

## Covid-19 and nutrition: An empowering approach for preventing the Covid-19 epidemic in the Democratic Republic of the Congo (DRC)

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**ABSTRACT:** *Background:* The covid-19 has reached DRC. Numbers of confirmed cases and deaths are increasing despite the confinement strategy implemented since March 2020. In addition, mainly for economic reasons, the population is claiming for the confinement measures to be waived, which may lead to an increase of the risk of infection, morbidity and mortality related to Covid-19, which calls for a more focused prevention strategy. Nevertheless, Covid-19 prevention approach is more social distancing and hygiene oriented, with few attention to nutrition and other lifestyle aspects such as alcohol use, smoking and physical activity.

*Objective:* to support the DRC health authority's efforts for empowering populations for better prevention, by designing a more comprehensive approach including nutrition and other lifestyle factors.

*Design:* This paper is a context analysis and a review and viewpoints about different health aspects that should be integrated when designing a national comprehensive strategy to prevent covid-19 in DRC.

*Conclusion and recommendations:* The public health authorities to empower the populations against Covid-19 infection through a comprehensive approach consisting of sensitization at all levels, not only about social distancing and washing hands as it's being the case, but also and of utmost importance, about nutrition and other lifestyle factors such as alcohol use, smoking and physical activity since they affect immunity. The nutrition factor should include the dietetic management of patients with chronic diseases and/or co-infections. Therefore, task forces for fighting covid-19 epidemic in DRC should include nutrition specialists and researchers for more comprehensive approaches against covid-19, to the ultimate interest of the population.

**KEYWORDS:** COVID-19 pandemic, DRC, lifestyle, nutrition, lifestyle factors, chronic diseases, co-infections

## **INTRODUCTION**

The new epidemic disease, the corona virus infection disease 2019 as abbreviated Covid-19, is caused by the virus strain called SARS-CoV-2 [1], responsible for the actual pandemic that started recently in Wuhan, China, in December 2019 [1,2], and now scattered all over the world [3]. It has now expanded worldwide and has reached the Democratic Republic of the Congo (DRC).

Corona viruses, a family of viruses within the Nidovirus superfamily, are a group of viral diseases that infect many animal species including humans, causing acute and chronic diseases [4,5].

Covid-19 is a dangerous respiratory disease that causes death, especially to persons already weakened by age and/or other chronic diseases; the main symptoms are fever, fatigue and dry cough. Symptoms are mainly more severe in adults than in children, however all human population groups may be affected, including children, women of reproductive age, pregnant and lactating women, and elderly [6].

Most people infected with COVID-19 develop only mild or uncomplicated illness [7]; some patients show minor symptoms such as pain, diarrhea and nasal congestion while other may show severe symptoms such as dyspnea and pneumonia [3] approximately 14% develop severe disease that requires hospitalization and oxygen support, and 5% require admission to an intensive care unit [7]. In severe cases, COVID-19 can be complicated by the acute respiratory distress syndrome (ARDS), sepsis and septic shock, multi-organ failure, including acute kidney injury and cardiac injury. Hypertension, diabetes mellitus and coronary heart diseases are the main chronic diseases that may aggravate the Covid-19 symptoms [8] but lifestyle factors have also been incriminated such as nutrition [9], alcohol use [10] and active smoking [11] and physical activity [12].

WHO has issued guidelines for treatment of Covid-19 disease [6] (WHO, May 2020). Guidance has been issued, aiming treatment and prevention of Covid-19 in varied settings such as schools, community members, prisons and other places of detention [5]. Key messages were about recognizing symptoms of Covid-19, avoiding contact with people affected with the disease and washing hands properly, often, with soap and clean water, especially before and after eating, after blowing nose, coughing, or sneezing, after going to the bathroom/ toilets/latrines and whenever hands are visibly dirty... However, no sufficient attention was given to preventive nutrition.

In clinical settings, number of therapeutic approaches and protocols have been defined, aiming to cure infected patients; to our knowledge, the only paper treating openly about nutrition and Covid is from the French speaking Society for Clinical Nutrition and Metabolism, suggesting that the nutritional diagnosis and the early nutritional care management of Covid-19 patients to be part of the overall therapeutic strategy [13]. An emphasis is put on the decision tree, whether to use enteral or parenteral artificial feeding when needed, as proposed by other authors for nutrition in clinical settings [14].

Overall, no special attention is put on preventive nutrition at community level and to our knowledge, there is no specific article discussing such an issue for DRC; this is important and we need to take in account the rapidly increasing number of new cases of Covid-19 and deaths as currently published on a regular basis over the world, especially since the confinement policy is being progressively abandoned or lightened in some countries. The objective of this paper is to support the DRC health authority's efforts for empowering populations for a better prevention of the Covid-19 in DRC populations, by designing a more comprehensive approach including nutrition and other lifestyle factors, along with the nutritional management of chronic diseases and co-infections.

## **DESIGN-METHODS**

This paper is a situation analysis and a review of and viewpoints about different health aspects that should be integrated when designing a national comprehensive strategy to prevent covid-19 in DRC.

## **THE DRC CONTEXT ANALYSIS**

In DRC, the prevalence of the Covid-19 disease is low (on 01 June 2020, there were 3180 confirmed cases, 72 deaths) compared to some other countries in Europe (France, Spain, Italy...), America (USA, Canada), Africa (South Africa, Kenya...). However, the incidence is increasing every day, along with the daily and overall mortality, and we think that the problem might be higher since the identification of cases is still a problem in the country, with a unique diagnosis testing center in Kinshasa, the capital town, and none in the provinces.

Anyway, the higher number of diagnosed cases is observed in Kinshasa; since the air traffic from Kinshasa to the provinces and vice versa, in addition to other confining measures, lower numbers of Covid-19 cases have been diagnosed in the provinces so far, and some of the latter have not yet notified any confirmed case. However, due to economic consequences of the confinement, people are claiming for a reduction or stop of the confinement measures, which might happen very soon, and we think that this lead to the spread out of the disease all over the country. This might create a health catastrophe since DRC health clinical settings are not well equipped for the treatment of the covid-19, countrywide.

In addition, despite the mining resources and high agriculture potentialities, DRC has a high rate of food insecurity; as a consequence, high rates of malnutrition are observed in children and adults, especially women. Countrywide, the health and demographic surveys held from 2013-to 2014 [15] informed that 43% of children under five were stunted, 8% were wasted and 23% were underweight. 30% of women had anemia and more than 14% were underweight while 16% had excess weight.

In rural areas, a study conducted recently in 2018-2019 by the Center for International Forestry Research (CIFOR) (not published yet), in partnership with the faculty of medicine of the University of Kisangani, in two rural localities of the Tshopo province has shown 97% of household food insecurity, 43% of stunting and 12% of wasting in children under five, and 25% of underweight in women. In parallel the survey reported, among others, poor food quality, poor access to potable water and poor hygiene conditions (ex. only 46% of the mothers washed hands before handling foods).

Moreover, let's mention that many rural and urban areas consume animals that have been evoked to be natural reservoirs of coronavirus, such as bats [8,16], pangolins [17] and even snakes [18] (Chen et al., 2020) although other studies refuted the hypothesis of snakes to be an intermediate host for covid-19 [17, 18] Zhang et al., 2020; Ji et al., 2020). From these hosts, fecal-oral and other routes of transmission to human are possible [19] (Chen et al., 2020), probably after virus mutation conferring the capacity to infect human beings [20] (Benvenuto et al., 2020)

Therefore, we think that in such a nutritional and health context, the risk of contracting Covid-19 will be elevated if targeted preventive measures are not taken at community levels. This is particularly important in actual world context where the idea of stopping the confinement strategy is spreading out. In DRC, people are claiming to stop the confinement measures due to economic difficulties for survival, which can be justified but in the same time the risk of massive infection will increase if the borders are open, meaning more open contact with infected persons coming from other areas of the country and the world. Therefore, it's important that people in DRC are informed of the necessity and the ways to adopt or maintain behaviors and practices aiming to protect health and help stop the expansion of Covid-19 disease countrywide. Those behaviors should include nutrition, and other modifiable lifestyle factors such as smoking, alcoholism and physical activity; they should be part of the preventive strategy, aiming to get them prepared through strengthening individual immunity, i.e. the individual capacity to fight or prevent infections. This is of particular importance within populations who are already nutritionally compromised such as DRC, as mentioned above. Though, as say Carter et al [12]., *"In times of crisis, whether it be real or perceived, there is something to be said about the benefits of empowering people to actively preserve their own health"*.

However, the routine nutrition and health sensitization approach the country is somehow diet-oriented, and more immunization focused. It does not significantly include the important aspects of diet quality and diversity, and strictly nothing about the other above mentioned lifestyle factors, that is alcohol consumption, smoking and physical activity although they are important factors influencing individual immunity.

#### **THE RATIONALE FOR DESIGNING A COMPREHENSIVE PREVENTION APPROACH INCLUDING OF NUTRITION AND OTHER LIFESTYLE FACTORS IN DRC**

In this section we show how the different lifestyle modifiable factors contribute to increasing the risk of Covid-19 infection, and the necessity to integrate them in the population empowerment strategy for Covid-19 prevention. The role of co-infections and chronic diseases is also discussed.

#### **THE NUTRITION FACTOR**

As mentioned above, most people infected with the **COVID-19** virus may experience mild to moderate respiratory illness and recover without requiring special treatment [7]. This will depend on individual immunity, which calls for good nutrition practices; indeed, it's known that nutrition has a role in overall health status, through supporting the immune system and maintaining proper immune function [9].

In DRC, a strategy to guarantee a good nutritional status at individual and population levels in should include both food security and food quality. Food security refers to durable food availability, accessibility and utilization, while food quality is indicated mainly by food balance and diversity. Information about healthy eating should also include water, sanitation and

hygiene aspects in order to avoid related infectious and parasites that might weaken individual immunity, then offering a good development space for Covid-19.

- Food security

In DRC, despite the high economical potentialities, the majority of the population's daily income is less than 1USD; as a consequence, food insecurity affects more than 50% of the households, countrywide. Country and province levels, it's important that the Congolese government and its partners reinforce the population's food security by promoting nutrition-oriented subsistence agriculture – i.e. with nutritional objective - for greater production of nutritious foods, like legumes (beans, peas, peanuts...), cereals and leafy/non leafy vegetables as they are of short harvesting period, usually 3 to 4 months, with possibility of three harvests per year. Also, populations should be encouraged to set up household gardens, for fruits and vegetable production. Such an approach would increase food availability at market and household levels.

By the way, increasing food availability at both levels will impact positively the food access through the Offer and Demand law. We think that agricultural policies aiming to promote cash crops such as coffee, cocoa... shouldn't be given priority during this covid-19 pandemic, they might be postponed and looked at latter on after the epidemic is over.

In order to augment food access, the government to pay salaries with no delays and think increase or adjust emoluments according to actual life cost. As business will restart slowly after the confinement measures are off, countrywide, Developing NGOs would be invited to promote income generating projects to help poor people improve their food security status.

The responsibility of the parents and/or other bread winners for households is also of utmost importance, mostly related to the life style in view of food security; in particular, they should be sensitized on the fact that some behaviors or attitudes such as alcoholism and smoking are costly and cash-wasting. Smoking cessation, along with alcohol withdrawal or at least strict alcohol consumption moderating up to the accepted levels (2 and 1 measures/day for men and women respectively) [21] would help save money that would be injected in food expenses, which would increase food access, and overall household food security. Also, the worrying habit of selling nutritious foods for cash, or using nutritious foods to prepare traditional alcohol as observed for maize, fish, bush meat... in some areas of the country, would waste opportunities for better nutrition of household members. However, economic security wise, selling nutritious foods wouldn't be considered as a problem in case the gained cash serves to purchase, among others, other nutritious foods for the sake of variety.

- Food quality

Once nutritious foods are available and accessible at market and household levels, it's important that the communities are informed about good feeding practices that would allow better food quality through diversity and balance.

Therefore, DRC government to strengthen nutritional education and sensitization countrywide, through administrative structures such as national and provincial health ministries, and NGOs involved in nutrition, should it be through nutrition specific or nutrition sensitive projects. All possible means should be used, including mass media, schools, churches...to ensure that the information reaches the DRC population countrywide. Both urban and rural areas shouldn't be given attention, as there is usually a flux of travellers between the two geographical areas.

The nutrition education topics would include the food quality indicators (food balance and diversity), food safety (ex. Bush-meat consumption), specific dietetic principles for Covid-19 underlying comorbidities (chronic diseases and other co-infections), and other important thematic such as other modifiable lifestyle factors including their consequences on Covid-19 infection risk, along with general water, sanitation and hygiene (WASH) related issues.

Food diversity wise, e.g. the message is that adult women should eat every day foods from at least five out of the ten food groups here after: 1) Grains, white roots and tubers, and plantains; 2) Pulses (beans, peas and lentils), 3) Nuts and seeds; 4) Dairy 5) Meat, poultry and fish, 6) Eggs 7) Dark green leafy vegetables 8) Other vitamin A-rich fruits and vegetables 9) Other vegetables, and 10) Other fruits (Caswell et al., 2018). For children, there are 7 food groups: 1) Grains, roots and tubers, 2) Legumes and nuts, 3) Dairy products, 4) Flesh foods, 5) Eggs, 6) Vitamin A-rich fruits and vegetables, and 7) other fruits and vegetables [22].

There is evidence that food diversity is associated with good nutrition status [23,24], so it's important that the populations in DRC are informed about the food grouping and it's rationale, and are eating accordingly.

Regarding food balance, people should know how to include in the daily menus, the three macronutrient food sources, which are: carbohydrates (usually the staple foods), lipids (from oils, meat, fish, oily grains and fruits) and proteins (meat, eggs,

legumes, milk). Food diversity helps reach food balance if the food quantities consumed from each group are sufficient, so no need for calculations during education/sensitization sessions.

Food safety information will mostly relate to bush meat consumption; indeed, as mentioned above, some animal reservoirs of coronavirus are eaten in some areas of DRC (bats, pangolins) and the virus can be transmitted from animals to humans. Since the virus is not resistant to high temperature, we recommend the concerned population not to eat raw meat. Therefore, bush meat should be eaten in a cooked version; this is for general hygiene and for reducing the risk of Covid-19 infection. Anyway, the populations will be encouraged to consume only cooked or heated foods for general food hygiene and safety

As per water, sanitation and hygiene (WASH information), the op. cit. study conducted by the Center for International Forestry Research in two rural localities of the DRC Tshopo province (not published yet) showed that more than 95% of the population did not have potable water, they rather used surface water from rivers, streams or ponds; more than 95% were drinking untreated water; less than 50% washed hands before handling foods and more than 90% used pit latrines or just had no latrines at home; ... This might also be the case in many other rural and even urban areas in DRC, where only 13.7% of the households have a specific place for washing hands [15]. Therefore the majority of the population was exposed to water related diseases, which may cause comorbidities and impact negatively the individual immunity, which would favor Covid-19 epidemic spread out. The government and NGOs involved in nutrition and/or health, should 1) help provide the populations with short distant potable water sources (drillings, piped water...), 2) promote and give means to the population for water treatment (boiling, using chemicals...), 3) sensitize about general hygiene rules (washing hands before handling foods, after toilets, before feeding children, ... and the use of clean water for washing dishes and 4) promote the construction of improved latrines.

Concerning chronic diseases (obesity, diabetes, hypertension, coronary heart disease...) they are known to be risk factors of Covid-19 morbidity and mortality [2]. The health authorities should implement or boost existing nutrition and health education programs for patients with chronic diseases, for better control in order to enable them for covid-19 prevention and mortality. Other inflammatory diseases may impact the immune system by increasing protein catabolism [25], especially the nutrition proteins (serum albumin and pre-albumin), which calls for energy and protein-rich diet [25]. Therefore, in such cases, the recommendations about food quality and food security are to be followed, along with increasing the protein intake close to the higher limit of the accepted value interval (10-15% of the total energy intake) in order to boost the plasmatic proteins; this should be reached out just by increasing the protein-rich foods consumption, mainly of animal origin, without focusing on calculations.

#### **OTHER LIFESTYLE MODIFIABLE FACTORS**

Modifiable lifestyle factors such as diet, alcohol use, smoking and physical activity should not be marginalized in the Covid-19 management [12]. Alcohol use and smoking are evoked above as economic and food insecurity factors as they cause cash wasting, and household financial food inaccessibility. In this section we will have a look at physiological aspects of these factors and how they are linked to Covid-19.

- **Alcohol consumption**

The Multiple Indicator Cluster Survey conducted in DRC [26] showed that 48.6% of women and 53.7% have declared consuming alcoholic drinks. It's known that alcohol consumption weakens the immune system; this affects negatively the ability to cope with infectious diseases, and increases susceptibility to certain diseases; as such, it increases the risk of acute respiratory distress syndrome (ARDS), a very severe complication of COVID-19 [10,27]. Also, exposure to acute or chronic ethanol suppresses innate immunity and increases the risk of mortality in patients with sepsis by decreasing the production of pro-inflammatory cytokines and chemokines [28]. Therefore, it's important that people be informed about this, especially in the DRC context of poverty, where many alcohol drinkers are using cheap local/traditional distilled alcoholic drinks, with very high and uncontrolled degrees of alcohol. Also, people should be careful regarding rumors aiming to promote heavy alcohol consumption as a prevention factor against covid-19 and other viral diseases; the health authorities should give the right information that that there is no type of alcoholic product that helps prevent or treat COVID-19 infection [27]. On a concentration of at least 60% alcohol has a disinfectant effect on the skin, but not when ingested. Moreover, alcohol shouldn't be considered as an important component of the diet, so it's even not listed among the food groups [25]. Some studies have mentioned moderate alcohol consumption to have a beneficial impact on the immune system compared to alcohol abuse or abstinence [29], however the best drink remains water, provided that it's potable. Therefore we should advise people who have not started drinking not to start, and those who have started, to drink with moderation, i.e. two standard measures/day

and a max. of 10 standard glasses/week for women, and 3 standard measures/day and an max of 15 standard glasses/week for men; also, not to drink every day and avoid to increase one's alcohol consumption to the higher limit [21].

- Smoking

In DRC, although smoking is not common in women (5.7%), approx. 33% of men smoke cigarette or other types of tobacco [26]. The population should be informed that active smoking is significantly associated with the risk of severe COVID-19, as smokers are more vulnerable to lung infection [11] and it's most likely associated with the negative progression and adverse outcomes of COVID-19 [30]. Smoking increases the individual requirements in vitamin C by 30% while decreasing its absorption, which usually leads to common C deficiency in smokers. In another hand, it's known that Vitamin C is a strong antioxidant and that its deficiency impairs immunity and augments susceptibility to infections; the latter impact negatively vitamin C levels through enhanced inflammation and metabolic requirements [31]. Therefore, prophylactic prevention of infection requires daily and sufficient dietary vitamin C intakes; according to Carr and Maghini [31], supplementation with vitamin C may help to prevent and even treat respiratory and systemic infections. Vitamin C food sources are mainly fruits (orange, lemon, guayava...) and vegetables [25]; these foods should be consumed on a regular basis during this covid-19 epidemic, for the sake of prevention. Fruits and vegetables are also good sources of vitamin A. The latter decreases in the body due to smoking [32], and its deficiency is related to respiratory impairment, including airway hyperactivity or spasms, and to a decrease in alveoli and alveolar duct density. Damage to the alveoli affects oxygen absorption from the lungs into the body and the release of carbon dioxide from the body, which affects a smoker's ability to breathe.

The role of Vitamin D has also been evocated as being important for reducing Covid-19 infection along with influenza, but randomized and population studies are still needed for validation [12]. Anyway, since DRC has tropical and equatorial climates, we think that the regular insolation countrywide would protect from eventual vitamin D deficiency and then contribute to Covid-19 infection prevention. However, during the confinement period, exposition to solar UV rays might be reduce as people mostly stay inside their houses, so health authorities should be vigilant and exhort spend some time out of their houses everyday but wearing their masks and without breaking the confinement rules.

- Physical activity

It's generally known that physical activity strongly contribute to fighting obesity as it leads to energy expenditure attributed to skeletal muscle contractions [25]; obesity is already incriminated as an aggravating factor of the Covid-19 disease [12]. In another hand, there is a positive association between the change in serum vitamin D (25 (OH) D) and physical activity [33]; physical exercise is a pathway for increasing vitamin D status, especially if performed outdoors, which promotes vitamin D synthesis through the interaction between ultraviolet radiation and 7-dehydrocholesterol in the skin [12,34]. However, indoor physical activity may also improve vitamin D status via other biological mechanisms beyond 7-dehydrocholesterol, independent of sun exposure [33], which means that physical activity should be performed whenever and wherever possible. While controlling infection not to not spread out widely, people should limit attitudes that lead to inactivity, which would contribute to anxiety and depression, which in turn may lead to a sedentary lifestyle; as a result, the latter would lead to missing the advantages of physical exercise in terms of strengthening immunity, fighting obesity and increasing vitamin D status, as evoked above, three factors that may empower humans against the coronavirus-19 infection. So the health authorities should encourage the populations to exercise, despite the confinement, at least 30 minutes of moderate activity per day, every day.

#### **ROLE OF CHRONIC DISEASES AND CO-INFECTIONS**

Chronic diseases, such as obesity, heart disease, diabetes, stroke, hypertension, and kidney disease etc. are important underlying factors of Covid-19infection and disease [35]. Indeed, people living with chronic pain have the largest global morbidity, so it's important that they are treated correctly because they are more likely to be very ill or die. COVID-19 disease will have substantial consequences for people with chronic pain, especially in case of under-treatment or disrupted treatment [36]. Therefore, DRC leaders of public health and health care systems should promote therapeutic education, aiming to give the patients more autonomy for a better management of their chronic disease [37]. This should include both how to take medications and, with special mark, the role of diet, the latter being neglected or given less importance by many care providers in the DRC context. For dietetic treatment of almost all the chronic diseases, there are physiologic and metabolic principles that should be respected and individualized protocols to be followed in order to maximize the health results on the patients. The health authorities should make sure that the chronic disease's patients are informed and become autonomous in the

treatment; this would help those patients to protect their immune function, so to minimize the risk of contracting covid-19, or maximize the chance to survive in case of Covid-infection.

Co-infections are another important factor to be given attention in Covid-19 prevention. According to Zhou et al [2]. in the current coronavirus disease 2019 (COVID-19) pandemic, 50% of patients with COVID-19 who have died had secondary bacterial infections; for Chen et al [19]. both bacterial and fungal co-infections were incriminated.

Respiratory viral infections predispose patients to co-infections and these lead to increased disease severity and mortality, so they have to be identified and treated [38]. Nutrition wise, such infections increase the needs in proteins by decreasing plasmatic nutrition proteins, especially albumin. As mentioned above, a healthy diet rich in protein-source foods, would guarantee a good immunity level, which in turn will allow people to fight infections [25] and get ready for covid-19.

## **CONCLUSION ET RECOMMANDATIONS**

As shown from this analysis there is, in DRC, a risk of covid-19 massive expansion over the country after the confinement measures will be over. It's the responsibility of the leaders of public health and health care system and their partners such as NGO's and UN agencies involved in health and nutrition to empower the populations against Covid-19 infection through a comprehensive approach consisting of sensitization at all levels, not only about social distancing and washing hands as it's being the case, but also and of utmost importance, about nutrition behaviors, taking in account region-specific issues. The nutrition contribution should include other lifestyle aspects such as alcohol use, active smoking and physical activity since they affect immunity. People with chronic diseases or co-infections should be given particular attention as they are already weakened and therefore at higher risk of contracting the Covid-19 disease.

Therefore, the task force for fighting covid-19 at all decision levels in DRC should include nutrition specialists and researchers for more comprehensive approaches against covid-19, to the ultimate interest of the population.

## **AUTHORS CONTRIBUTIONS**

Pr. Victor Buhendwa Mirindi designed the study and wrote the initial draft as submitted to co-authors. The latter revised the paper.

## **COMPETING INTERESTS**

Authors declared they have no conflicts of interest.

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