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Nutraceuticals-COVID-19 Paradox and Ethiopians Experiences: KMU in Focus

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Abstract

There are neither clinically approved vaccines nor specific therapeutic drugsavailable for COVID-19. Ethiopians are hereby sharing the world community that nutraceuticals could combat risks associated with RNA viruses despite paradoxical reports. The researchers conducted a questionnaire survey in Kotebe Metropolitan University (KMU). The key informants' interview was carried out to strengthen the survey approach. The majorities 80% of the respondents' claimed nutraceuticals could combat or inhibit COVID-19 infections or reduce associated risks. The use of garlic, ginger, honey, eucalyptus, vitamins, turmeric, ruta, moringa and licorice significantly increased after the outbreak of the pandemic than before ($p<0.05$). The majorities (79%) are accustomed to such practices through family tradition and experienced it *via* experts of traditional medicines. In this regard, 85% of them strongly agree that nutraceuticals are promising candidate for COVID-19 drugs or vaccine discoveries. In addition, the key informants said COVID-19 patients could attempt any of the following four alternatives whose procedures are disclosed in this manuscript ingest garlic-honey mix followed by inhalation of eucalyptus essential oil in steamed water ingest garlic-ginger-honey mix followed by inhalation of eucalyptus-lemon-ruta mixture in steamed water ingest garlic-honey mixtures followed by inhalation of eucalyptus-garlic-ginger mix in water ingest *Moringa oliefera* cooked in mixture with onion, garlic and olive oil (Ethiopian dish cooking style) followed by inhalation of eucalyptus-garlic-salt mix in steamed water. Although the scope of the study is KMU, the majorities of Ethiopians (be it urban or rural or illiterate or literate) are using nutraceuticals not only for common cold or influenza but also to reduce the infection risks of COVID-19 as has been found in this study and contextualized with the literature.

Keywords: Nutraceuticals; Coronavirus; COVID-19; Ingestion; Inhalation; Tradition

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Introduction

Coronavirus (CoV) is enveloped, positive-sense single-stranded RNA (ssRNA) virus belonging to the *Coronaviridae* family. In humans, it mainly causes common cold, but complications including pneumonia and SARS can occur [1]. The known Human CoV (HCoV) includes HCoV-229E, OC43, NL63, HKU1 [2]. As of August 18, 2020, COVID-19 global confirmed cases were more than 2,17,56,357 and confirmed deaths were more than 7,71,635 [2].

There are neither clinically approved vaccines nor specific therapeutic drugs available for COVID-19. Anti-viral drugs are currently available for the treatment of influenza and other virus, but the emergence of resistant viral strains may eventually limit their efficacy [3,4]. Vaccination is the most effective strategy for viruses prevention, but timely vaccine development remains challenging, due to the difficulty of predicting the exact viral strain that could emerge to cause the next seasonal outbreak [3-5]. This emphasizes the urgency for treatment options, which can be both safe and effective.

It appears that certain nutraceuticals may provide relief in clinical symptoms to patients infected with encapsulated RNA viruses such as influenza and coronavirus [5,6]. In general, Eucalyptol from eucalyptus essential oil [7], Gingerol [8, 9], Vitamins [10, 11], Phycocynobilin [5], *Artemisia annua* [12,13], Moringa quercetin [14], Licorice *Glycyrriza glabra* [15] and Curcumin [16] are documented to inhibit COVID-19 or reduce associated risks *via* boosting immunity, preventing viral penetration or deactivation .

Furthermore, eucalyptus, garlic, ginger, moringa, turmeric, *Artemisia annua*, licorice and cinnamon are reported to have medicinal values in Ethiopia [17]. Ethiopians are using garlic for different medicinal values such as for common cold, malaria, cough, pulmonary TB, hypertension, wounds, STDs, asthma, parasitic infections, toothache, diabetes and hemorrhoids[17]. Ginger and Rue are also used for stomachache, cough, fever and influenza treatment in Ethiopia [17]. Besides, a survey conducted on household respondents (N=600) in Addis Ababa documented that the residents are consuming garlic (46.5%) ginger (41.7%), citrus fruits (19.5%) and honey (1%) to reduce the infection risk of COVID-19 [18].

A few authors still said the use of herbal drugs to treat COVID-19 should be with caution [19]. Some of the claims are convincing. It is important that the dose, safety and interactions of the herbal medicine should be evaluated and the active pharmaceutical ingredients should be isolated and characterized. However, few researchers are on the contrary to the contemporary published articles. Nutraceuticals are reported to have anticoronaviral activity, but few claim that it is not proven to prevent or cure COVID-19 [20]. Despite the paradox, Ethiopians lifelong use of nutraceuticals as antiviral activity would witness the world scientific community that nutraceuticals are promising candidate for reducing COVID-19 infections and associated risks. Consequently, this report describes the results from a semi-structured questionnaire circulated among Kotebe Metropolitan University staffs for identifying nutraceuticals used for reducing, combating or inhibiting COVID-19 risks. The key informants' interview was carried out to strengthen the survey approach.

Method

A semi-structured questionnaire was circulated among Kotebe Metropolitan University staffs for identifying nutraceuticals used for reducing, combating or inhibiting COVID-19 infections. A simple random sampling technique was used to collect data. There were 1200 staff members in KMU during the study period. Since there was not related research in KMU, to get most favourable sample size, calculation was performed using the assumption of proportion (p) of 50%, with 95% CI and 5% tolerable error employing the formula described by Daniel [21].

$$n = \left[\frac{N \times Z \times Z \times P(1-P)}{d \times d\,(N-1) + Z \times Z \times \mathrm{P}(1-P)} \right]$$

Where, n=sample size with finite population correction, N=population size, Z=statistic for a level of confidence, p=expected proportion (in proportion of one) and d=precision (in proportion of one).

$$n = \frac{Z^2 \frac{\alpha}{2} p(p-1)}{d^2}$$

$$n = \left[\frac{1.96 \times 1.96 \times 05 \times 05}{0.05 \times 0.05} \right] = 384.16$$

Since the number of staffs in KMU is less than 10,000 correction formula was employed.

$$nf = \left[\frac{384.16}{1 + \frac{384.16}{1200}} \right] = 291$$

Hence, the minimum sufficient computed sample size was 320 including 10% non-response rate. Data analysis was carried out using excel and SPSS version 20. p-value less than 0.05 were assumed as significant.

Results

Respondent's characteristics

Both male (47%) and female (53%) respondents were addressed through the questionnaires. The age ranges of the respondents were from 18-46 years. This shows that young and adult age groups were included in this assessment. The educational qualification of the respondents' range from primary education to PhD holders. The respondents' occupation and responsibilities are diverse. The responsibilities of the respondents include directors, coordinators, researchers, instructors, department heads, supportive and administrative staffs. The study includes professionals from different disciplines and area of specialties such as Chemistry, Biology, Physics, Maths, Environmental, Computer, Accounting, Linguistics, Urban Management, Nutrition, Accounting, Management, History and Engineering. All marital status groups single, married and divorced were included in this study. The income levels of the interviewer were from 1000-15,396 Birr (Mean income=5926 ETB). In this regard, low, medium and high income levels were incorporated. The household sizes of the respondents were from 1-7.

Covid-19 drugs or vaccines

The majorities of the respondents (88%), at the time of data collection, replied that there were neither drugs nor vaccines for the treatment of COVID-19. This is in agreement with Li et al. [22], findings who reported that there were neither clinically approved vaccines nor specific therapeutic drugs available for COVID-19.

Use of Covid-19 preventive techniques

The majorities (77%) of the respondents claimed to use the three WHO recommended preventive techniques of COVID-19 such as using facemask, physical distancing and frequent hand washing or sanitization. Only 23% replied staying at home. The lesser in the number of respondents recommending home stay is associated with the in-come levels of the respondents. Only medium and high income ones recommended home stay because the low income ones cannot afford for basic necessities if they do not work every working days.

Nutraceuticals combat Covid-19

The majorities (80%) of the respondents' claimed nutraceuticals could combat or inhibit COVID-19 infections or reduce the risks. The percentages of nutraceuticals used and route of consumption are as detailed in **Table 1**. The respondents said they frequently ingest garlic, honey and ginger alone or in mixtures (1-7 days/ week). The use of garlic, ginger, honey, eucalyptus, vitamins, turmeric, ruta, moringa and licorice significantly increased after the outbreak of the pandemic than before ($p<0.05$). Ethiopians used garlic for different medicinal values such as for common cold, cough, asthma as have been documented by Gall et al. [17]. Ginger and Ruta are also used for stomachache, cough, fever and influenza treatments in Ethiopia [17]. A survey conducted on household respondents (N=600) in Addis Ababa witnessed that the residents are consuming garlic (46.5%), ginger (41.7%), citrus fruits (19.5%) and honey (1%) to reduce the infection risk of COVID-19 [18]. The implication is that Ethiopians use garlic, ginger, eucalyptus, vitamins and honey not only for common cold and influenza but also to reduce coronavirus infections and associated risks. They majorities of the (79%) are traditionally accustomed to such practices through family tradition and experienced it *via* experts of traditional medicines **Figure 1**.

Consequently, the key informants recommended COVID-19 patients could attempt any of the following four alternatives.

Alternative-1: "Frequent garlic-honey mixture consumption was recommended as the best preventive technique to any viruses infections the key informant added. One of the traditional medicine experts detailed if COVID-19 patients ingest garlic-honey mixtures and inhale eucalyptus-lemon-salt mixtures in steamed water, after balanced meals, they can recover from COVID-19 infections.'' The key informant detailed the procedure as follows.

Add two beans of minced garlic. Then, add 2 teaspoons chopped fresh honey. Next, drop two teaspoons lemon juice. Thereafter, thoroughly mix. Then, enjoy it after eating balanced meals every night. The ingestion should be followed by inhalation of eucalyptus-lemon-salt mixtures in steamed water every night during sleeping time. Then, avoid stress and have a good sleep covering your face inducing sweating. This should be repeated every night for one week.

The key informant strongly agree that ingestion of garlic-honey mixtures followed by steam inhalation of eucalyptus-lemon-salt mixture in steamed water could inhibit or reduce COVID-19 infections or associated risks **Table 2**. This is expected to combat cough, shortness of breath and pneumonia **Table 3**. This finding is in agreement with Boone et al. [23] report.

Alternative-2: Another key informant said "I traditionally know my families use eucalyptus, garlic, ginger, ruta and honey for common cold. And, now they are using them as immunity boosting to prevent coronavirus infections and associated risks, too. They ingest garlic-ginger-honey; inhale eucalyptus-lemon-ruta mixture in steamed water. I am also using them adopting as family traditions" **Table 2.**

Alternative 3: Another key informant of age 87 said "For cold or influenza related coughs, garlic-honey mixtures are recommended one time/day for one week after balanced diet, followed by inhalation of eucalyptus-garlic-ginger mix in steamed water every night during sleeping time. This can help recover from COVID-19 infections'' **Table 2**.

Alternative 4: "Ingestion of *Moringa oliefera* cooked in mixture with onion, garlic and olive oil (following Ethiopian dish cooking style) can reduce risks associated with COVID-19,an old woman, age 63, disclosed. This can be followed by inhalation of eucalyptus essential oil in steamed water the woman added."

This finding is in line with Boone et al. [23] who reported that herbs added to honey can treat sore throats and coughs. Besides, Boone et al. [23] documented that a mixture of 1 teaspoon of honey with 1 teaspoon of dried orange peel and ginger can boost innate immunity to reduce infection hazards associated with CoV. Furthermore, it was documented that respiratory symptoms associated with coronavirus can be treated naturally, using traditional Chinese medicine or herbal Boone et al. [23]. For serious symptoms like pneumonia, herbs can be used in the early stages of infection to attempt to prevent pneumonia from

Table 1: Dose of nutraceuticals used before and after the pandemic outbreaks.

Nutraceuticals	Before COVID-19	After COVID-19	p-value	Administration routes
Garlic	58%	80%	$p<0.05$	Ingestion/inhalation
Ginger	50%	71%	$p<0.05$	Ingestion/inhalation
Turmeric	25%	53%	$p<0.05$	Ingestion/inhalation
Eucalyptus	18%	27%	$p<0.05$	Inhalation
Spirulina	6%	7%	$p>0.05$	Ingestion
Honey	48%	71%	$p<0.05$	Ingestion
Moringa	5%	9%	$p<0.05$	Ingestion
Artemisia	9%	10%	$p>0.05$	Inhalation
Licorice	3%	10%	$p<0.05$	Inhalation
Elderberry	2%	3%	$p>0.05$	Ingestion
Vitamins	15%	51%	$p<0.05$	Ingestion/inhalation
Others*	13%	20%	$p<0.05$	Ingestion/inhalation
Others*=Ruta, Green tea, Feto, alcohol (local Areke)				

occurring, or during the later stages of infection to prevent it from progressing Boone et al. [23] reported.

Quercetin (enriched in MO) has been shown to have antiviral effects against both RNA (e.g. Influenza and coronavirus) and DNA viruses (e.g. Herpes virus) [24]. The implication is that the mixtures of phenolic compounds in MO and garlic can reduce COVID-19 risks.

Moreover garlic, eucalyptus and licorice were reported to treat cough, shortness of breath and even pneumonia according to Boone et al. [23]. The procedure is outlined below and is similar to Ethiopian case except the differences in the ingredients used "Bring water to boil, and then place in a large bowl, filling up to 2/3 of the bowl. Add the herbs and oil, which can be subbed with the following: mint, lavender, rosemary. Allow cooling and steep for 7 minutes-10 minutes then lean over the bowl and drape the warm towel in a way to completely cover your head and keep the steam contained. Breathe deeply for 1 minute before resting. Repeat as necessary to provide relief from shortness of breath or cough. Only for breathing, do not drink".

This is supported by contemporary published articles that Eucalyptol [1,8-cineole] from eucalyptus essential oil has been reported as a potential inhibitor of COVID 19 infection [7]. Gingerol has the potential inhibitor effects against COVID-19 Main protease [8, 9]. Vitamins are reported to be effective options for COVID-19 infections prevention [10,11]. Nutraceuticals were reported to have the potential to increase the body's interferon type 1 in the fight against RNA viruses including flu and CoV [5]. *Artemisia Annua* extracts was reported to display anti-SARS-CoV effect from [12,13]. The main flavonoids found in moringa leaves are myrecytin, quercetin and kaempferol [14]. Flavonoids have been reported to show anticoronavirus activity [11,25,26]. Licorice (*Glycyrriza Glabra*) neutralizes the main functional groups (-NH_2 and-COOH) with which CoV encapsulated or enveloped themselves by esterification processes the researchers claimed [15]. Curcumin has the potential for inhibiting encapsulation of the coronavirus and viral protease as well as modulating various cellular signalling pathways [16].

Information access

The respondents said they get information that nutraceuticals could combat COVID-19 infections adopting as family traditions (48%) and experts of traditional medicines (31%) followed by access to social media (27%). Only few respondents get access to information from books, published articles and monographs **Figure 2**. This indicates that the respondents get access to information about the healing potential of nutraceuticals adopting them from their ancestors as family traditions or getting access to them *via* experts of traditional medicines rather than reading contemporary published articles or books.

Mechanisms of action

The mechanisms through which these nutraceuticals could combat or reduce COVID-19 risks are boosting the bodies' innate immunity (53%), inhibition of viral attachment (27%) and viral deactivation (20%) the respondents said. This is in agreement with Mark and James [5], who reported that nutraceuticals have the potential to increase the body's interferon type 1 in the fight against RNA viruses including flu and CoV [5] and that the nutraceuticals can inhibit [8, 9] CoV and deactivate them [15].

In this regard, 71% of the respondents are voluntary to use these nutraceuticals based on scientific evidences to combat COVID-19 risks and 85% of them strongly agree that nutraceuticals are promising candidate for COVID-19 drugs or vaccine discoveries. The respondents forwarded their general

Table 2: Ingestion or inhalation of nutraceuticals for COVID-19 inhibition or prevention.

S.No.	Alternatives	Liker scales		
		Stronglyagree	Agree	Fairlyagree
1	Ingest garlic-honey mixtures	✓		
2	Ingest garlic-ginger-honey mixtures		✓	
3	Steam inhalation of eucalyptus essential oil in steamed water		✓	
4	Steam inhalation of eucalyptus-lemon-ruta mixture in steamed water		✓	
5	Steam inhalation of eucalyptus-garlic-ginger mix in steamed water	✓		
6	Steam inhalation of eucalyptus-lemon-salt mixture in steamed water	✓		
7	*Moringa oliefera* cooked in mixture with onion, garlic and olive oil		✓	

Table 3: Nutraceuticals claimed to combat COVID-19 main symptoms and pneumonia.

S.No.	Herbs	Answers		
		Cough	Shortness of breath	Pneumonia
1	Ingest garlic-honey mixtures	✓	✓	✓
2	Ingest garlic-ginger-honey mixtures	✓	✓	
3	Inhalation of eucalyptus essential oil in steamed water	✓	✓	
4	Inhalation of eucalyptus-lemon-ruta mixture in steamed water	✓	✓	
5	Inhalation of eucalyptus-garlic-ginger mix in steamed water	✓	✓	✓
6	Inhalation of eucalyptus-lemon-salt mixture in steamed water	✓	✓	

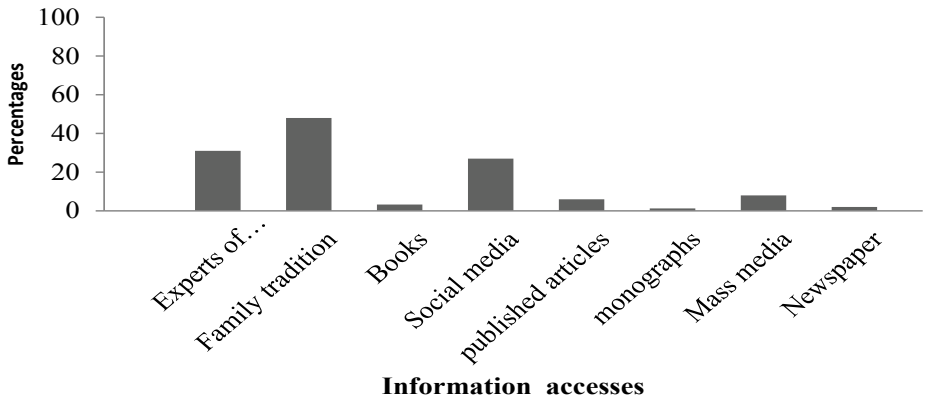

Figure 1 Respondents access to information that nutraceuticals combat COVID-19 infections.

opinion that nutraceuticals should be promoted and research and development should focus on them.

Factors associated with the use of Nutraceuticals

Nutraceuticals use related predictors were tested using multivariable logistic regression for potential association. The high and medium income staffs were more frequently using nutraceuticals (especially garlic, ginger, vitamins and honey) compared with low income ones (AOR: 5.9, 95% CI: (1.8-18.1)). This can be related with the high costs of these nutraceuticals in Ethiopia. The more the number of households (>4) in a family, the less frequently (AOR: 0.4, 95%CI: (0.2-0.6)) they were using nutraceuticals for reducing COVID-19 infections as compared with households with lesser number despite being in the same income category. This might be associated with the per capita income of the households. Staffs who were single were less likely to get these nutraceuticals than those who were married (AOR: 0.3, 95%CI: (0.2-0.9)).

Conclusion

The majorities (80%) of the respondents in Kotebe Metropolitan University (KMU) claimed nutraceuticals could combat, inhibit COVID-19 infections or reduce associated risks. The use of garlic, ginger, honey, eucalyptus, vitamins, turmeric, ruta, moringa and licorice significantly increased after the outbreak of the pandemic than before ($p<0.05$). The majorities (79%) are traditionally accustomed to such practices through family tradition and experienced it via experts of traditional medicines. In this regard, 85% of them strongly agree that nutraceuticals are promising candidate for COVID-19 drugs or vaccine discoveries. Consequently, the traditional medicine experts recommended COVID-19 patients should use the following four protocols whose procedures are disclosed in this manuscript:

- Ingest garlic-honey mix followed by inhalation of eucalyptus essential oil in steamed water
- Ingest garlic-ginger-honey mix followed by inhalation of eucalyptus-lemon-ruta mixture in steamed water
- Ingest garlic-honey mixtures followed by inhalation of eucalyptus-garlic-ginger mix in steamed water
- Ingest Moringa oliefera cooked in mixture with onion, garlic and olive oil (Ethiopian dish cooking style) followed by inhalation of eucalyptus-garlic-salt mix in steamed water

Although the scope of the study is KMU, the majorities of Ethiopians (rural or urban, literate or illiterate) are using nutraceuticals not only for common cold or influenza but also to reduce the infection risks of COVID-19 as has been detailed in literature reviews of this manuscript.

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