agoudavi, Glennis Andall-Breton, Krishna K. Aryal, Brice Wilfried Bicaba, Pascal Bovet, Garry Brian, Maria Dorobantu, Gladwell Gathecha, Mongal Singh Gurung, David Guwatudde, Mohamed Msaidie, Corine Houehanou, Dismand Houinato, Jutta Mari Adelin Jorgensen, Gibson B. Kagaruki, Khem B. Karki, Demetre Labadarios, Joao S. Martins, Mary T. Mayige, Roy Wong McClure, Omar Mwalim, Joseph Kibachio Mwangi, Bolormaa Norov, Sarah Quesnel-Crooks, Bahendeka K. Silver, Lela Sturua, Lindiwe Tsabedze, Chea Stanford Wesseh, Andrew Stokes, Maja Marcus, Cara Ebert, Justine I. Davies, Sebastian Vollmer, Rifat Atun, Till W. Baernighausen, Lindsay M. Jaacks (2019). **Health system performance for people with diabetes in 28 low- and middle-income countries: A cross-sectional study of nationally representative surveys.** *PLoS Med* 16(3): e1002751. DOI: 10.1371/journal.pmed.1002751.
- Ahoua A. R. C., Monteillier A., Borlat F., Ciclet O., Marcourt L., Ebrahimi S. N., Koné M. W., Bonfoh B., Christen P., Cuendet M. (2019). **Antiinflammatory and quinone reductase inducing compounds from *Beilschmiedia mannii*.** *Planta medica*, 85(5):379–384. DOI: 10.1055/a-0798-3155
- Malik Orou Seko, Walter Ossebi, Gnamien Sylvain Traoré, Andrée Prisca Ndjoug Ndour, Jasmina Saric, Gilbert Fokou, Daouda Dao, Bassirou Bonfoh (2019). **Typology, technical efficiency and scale economy of dibiteries in Dakar, Senegal.** *AAS Open Research* 2019, 2:10. DOI: 10.12688/aasopenres.12953.2.
- Kossia D. T. Gboko, Sylvain G. Traoré, Aimé R. Sanhoun, Jérôme Kirioua, Nize Otaru, Fabienne

PUBLICATIONS

- Kurt, Fabienne N. Jaeger, Julia Isenring, Dasel W. M. Kaindi, Bernd Kreikemeyer, Pierre Renault, Jan Hattendorf, Leo Meile, Christoph Jans, Roland Nguetta, Bassirou Bonfoh (2019). **Risk factors for the carriage of *Streptococcus infantarius subspecies infantarius* isolated from African fermented dairy products.** PLoS ONE 14(11): e0225452. DOI: 10.1371/journal.pone.0225452.
- Ikenna C. Eze, Clémence Essé, Fidèle K. Bassa, Siaka Koné, Félix Acka, Christian Schindler, Medea Imboden, Véronique Laubhouet-Koffi, Dinard Kouassi, Eliézer K. N'Goran, Jürg Utzinger, Bassirou Bonfoh, Nicole Probst-Hensch (2019). **Asymptomatic *Plasmodium* infection and glycemic control in adults: Results from a population-based survey in south-central Côte d'Ivoire.** Diabetes Res Clin Pract. 2019 Oct;156:107845. DOI: 10.1016/j.diabres.2019.107845.
- Francis Sena Nuvey, Katharina Kreppel, Priscilla Awo Nortey, Adolphina Addo-Lartey, Bismark Sarfo, Gilbert Fokou, Donne Kofi Ameme, Ernest Kenu, Samuel Sackey, Kennedy Kwasi Addo, Edwin Afari, Dixon Chibanda and Bassirou Bonfoh. **Poor Mental Health of Livestock Farmers in Africa: A Mixed Methods Case Study From Ghana.** BMC Public Health 20, 825 (2020). <https://doi.org/10.1186/s12889-020-08949-2>.
- Ester J Diarz, Beatrice J Leyaro, Sokoine L Kivuyo, Bernard J Ngowi, Sia E Msuya, Sayoki G Mfinanga, Bassirou Bonfoh and Michael J Mahande. **Red Meat Consumption and Its Association with Hypertension and Hyperlipidaemia Among Adult Maasai Pastoralists of Ngorongoro Conservation Area, Tanzania.** PLoS ONE 15(6): e0233777. <https://doi.org/10.1371/journal.pone.0233777>.
- Sanhoun Aimé R., Sylvain G. Traoré, Kossia D. T. Gboko, Jérôme Kirioua, Fabienne Kurt, Nize Otaru, Patríz Iten, Dasel W. M. Kaindi, Bernd Kreikemeyer, Pierre Renault, Daouda Dao, Jan Hattendorf, Leo Meile, Marina Koussemon, Christoph Jans, Bassirou Bonfoh. **Traditional milk transformation schemes in Côte d'Ivoire and their impact on the prevalence of *Streptococcus bovis* complex bacteria in dairy products.** PLoS ONE 15(5): e0233132. <https://doi.org/10.1371/journal.pone.0233132>.
- Aka, S., Dridi, B., Bolotin, A., Yapó, E. A., Koussemon-Camara, M., Bonfoh, B., & Renault, P. (2020). **Characterization of lactic acid bacteria isolated from a traditional Ivoirian beer process to develop starter cultures for safe sorghum-based beverages.** International Journal of Food Microbiology, 322, 108547. <https://doi.org/10.1016/j.ijfoodmicro.2020.108547>.
- Khamis, A. G., Senkoro, M., Mwanri, A. W., Kreppel, K., Mfinanga, S. G., Bonfoh, B., & Kwesigabo, G. (2020). **Prevalence and determinants of hypertension among pastoralists in Monduli District, Arusha region in Tanzania: a cross-sectional study.** Archives of Public Health, 78(1), 1–12. <https://doi.org/10.1186/s13690-020-00485-0>.
- Khamis, A. G., Mwanri, A. W., Kreppel, K., & Kwesigabo, G. (2020). **The burden and correlates of childhood undernutrition in Tanzania according to composite index of anthropometric failure.** BMC Nutrition, 6(1), 1–13. <https://doi.org/10.1186/s40795-020-00366-3>.
- Orou Seko, M., Ndour, A. P. N., Ossebi, W., Saric, J., Kreppel, K., Dao, D., & Bonfoh, B. (2020). **Consumer Perception on Purchase Decision Factors and Health Indicators Related to the Quality and Safety of Meat Sold in Dibiteries in Dakar, Senegal.** Sustainability, 12(18), 7428. <https://doi.org/10.3390/su12187428>.
- Yapo, A. E., Strub, C., Durand, N., Ahoua, A. R. C., Schorr-Galindo, S., Bonfoh, B., Fontana A. & Koussémon, M. (2020). **Mass spectrometry-based detection and risk assessment of mycotoxin contamination of 'kankankan' used for roasted meat consumption in Abidjan, Côte d'Ivoire.** Food Additives & Contaminants: Part A, 37(9), 1564–1578. <https://doi.org/10.1080/19440049.2020.1784468>.
- Traoré, S. G., Ndour, A. P. N., Ossebi, W., Seko, M. O., Fokou, G., Alonso, S., Koné, P. S., Roesel, K., Grace, D. & Bonfoh, B. (2021). **Impact of Good Hygiene Management Practices on the Reduction in Microbial Contamination of Roasted Sheep Meat Sold at Urban Dibiteries in Senegal.** Food Protection Trends, 41(1), 70–79; Jan 2021. <https://hdl.handle.net/10568/110766>.
- Khamis, A. G., Ntwenya, J. E., Senkoro, M., Mfinanga, S. G., Kreppel, K., Mwanri, A. W., Bonfoh, B. & Kwesigabo, G. (2021). **Association between dietary diversity with overweight and obesity: A cross-sectional study conducted among pastoralists in Monduli District in Tanzania.** PloS one, 16(1), e0244813; Jan 2021. <https://doi.org/10.1371/journal.pone.0244813>.

PUBLICATIONS

- Kagaruki, G. B., Mahande, M. J., Kimaro, G. D., Ngadaya, E. S., Mayige T, M., Selemani, M., Jaacks, L. M., Jaffar, S., Mfinanaga, S. G., & Bonfoh, B. (2021). **Prevalence and Correlates of Cardio-Metabolic Risk Factors Among Regular Street Food Consumers in Dar es Salaam, Tanzania. Diabetes, metabolic syndrome and obesity: targets and therapy**, 14, 1011-1024. March 2021. <https://doi.org/10.2147/DMSO.S287999>.
- Coulidiaty, A. G. V., Sanou, A., HOUNGBEDJI, C. A., Djibougou, D. A., Dicko, A., Kobo, G., Kambou, B. M., Kabré, E., Ouedraogo, A.-S. & Bonfoh, B. (2021). **Prevalence and sensitivity to antibiotics of Campylobacter spp in chicken, farmers and soil in Bobo-Dioulasso, Burkina Faso. PAMJ-One Health**, 4(8). Feb 2021. <https://10.11604/pamj-oh.2021.4.8.28089>.
- Koffi, A. L. Judicaelle. (2021). **Consommation du «garba» en Côte d'Ivoire : entre risques sanitaires et construction de lien social. European Scientific Journal, ESJ**, 17(19), 230. <https://doi.org/10.19044/esj.2021.v17n19p230>.
- Teufel, F., Seigle, J. A., Geldsetzer, P., Theilmann, M., Marcus, M. E., Ebert, C., ... Kagaruki G. B., ... & Manne-Goehler, J. (2021). **Body-mass index and diabetes risk in 57 low-income and middle-income countries: a cross-sectional study of nationally representative, individual-level data in 685 616 adults. The Lancet**, 398(10296), 238-248.
- Khamis, A. G., Mwanri, A. W., Ntwenya, J. E., Senkoro, M., Kreppel, K., Bonfoh, B., ... & Kwesigabo, G. (2021). **Design and validation of a food frequency questionnaire to assess the dietary intake for adults in pastoral settings in Northern Tanzania. BMC research notes**, 14(1), 1-7.
- Mobio, A. J., Fokou, G., Aka, S., Kouassi, K. B., Kreppel, K. S., Kouakou, K. P., ... & Bonfoh, B. (2021). **Exploring beyond the conjunctural rhetoric: sociocultural drivers for the "cassava crisis" in Côte d'Ivoire. Agricultural and Food Economics**, 9(1), 1-20. <https://doi.org/10.1186/s40100-020-00174-0>.
- Orou Seko M, Ossebi W, Laré N and Bonfoh B (2021). **Understanding the Relationships Between the Consumer Perception on Food Risks, Quality, and Safety Indicators of Braised Meat Sold in "Dibiterie" Restaurants in Dakar, Senegal. Front. Vet. Sci.** 8:788089. doi: 10.3389/fvets.2021.788089.
- Bonfoh B, Kone BV, Koffi YD, Miyama T, Fujimoto Y, Fokou G, Zinsstag J, Sugimura R and Makita K (2022) **Healthy Aging: Comparative Analysis of Local Perception and Diet in Two Health Districts of Côte d'Ivoire and Japan. Front. Aging** 3:817371. doi:10.3389/fragi.2022.817371

GRADUATIONS AND PROMOTIONS

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2018			
1	NUVEY Francis Sena Kwaku	MSc	Ghana
2	LITIE Baliet Adams	MSc	Côte d'Ivoire
3	SCHAERER Judith	MSc	Switzerland
4	TINE Sakagne Raphael	MSc	Senegal
2019			
1	DIARZ Ester Jacob	MSc	Tanzania
2	LARE Nibangue	PhD	Togo
2020			
1	AMANOR Ivy	MSc	Ghana
2	GBOKO Kossia Debia Thérèse	MSc	Côte d'Ivoire
2021			
1	COULIBALY Dognimin Ismaël	MSc	Côte d'Ivoire
2	OROU Seko Malik	PhD	Benin
3	DINDE Arlette Olaby	PhD	Côte d'Ivoire
4	KONE Bognan Valentin	PhD	Côte d'Ivoire
5	COULIDIATY Abdul Gafar Victoir	MSc	Burkina Faso
2022			
1	KOFFI Aya Judicaëlle	PhD	Côte d'Ivoire
2	KHAMIS Ahmed Gharib	PhD	Tanzania

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2018	Dr HOUNGBEDJI Clarisse	Assistant lecturer	Université Alassane Ouattara, Bouake, Côte d'Ivoire
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