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ASSESSING FOOD INSECURITY AMONG FAMILIES DURING THE COVID-19 PANDEMIC IN THE OFORIKROM MUNICIPALITY, ASHANTI REGION OF GHANA

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ABSTRACT

The COVID-19 pandemic has intensified food insecurity globally, and if this trend continues unchecked, the Sustainable Development Goals (SDG) 2 with a focus on the zero-hunger target by 2030 will likely be affected. This study aimed to compare food insecurity among two communities (Ayeduase and Kotei), family types and gender during the COVID-19 pandemic at the Oforikrom Municipality of the Ashanti Region of Ghana. A longitudinal study was conducted at baseline and end-line among 160 respondents. A semi-structured questionnaire and a 2-stage sampling technique were employed in collecting data in December 2020 for baseline and June 2021 for end-line. The overall prevalence of food insecurity was 49.4%, 29.4% and 21.2% for mild, moderate and severe food insecurity respectively at baseline. At end-line, moderate and severe food insecurity decreased (13.1% and 10%) respectively among the respondents. Severe food insecurity was higher among respondents in Kotei (22%) than in Ayeduase (20%) at baseline. However, at end-line severe food insecurity among respondents in Ayeduase was higher (11.2%) than Kotei (8.7%). There was a significant association between food insecurity and no formal education at baseline and end-line (p= 0.005 and p= 0.003 respectively), and easy access to water at baseline and end-line (p= 0.015 and p= 0.045 respectively), whiles at end-line, there was a significant associated between food insecurity and extended families (p= 0.022). As income levels increased, food insecurity rate reduced. Relief support plans and policies for families during pandemics should be focused on the implementation of sustainable food security strategies to prevent hunger and malnutrition.

Keywords: COVID-19, food Insecurity, micronutrient deficiency, nutritional status, Ghana

INTRODUCTION

One of the most challenging infectious diseases that has challenged international leaders in recent times is the COVID-19 pandemic (Bukari *et al*., 2021). The severe acute respiratory syndrome (SARS-CoV-2) causes coronavirus or COVID-19, an infectious disease (Zhou *et al*., 2020). COVID-19 presented itself as severe pneumonia with an unknown cause and began to spread from one country to another, city-to-city, and town-to-town for which it was then termed as a pandemic by World Health Organization (WHO) in March 2020 (Grant *et al*., 2020).

Food insecurity is the inability for people to access adequate amount of quality and nutritious foods for a healthy growth and development (UNICEF& WHO, 2017). Food insecurity issues mostly arise because of sharp declines in food production, and could also be a result of a pandemic (Laborde *et al*., 2020). However, for an individual or a population to be food secured, there must be nutritional adequacy, which means any individual who is malnourished or is deficient of micronutrients can be considered as being food insecure (Ivers & Cullen, 2011).

Food insecurity can cause long-term effects such as stunting and chronic micronutrient deficiencies (Das, Hossain & Nesa, 2009). However, billions of people are food insecure because of the disruptions caused by the COVID-19 (Zurayk, 2020). Globally, the coronavirus has threatened the food security of many people (Laborde, Martin, Swinnen, & Vos, 2020). For many families in Ghana, household income and consumption of food were reduced because of the COVID-19 pandemic (Owusu & Frimpong-Manso, 2020).

Despite significant global actions against food insecurity, it continues to remain an enduring problem affecting human societies and making it difficult to achieve SDG 2, which focuses on lessening hunger, attaining food security, improving nutrition, and promoting sustainable agriculture. Thus, this study aimed at assessing food insecurity among families during the COVID-19 pandemic.

MATERIALS AND METHODS

Design and Sample

This study was conducted in two communities (Kotei and Ayeduase) within the Oforikrom Municipality of the Kumasi metropolis. A longitudinal research approach was used in which data was collected at the baseline and end-line (6 months later). Using 10% prevalence of food insecurity in the Ashanti Region (Darfour & Rosentrater, 2016); the sample size was estimated as; z = 1.96, p = 0.092, q = 0.908 and d = 0.05 at a 95% confidence interval

$$n = \frac{1.96^2 \times (0.10)(0.99)}{0.05^2}$$

n= 152

The sample size was adjusted upwards by 5% (7.6) to cater for non-response during data collection. Therefore, the minimum sample size for the study was estimated as 160.

Ethical approval for this study was obtained from the Committee on Human Research, Publication and Ethics (CHRPE) of the School of Medical Science (SMS), Kwame Nkrumah University of Science and Technology Kumasi to undertake the study (CHRPE/AP/507/20). Permission was also obtained from the communities selected for the study within the Kumasi metropolis from the Oforikrom Municipal Assembly. Consent forms were administered in English and later translated into the "Ashanti Twi" language for easier understanding. Families within the ages of 18-50 years who had stayed in the community for one year and more were included in the

study while individuals above the age range 50 who had not stayed for at least one year in the community were excluded from the study. Food insecurity was assessed with the FIES (food insecurity experience scale) which is an eight (8)-item questionnaire with dichotomous responses of 'yes' or 'no' (Cafiero, Viviani & Nord, 2018). Food insecurity was assessed using raw scores for which raw scores below 4 were termed mild food insecure, raw score between 4-6 was termed moderately food insecure, and a raw score 7 to 8 and termed severe food insecure (Reagan, 2018). Body Mass Index (BMI) of participants were also computed by the formular weight (kg)/ height (m^2) and used as an indicator for malnutrition according to BMI categories underweight (<18.5) normal (18.5-24.9) overweight (25-29.9) and obese (≥30) (World Health Organization ,1995). Respondents were also asked if they had easy access to water by answering "yes" or "no".

Data Collection

Data collection started in December 2020 for the baseline and six (6) months later, the end-line data was collected in June 2021. Purposive sampling was used to select the two (2 communities (Ayeduase and Kotei) within the Oforikrom Municipality in Kumasi. These areas were chosen because they are made up of heterogeneous populations and there has been limited research done in these areas with regards to food insecurity and malnutrition. The common language spoken in both communities is the 'Ashanti Twi', and the most common business in the two communities is the fast-food business. Respondents who were recruited at baseline were the same respondents who were followed up at the end-line (6th-month). Study respondents were recruited through house-to-house visits in the study areas. In each house one (1) individual within the inclusion criteria was selected. If a house had more than one individual in a household within the inclusion criteria, simple balloting was used to select one person from each household to be part of the study. If a house had just one person in the desired age-group, he/she was automatically recruited.

Data Processing and analysis

Data was entered into Microsoft excel 2007 and the analysis was done using STATA version 16. Categorical data such as gender, occupation, and marital status were presented as frequencies and percentages while continuous data such as age was presented as mean and standard deviation. The overall prevalence of food insecurity was obtained for baseline data and end-line data using the FIES (food insecurity experience scale) which is an eight (8)-item questionnaire with dichotomous responses of yes or no (Cafiero, Viviani & Nord, 2018). The Rasch model procedures were used to generate item parameters and respondent parameters (Engelhard, 2013). Each respondent was scored according to the question items and scored based on the raw score.

The Body Mass Index (BMI) of all respondents were calculated using WHO standards and formula weight (kg)/height(m^2) (WHO, 1995). A Chi square test was done to determine the association between food insecurity and gender, location and family type. To further test the strength of associations, linear regression analysis was performed for differences that were significant in the Chi square analysis. A p-value < 0.05 was considered statistically significant.

RESULTS

Characteristics of respondents

Table 1 summarizes the background characteristics of respondents. A total of 160 respondents, (80 from Ayeduase and 80 from Kotei) communities were interviewed. The

mean age for respondents in Ayeduase was 23.38 ± 10.91 while Kotei was 31.4 ± 9.9. The overall mean age for the respondents was 37.7 ± 11.3 (Table 1).

Table 1: Sociodemographic characteristics of respondents

Characteristics	Ayeduase n [80] n (%)	Kotei n [80] n (%)	Total N= [160] N (%)
Age group (in years)			
18-29	18 (22.5%)	41 (51.3%)	59 (36.9%)
30-39	12 (15.0%)	21 (26.2%)	33 (20.6%)
40-50	50 (62.5%)	18 (22.5%)	68 (42.5%)
Mean (SD)	**23.38 (±10.91)**	**31.35 (±9.96)**	**37.67 (±11.34)**
Sex			
Female	40 (50.0%)	40 (40.0%)	80 (50.0%)
Male	40 (50.0)	40 (50.0%)	80 (50.0%)
Ethnicity			
Akan	49 (61.3%)	62 (77.5%)	111 (69.4%)
Ewe	5 (6.2%)	2 (2.5%)	7 (4.4%)
Others	26 (32.5%)	16 (20.0%)	42 (26.3%)
Religion			
Christianity	77 (96.3%)	74 (92.5%)	151 (94.4%)
Muslims	3 (3.7%)	6 (7.5%)	9 (5.6%)
Have children			
No	15 (18.7%)	40 (50.0%)	55 (34.4%)
Yes	65 (81.3%)	40 (50.0%)	105 (65.6%)
Level of education completed			
JHS	22 (27.5%)	23 (28.8%)	45 (28.1%)
No formal education	16 (20.0%)	4 (5.0%)	20 (12.5%)
Primary	7 (8.8%)	11 (13.7%)	18 (11.2%)
SHS	20 (25.0%)	24 (30.0%)	44 (27.5%)
Tertiary	15 (18.8%)	18 (22.5%)	33 (20.6%)
Current occupation			
Government employed	10 (12.5%)	8 (10.0%)	18 (11.2%)
Self-employed	35 (43.7%)	32 (40.0%)	67 (41.9%)
Trading	15 (18.7%)	8 (10.0%)	23 (14.4%)

Student	0 (0.0%)	16 (20.0%)	16 (10.0%)
Unemployed	20 (25.0%)	16 (20.0%)	36 (22.5%)
Access to water			
Yes	53 (66.3%)	37 (46.3%)	90 (56.3%)
No	27 (33.8%)	43 (53.8%)	70 (43.8%)

*JHS (Junior High School) *SHS (Senior High School)

Prevalence of food insecurity during the COVID-19 pandemic at baseline and end-line

As depicted in Figure 1, the prevalence of food insecurity was 49.4%, 29.4%, and 21.2% for mild, moderate, and severe food insecurity at baseline. However, at the end-line, which was 6 months later during the coronavirus pandemic in Ghana, food insecurity prevalence had reduced with only 10% of the respondents having severe food insecurity, 13.1% being moderately food insecure, while more than three quarters of the respondents (76.9%) were mildly food insecure (Figure 1).

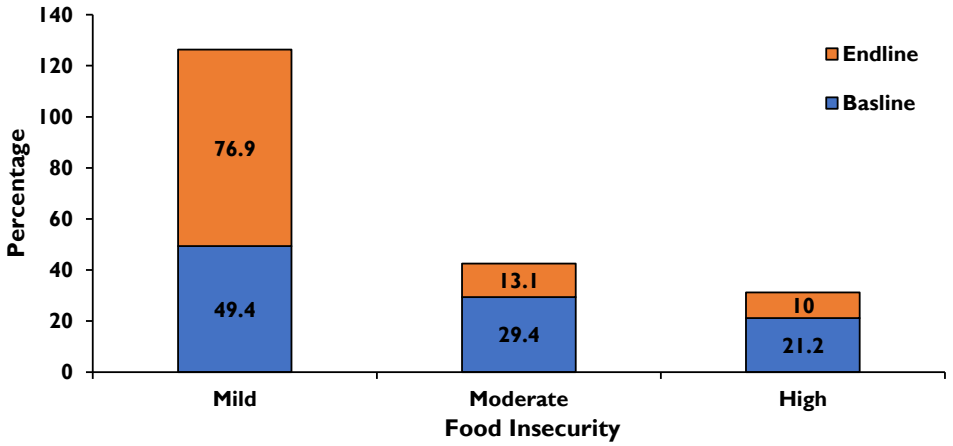

Figure 1: Prevalence of food insecurity at baseline and end-line

Baseline and end-line prevalence of food insecurity between gender, family and location

As shown in Table 2, the results revealed that women were the most affected with severe food insecurity both at baseline and end-line compared to men. For women in this study, severe food insecurity was 26.3% and 16.3% in men at baseline. There was a significant variation between the prevalence of food insecurity at baseline and end-line and gender ($p < 0.001$). Among the two (2) different locations that were used in this study (Ayeduase and Kotei), severe food insecurity was higher among respondents in Kotei at a baseline with 22%, but at the end-line, severe food insecurity was higher in Ayeduase (11.2%) (Table 2).

Table 2: Prevalence of food insecurity with gender, family, and location at baseline and end-line baseline

		Baseline N = [80]			End-line N = [80]		
		Mild	**Moderate**	**Severe**	**Mild**	**Moderate**	**Severe**
Gender	Male	57.5%	26.2%	16.3%	81.2%	10.0%	8.3%
	Female	41.2%	32.5%	26.3%	72.5%	16.3%	11.2%
	p-value	**<0.001**					
Family	Extended	51.3%	31.2%	17.5%	73.7%	15.0%	11.3%
	Nuclear	47.5%	27.5%	25.0%	80.0%	11.3%	8.7%
	p-value	**<0.001**					
Location	Ayeduase	56.3%	23.7%	20.0%	76.2%	12.5%	11.2%
	Kotei	42.5%	35.0%	22.0%	77.5%	13.8%	8.7%
	p-value	<0.001					

Prevalence of food insecurity domains during COVID-19

As depicted in Table 3, the various food insecurity domains shows that lack of money also lead to the prevalence of food insecurity during the COVID-19 pandemic. (Table 3).

Table 3: The 8 FIES (Food insecurity experience scale) domains used during the COVID-19 pandemic

SN	Food insecurity indicators	Baseline N = [160]	End-line N = [160]	p-value
1.	Were you ever worried you would run out of food because of a lack of money or other resources?	96 (60.0%)	31 (19.4%)	<0.001
2.	Were you ever unable to eat healthy and nutritious food because of a lack of money or other resources?	71 (44.4%)	40 (25.0%)	<0.001
3.	Did you have to only eat few kinds of foods because of a lack of money or other resources?	77 (48.1%)	39 (24.4%)	0.001
4.	You had to skip a meal because there was not enough money or other resources to get food?	80 (50.0%)	65 (40.6%)	0.116
5.	Did you eat less than you thought you should because of a lack of money or other resources?	76 (47.5%)	68 (42.5%)	0.432
6.	Your family ran out of food because of a lack of money or other resources?	59 (36.9%)	52 (32.5%)	0.481
7.	Were you hungry but did not eat because there was not enough money or other resources for food?	54 (33.8)	30 (18.7%)	0.003
8	Did you ever go the whole day without taking in food because there was not enough money or resources?	103 (35.6)	24 (15.0%)	<0.001

Nutritional status among gender

Figure 2 depicts the prevalence of malnutrition during the COVID-19 pandemic at baseline and end-line by gender. Out of 160 respondents, the men who had a normal BMI at baseline were 37.5 %, those who were overweight or obese were 57.5 % while only 5 % were underweight. However, at baseline, the women who had a normal BMI were 32.5 % while those who were overweight or obese were 67.5% with underweight being 10%. At the end line, the percentage of men with a normal BMI reduced to 35% while overweight/obese increased to 62.5% with underweight also reducing to half of the baseline value (2.5%). The end-line results for the women showed a reduction in women who had a normal BMI to 27.5 % compared to the baseline data (32.5%). However, women who were overweight/obese increased to 67.5 % while underweight reduced to 5% compared to that of the baseline data (Figure 2).

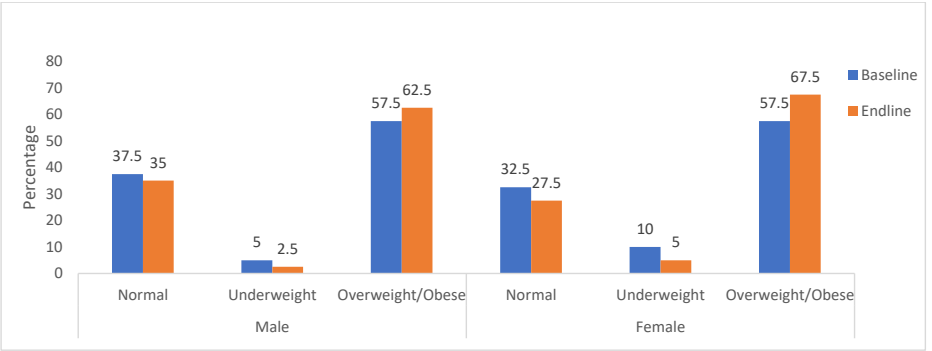

Figure 2 Nutritional status at baseline and end-line by gender

Factors associated with food insecurity at baseline and end-line

Table 4 shows the factors associated with food insecurity and the perceived impact of food insecurity at baseline and end-line. As the age of the respondents increased, food insecurity levels reduced at baseline. There was a negative correlation between respondents aged 30-39 years (B= -0.14, 95% CI: -1.48, 1.21). Also, having children increased the chances of food insecurity at both baseline and end-line. The results revealed that those who had children were likely to be severely food insecure (B= 0.17, 95% CI: -0.57, 0.11). The educational status of respondents also revealed those with no formal education was food insecure (B= -2.39, 95% CI: -0.04, -0.74) only at baseline. Meanwhile, there was a significant association between respondents without formal education and food insecurity at both baseline (p= 0.005) and end-line (p= 0.003). Respondents who have had some levels of tertiary education were negatively correlated with being food insecure (B= -2.26, 95% CI: -3.67, -0.86) at baseline when the initial data was collected. There was a positive correlation between respondents who believed COVID-19 existed and food insecurity (B= 0.12, 95% CI: -0.94, 1.19) at baseline and (B= 0.29, 95% CI: 0.05, 0.54) at end-line. Thus, the results revealed a significant association (p= 0.016) between those who believed COVID-19 existed and food insecurity. Furthermore, respondents who took supplements to protect themselves against the COVID-19 pandemic had a reduced risk of higher food insecurity (B= 0.-0.07, 95% CI: -0.61, 1.26) at baseline than at (B= 0.01, 95% CI: -0.18, 0.22) at end-line (Table 4).

Impact of COVID-19 on food insecurity at baseline and end-line during the COVID-19 pandemic

Respondents revealed they became more food insecure because COVID-19 affected their standard of living. Respondents who reported having easy access to safe water had a reduced chance of being food insecure at baseline (B= -0.27, 95% CI: -0.48, -0.05) and (B= -0.22, 95% CI: -0.43, -0.01) at end-line. However, at both baseline and end-line, easy access to water was significantly associated with food insecurity. Thus, significant differences occurred at baseline (p= 0.015) and end-line (p= 0.045). A negative correlation existed between respondents who earned GH₵ 100-499, GH₵ 500-999 and above GH₵ 1000 with (B= -1.96, 95% CI: -4.43, 0.50), (B= -2.52, 95% CI: -5.23, 0.19) and (B= -2.37, 95% CI: -5.09, 0.35) at baseline respectively. There was a significant association at baseline between respondents who earned GH₵ 100-499 (p= 0.029), GH₵ 500-999 (p= 0.002) and above

GH₵ 1000 (p= 0.022), and food insecurity. At the end-line, there was also a negative correlation between food insecurity and monthly salary. There was a significant association between those who sometimes could not eat balanced meals at baseline and end-line during the COVID-19 pandemic (p= 0.002) and (p= 0.038) respectively (Table 5).

DISCUSSION

The prevalence of food insecurity during COVID-19 at baseline and end-line between families

The prevalence of food insecurity was 49.4%, 29.4%, and 21.2% for mild, moderate, and severe food insecurity respectively at baseline during the surge of the deadly coronavirus in 2020 in the two communities studied. However, at the end-line, which was 6months after the baseline data was collected in 2021, food insecurity prevalence was low with only 10% of the respondents being severely food insecure, 13.1% being moderately food insecure while more than three-quarters of the respondents (76.9%) were mildly food insecure. The findings of this study stipulate that, at the end-line, the prevalence of food insecurity was reduced. The reason for this result could be because, the coronavirus crisis improved at the end-line resulting in a decline in the prevalence of food insecurity. The results of this study are in line with another study by Raifman *et al*. (2020). In their longitudinal study which was conducted every 2 weeks from April 1st to April 28th on food insecurity and unemployment during the COVID-19 pandemic, they found out that food insecurity among families was 31% in the first wave of their data collection.

Table 4: Factors associated with food insecurity at baseline and end-line during the COVID-19 pandemic

	Baseline						End-line					
Variables	B	S.E.	Wald	Sig.	95% C.I. for EXP(B)		B	S.E.	Wald	Sig	95% C.I. for EXP(B)	
					Lower	Upper					Lower	Upper
Age group (in years)												
18-29												
30-39	-0.14	0.68	-0.20	0.839	-1.48	1.21	0.24	0.15	0.16	0.874	-0.29	0.32
40-50	-0.67	0.69	-0.96	0.338	-2.04	0.70	0.21	0.18	1.32	0.190	-0.10	0.52
Sex												
Female												
Male	0.14	0.53	0.26	0.797	-0.91	1.19	-0.04	0.12	-0.34	0.733	-0.28	0.19

Family type														
Nuclear family														
Extended family	0.32	0.47	0.69	0.489	-0.61	1.26	-0.10	1.18	0.345	0.022	-0.31	0.11		
Ethnicity														
Akan														
Ewe	-1.07	1.14	-0.94	0.349	-.3.35	1.19	-0.08	-0.34	0.734	0.734	-0.60	0.43		
Others	0.06	0.57	0.10	0.917	-1.06	1.18	0.07	0.53	0.597	0.597	-0.18	0.32		
Religion														
Christianity														
Islam	0.29	1.02	0.03	0.977	-1.99	2.05	0.22	0.23	-1.19	0.333	-0.22	0.68		
Have children														
No														
Yes	0.17	0.19	-1.20	0.441	-0.46	0.11	0.16	0.14	-1.19	0.238	-0.45	0.11		
Level of education completed						Trading			-0.99	1.02	-0.97	0.331	-0.30	1.02
						Student			1.08	1.11	0.97	0.332	1.11	3.28
No level of formal education	-2.39	0.83	-2.87	**0.005**	-0.04	Unemployed			0.98	0.94	1.05	0.298	-0.87	2.28
Primary	-0.02	0.83	0.04	0.972	-1.61	1.68	-0.04	0.19	-0.24	0.813	-4.41	0.32		
SHS	-1.01	0.61	-1.64	0.103	-2.23	0.21	-0.22	0.13	-1.58	0.117	-0.49	0.05		
Tertiary	-2.26	0.71	-3.19	**0.002**	-3.67	-0.86	-0.19	0.16	-1.24	0.218	-0.51	0.11		
Current occupation														
Government employed														
Self-employed	0.67	0.81	0.82	0.415	-0.94	2.27	0.14	0.18	0.79	0.431	-0.22	0.51		

Table: 5 Perceived Impact of COVID-19 on food Security

	Baseline						End-line					
	B	S.E.	Wald	Sig.	95% C.I. for EXP(B)		B	S.E.	Wald	Sig.	95% C.I. for EXP(B)	
Variables					Lower	Upper					Lower	Upper
Average monthly income (GHS)												
<100												
100-499	-1.96	1.25	-1.58	0.117	-4.43	0.50	-0.62	0.28	-2.21	**0.029**	-1.17	-0.64
500-999	-2.52	1.37	-1.84	0.068	-5.23	0.19	-0.55	0.31	-1.79	**0.002**	-1.16	-1.89
>1000	-2.37	1.37	-1.72	0.087	-5.09	0.35	-0.72	0.31	-2.31	**0.022**	-1.33	-0.10
Effect of COVID-19 on standard of living												
No												
Yes	0.22	0.13	1.70	0.091	-0.04	0.48	0.03	0.13	0.24	-808	0.22	0.28
Easy Access to safe water												
No												
Yes	-0.27	0.11	-2.45	**0.015**	-0.48	-0.05	-0.22	0.10	-2.02	**0.045**	-0.43	-0.01
Couldn't eat balanced diet												
Never												
Sometimes	0.38	0.12	3.10	**0.002**	0.13	0.62	0.25	0.12	2.09	**0.038**	0.01	0.49

However, food insecurity levels reduced to 21.9% among families which means, as months went by, the prevalence rate of food insecurity reduced. Some respondents in this study revealed they ate less food owing to lack of money or resources at baseline (47.5%), and 42.5% at the end-line. This clearly shows that food insecurity levels improved along the line from baseline to end-line.

Food insecurity and hunger have many possible adverse health and social effects such as multiple infections, danger of malnutrition, chronic diseases, poor health status, bad mental health state, scuffles in society, increased financial and societal inequalities (Ke & Ford-Jones, 2015). For this reason, timely interventions are required to curtail the impact of COVID-19 on food security to be able to achieve the Sustainable Development Goal (SDG) 2 which sets to eliminate hunger, improve food security and agriculture. The findings of this study are in alignment with another study conducted in March and June 2020 in Brazil, in which 64% of respondents ate less and 39% skipped meals when the food insecurity access scale was used to access the prevalence of food insecurity among individuals among families (Manfrinato *et al*., 2021), hence, as the months went by, the prevalence rate of food insecurity reduced. Similarly, in our study, 50% of the respondents skipped meals at baseline compared to end-line (40.6%), and there was a significant association between respondents skipping meals during the COVID-19 pandemic at baseline and end-line (p= 0.001). The reason for the similarities in the findings could be because food accessibility and availability were compromised during the pandemic and most supermarkets were closed making people skip meals to be able to save some for the next day. Also, if people are fearful about the transmission of the virus, its impact may affect food security, thus, making people who are more fearful avoid food stores or other direct means of procuring food (Fitzpatrick, Harris & Drawve, 2020). The results from this study revealed that women were the most affected with severe food insecurity both at baseline and end-line compared to men. For women in this study, severe food insecurity was 26.3% and 16.3% in men at baseline. The present study corresponds with a study conducted on the gender difference in food insecurity and researchers found that women had a higher likelihood of being food insecure than men (Broussand, 2019). While a considerable number of the researchers have been keen about the role of women in safeguarding the food security of their household, not much attention has been paid to their food security situation (Broussard, 2019). It is therefore necessary that women are given special consideration, and appropriate policy measures established to improve access to nutritious foods.

Nutritional status between gender using anthropometric measurements at baseline and end-line in the study area

The influence of nutrition on the immune system has been well documented in literature (Messina *et al*., 2020). In this study, nutritional status was assessed using BMI levels by categorizing it as underweight, normal-weight, and overweight/obese. Out of 80 men and 80 women, the men who had a normal BMI at baseline were 37.5 %, overweight or obese were 57.5 %, while only 5 % were underweight. However, the BMI of the respondents (overweight/obesity and underweight levels) were higher in women than in men for both at baseline and end-line. A majority of the men had a normal BMI at both baseline and end-line than the women. Also, normal BMI and underweight levels decreased towards the end-line for both men and women. In a study conducted by Lowry & Tomiyama (2015), the same method of categorization was employed. Our study is

also in line with a longitudinal study online conducted among US adults with findings indicating that, the average weight / BMI of US adults increased during the early months of the pandemic, before decreasing levels in November-December 2020 (Dicken *et al*., 2021). The reason for this could be attributed to the restrictions and lockdowns during the first wave of the COVID-19 outbreak which prevented people from becoming more physically active and thus, an increase in the earlier part of the pandemic, with a subsequent reduction in BMI months after the crisis reduced.

Socioeconomic factors associated with food insecurity in the study at baseline and end-line

Findings of this study revealed that respondents who had higher educational status (tertiary education) were negatively correlated with being food insecure (B= -2.26, 95% CI: -3.67, -0.86) at baseline. The results also showed a significant association (p= 0. 002) between tertiary level and food insecurity at baseline. This showed that the higher the educational background of an individual, the less likely the person was to be food insecure. This study agrees with another study conducted to determine dietary diversity and household food security during the coronavirus in Bangladesh (Ahmed *et al*., 2019). Researchers found that higher educational level was positively associated with food security which might be attributable to the fact that, better-educated people can diversify their environments and can maintain their families' food availability through higher earning potential (Ahmed *et al*., 2019). Educational status of respondents revealed that, those with no formal education were food insecure at baseline (B= -2.39, 95% CI: -0.04, -0.74) and end-line (B= 0.58, 95% CI: 0.19, -2.97). However, there was a significant association between respondents with no formal education and food insecurity at baseline (p= 0.005) and end-line (p=0.003). The reason for this could attributed to the fact that those with no level of formal education are likely not to have enough money or resources to achieve food security. Respondents who reported having easy access to safe water at baseline and end-line had a reduced chance of being food insecure. This could be attributed to the fact that access to water is an important indicator for food security in that, it is needed in all the agricultural processes to ensure food is available from the farm to the table (Berry, Dernini, Burlingame, Meybeck & Conforti, 2015). This shows that safe water is an important element when it comes to being food insecure or secured.

Impact of COVID-19 on food insecurity

The regression analysis also revealed some impact of the COVID-19 pandemic on the monthly income of respondents. There was a significant association at baseline between respondents who earned GH₵ 100-499 (p= 0.029), GH₵ 500-999 (p= 0.002), and above GH₵ 1000 and food insecurity (p= 0.022). The level of significance shows that COVID-19 affected the monthly income of respondents. This study agrees with a study conducted in Bangladesh among respondents with online and face-to-face interviews where COVID-19 caused a reduction in over 70 % of their family's income (Kundu *et al*., 2021). The reason had to do with a slowdown in their business and income generating activities because of the lockdown during the pandemic. The COVID-19 pandemic has created an economic downturn globally which has resulted in the loss of income and livelihoods on a universal scale (World Bank, 2020). However, in our study, at baseline, there was a significant association between food insecurity and quantity of food respondents ate (p= 0.001). This agrees with another study in Ghana where household income and

consumption of food were reduced because of COVID-19 (Owusu & Frimpong-Manso, 2020). The more respondents could not eat a balanced diet, the more food insecure they became because the inability to eat a balanced diet was positively correlated with food insecurity at baseline (B= 0.38, 95% CI: 0.13, 0.62) and at end-line (B= 0.25, 95% CI: 0.01, 0.49). A balanced diet is a diet that fulfills all of a person's nutritional needs and makes energy input matches energy expenditure (Derrickson & Anderson). However, food security is having physical, social and economic access to sufficient healthy and safe food that meets dietary requirements (UNICEF& WHO, 2017). This means that not consuming a balanced diet will make one food insecure.

CONCLUSION

This study contributes to the food insecurity literature and policy. COVID-19 has not only affected the vulnerable livelihoods but has also had a huge effect on food security and food systems. This study revealed that the prevalence of severe food insecurity among the study respondents during the pandemic was high during the baseline but declined during the endline. Food insecurity was found to be higher in the nuclear family than the extended family. From this study, women were found to be more food insecure than men both at baseline and end-line. From the regression analysis, there was a significant association between respondents with no formal education and food insecurity at baseline (p= 0.005) and the end-line (p= 0.003). Also, the more an individual had some level of formal education, the less likely the person was to be food insecure. Education, monthly earning, access to water, not being able to eat a balanced diet were all factors significantly associated with food insecurity. Programs to improve awareness on the coronavirus pandemic should include food security and dietary diversity programs.

LIMITATION

The sample size of this study was relatively small and therefore the results cannot be generalized to the whole country thus, a larger sample size is recommended in future studies.

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