



Knowledge, Attitude, Practice and Fear of COVID-19 among Biology Students: Implications for Communicable Diseases

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Abstract

Knowledge, Attitude, Practice (KAP), and Fear of COVID-19 (FOC) are important for planning effective public health prevention and control strategies for infectious diseases. There is limited integration of both KAP and fear (FOC) variables among university students, especially in Nigeria. This study aimed to survey the KAP and FOC and to investigate their relationships among biology students in a Nigerian university. A survey was conducted cross-sectionally to elicit responses regarding the KAP and FOC among 1,919 biology students between January and July, 2021. Univariate and bivariate analyses were performed on the data collected. Results revealed that 64.5% of the participants had correct knowledge; with significant differences in bivariate analyses. Also, 56.86 % participants reported positive attitudes; females, biology majors and science students exhibited greater positive attitude than males, non-biology majors and non-science students ($p < 0.05$), while 65.16% participants exhibited proactive practice. The overall moderately high score for Knowledge was 3.22 ± 1.23 (range: 0 - 5), Attitude was 7.55 ± 2.35 (range: 0 - 10), and Practice was 7.52 ± 2.33 (range: 0 - 10) while the total KAP score was 18.30 ± 4.68 (range: 0-25), despite having a low fear of COVID-19 score (19.48) among the students. Majority of the students exhibit adequate knowledge, proactive practice, positive attitude; and low fear of the pandemic; but KAP and fear scores disparity exist across groups. These results have vital implications when planning prevention of future pandemics.

Keywords: Attitude, Awareness, Fear of COVID-19, Pandemic, Practice

1. Introduction

The occurrence of the COVID-19 pandemic, which started spreading from Wuhan, China in late December 2019 (Peng *et al.*, 2020; Zhu *et al.*, 2020), has highlighted the significance of understanding the dynamics of communicable diseases with genetic underpinnings among diverse populations. Among these populations, undergraduates represent a group with distinctive perspectives and potential implications for future infectious genetic diseases (Peng *et al.*, 2020; Zhu *et al.*, 2020). Students of life science are positioned at the intersection of biological sciences and public health, making them particularly insightful subjects for studying the dynamics of pandemic response and preparedness. The COVID-19 pandemic has prompted unprecedented international responses and public health interventions (Sari, 2024). Amidst these responses, understanding the level of knowledge of students regarding the transmission, pathogenesis, and genetic factors underlying communicable genetic diseases is essential. Additionally, assessing their attitudes towards public health strategies, e.g., vaccination and social distancing, and their practices concerning hygiene and preventive behaviours provides valuable insights into the effectiveness of public health messaging and education efforts (Abbasi-Ghahramanloo *et al.*, 2024).

In public health, the effectiveness of pandemic prevention strategies depends largely on public adherence, which in turn is determined by people's knowledge, attitude, practice (KAP) and fear related to the threat posed by the disease, as well as socio-demographic characteristics, cultural beliefs, media exposure, and trust in public health authorities (Ajilore *et al.*, 2017). Studies have shown that KAP significantly impacts personal experience and produce behaviours during or after pandemic outbreak (Yap *et al.*, 2010). Further reports also suggest that awareness is positively associated with the use of preventive protocols and has effect on the defensive actions of people both individually and as a community (Lau *et al.*, 2007; Leung *et al.*, 2005). Moreover, investigating the knowledge, attitudes, practices, and fears of students in the context of COVID-19 has broader implications for future communicable genetic diseases. As our understanding of the genetic determinants of communicable diseases continues to evolve, life science students are poised to play pivotal roles in research, surveillance, and intervention efforts. As suggested by Buthelezi and Mpuangnan (2024), it is important for studies to investigate the KAP of diseases because insights gained from such studies can inform the development of educational curricula, training programmes, and public health policies, aimed at preparing life science students to effectively respond to emerging communicable genetic threats.

Knowledge and attitude have been strongly associated with anxiety and panic, which in turn elicit practices

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such as protective actions towards communicable diseases and influence the use of health care services (Person *et al.*, 2004; Siddique *et al.*, 2017). In addition to these, individuals' preventive practices, such as hygiene, mask use, and social distancing, represent the behavioural expression of their knowledge and attitude levels. Together, these elements shape how effectively a population responds to infectious disease threats. In linking these aspects to the present discussion, this study considers how biology students' knowledge, attitude, and practice interact with their fear of COVID-19 to produce behavioural and psychological responses relevant to communicable disease prevention. In the era of post COVID-19, when nations are enforcing strict measures, adherence to preventive practices is necessary to prevent future pandemic. "Fear", as a psychophysiological phenomenon related to the neurobiology of a person's consciousness, may hinder one's clear and rational thinking due to the cognitive burden especially when reacting to a pandemic with an elevated level of fear (Adolphs, 2013). Exploring the fears and concerns of students regarding COVID-19 sheds light on the psychological and emotional dimensions of communicable disease outbreaks. Fear can influence individuals' adherence to public health guidelines, willingness to seek medical care, and uptake of preventive measures, thereby impacting the trajectory of disease spread and containment (Flato, 2024). Investigating the level of fear towards COVID-19 among university students in Nigeria could help in developing adequate management interventions to reduce the adverse effects of COVID-19 on the educational system.

Investigating the level of fear towards COVID-19 in a community such as university students could help in developing adequate management interventions to reduce the adverse effect of COVID-19 on the educational system. Notably, the COVID-19 pandemic forced the Nigerian educational system into unprecedented challenges and exposed the level of infrastructural deficit in its universities (Okagbue *et al.* 2023). The Nigerian university comprises undergraduates who are mostly young adults on the verge of life independence and autonomy but with limited experiences. Despite the efforts of the Nigerian government, university authorities, and public health agencies to incorporate the "new normal" life occasioned by the COVID-19 pandemic into the university system in Nigeria, the students may still show post COVID-19-related fears. However, there exist gap in research linking KAP and FOC among students. In light of these considerations, this research seeks to assess the KAP, and fear of COVID-19 expressed by biology students. By examining these dimensions comprehensively, this study aims to generate evidence-based recommendations to enhance pandemic preparedness and response strategies, both within the student population and across broader public health contexts.

2. Methods

2.1 Study Settings and Subjects

This cross-sectional study (n= 1,919) was carried out using a structured questionnaire from January to July, 2021. The participants include both male and female biology students of Tai Solarin University of Education, Nigeria who have taken or are currently taking the introductory biology course and who willingly participated in the survey. Students with illness, inability to communicate or with intellectual disability were excluded from the study. Questionnaires were administered at a period when there was gradual relaxation in the national lockdown and strict adherence to COVID-19 prevention protocols was ensured during data collection. This research was approved by the Ethical Committee of Biological Sciences, Tai Solarin University of Education, and it conformed to the provisions of the Helsinki Declaration. All participants were adequately informed about the aim of the survey and they all signed written consent voluntarily and anonymously prior to participation in the survey.

2.2 Survey Instrument and Scoring

A questionnaire titled "Knowledge, Attitude, Practice and Fear of COVID-19" (KAPFC) comprising items adapted from previous studies on knowledge, attitude and practice (KAP) towards COVID-19 (Peng *et al.*, 2020) and Fear of COVID-19 (Ahorsu *et al.*, 2020) in China and Spain respectively was used. The questionnaire contained demographic items (such as age, gender, year of study, major and type of college/faculty within the university), KAP items involving 5 items about knowledge of COVID-19 (e.g., main clinical manifestation), 5 items about attitude of the subjects towards COVID-19 (e.g., wild animal consumption), 5 items about practices associated with COVID-19 (e.g., return to school) and 7 items about fear of COVID-19 (Table 1).

This study used a conventional scoring method for each item in this KAPCF questionnaire thus: 1 point assigned to the correct response, and 0 for the incorrect response in the Knowledge part; 2 points assigned to positive/proactive, 1 point assigned to neutral and 0 point assigned to negative in the Attitude and Practice parts. In the Fear of COVID-19 section, variables were graded thus: 1 point was assigned to Strongly Disagree (SD), 2 to Disagree (D), 3 to Neither Agree nor Disagree (NAD), 4 points to Agree (A) and 5 points was assigned to Strongly Agree (SA). Total point was obtained by summing all items scores (range: 7-35); with higher scores interpreted as increased fear of COVID-19.

2.3 Validity and Reliability of Instrument

The KAPFC questionnaire underwent content validation by three experts in health education and public health to ensure relevance and clarity of items. Reliability was assessed using Cronbach's alpha coefficients, which indicated satisfactory internal consistency across the subscales: Knowledge ($\alpha =$

Table 1: Knowledge of COVID-19 among study participants

Measure	Responses	Assigned Point	N (%)
KoC 1: What kind of disease is it?	<ul style="list-style-type: none"> • Bacteria • Virus • Unknown 	Wrong/ 0 Correct/ 1 Wrong/ 0	392 (20.4) 1423 (74.2) 104 (5.4)
KoC 2: The major route for transmitting Covid-19 is?	<ul style="list-style-type: none"> • Respiratory droplets and close contact • Water • Food • Unknown 	Correct/ 1 Wrong/ 0 Wrong/ 0 Wrong/ 0	1351 (70.4) 347 (18.1) 71 (3.7) 150 (7.8)
KoC 3: Length of COVID-19 incubation period is?	<ul style="list-style-type: none"> • 1-14 days • 3-7 days • More than 14 days • Unknown 	Correct/ 1 Wrong/ 0 Wrong/ 0 Wrong/ 0	1176 (61.3) 240 (12.5) 401 (20.9) 102 (5.3)
KoC 4: Which persons are prone to Covid-19?	<ul style="list-style-type: none"> • The old and young children • People are generally susceptible • Young adults • People with pre-existing diseases • Unknown 	Wrong/ 0 Correct/ 1 Wrong/ 0 Wrong/ 0 Wrong/ 0	597 (31.1) 921 (48.0) 113 (5.9) 208 (10.8) 80 (4.2)
KoC 5: The main clinical symptoms of Covid-19 are?	<ul style="list-style-type: none"> • Fever and dry cough. • Fatigue. • Stuffy and runny. • Sore throat and Myalgia. • Diarrhea. • Unknown 	Correct/ 1 Wrong/ 0 Wrong/ 0 Wrong/ 0 Wrong/ 0 Wrong/ 0	1315 (68.5) 192 (10.0) 202 (10.5) 130 (6.8) 40 (2.1) 40 (2.1)

0.78), Attitude ($\alpha = 0.82$), Practice ($\alpha = 0.80$), and Fear ($\alpha = 0.84$). These values demonstrate that the instrument was both valid and reliable for this study.

2.4 Data Analysis

Data were processed on Statistical Package for Social Sciences (SPSS) version 20 software. T test statistic was used to compare mean values of continuous variables; Chi square test and t-test were utilized to compare categorical and bivariate continuous variables. Correlation analysis was employed to test the relationships among the variables; $P < 0.05$ and $P < 0.001$ were reckoned statistically significant in two-sided test.

3. Results

3.1 Demographic Characteristics of Participants

The participants ($n = 1,919$) were recruited from pure biology and biology education students taking course biology courses in Tai Solarin University of Education, Nigeria. Among the participants, 661 (34.4%) and 1,258 (65.6%) were males and females respectively; 140 (34.9%) were pure biology; 413 (21.5%) were in their first year, 1,178 (61.4%) were in the middle (second and third) years while 328 (17.1) were in their final year. The ages of the participants ranged from 17 to 28 years while they averaged an age of 22.3 ± 0.75 years.

3.2 Knowledge of COVID-19

Among the total 9,595 answers, 6,186 (64.47%) indicated correct knowledge. Further analyses,

summarised in Table 2, show that the female students had significantly higher score for item KoC5 than their male counterparts ($p < 0.001$); pure biology students had significantly higher scores for KoC1 to KoC5 than biology education students ($p < 0.05$); while first year students had significantly lower knowledge in KoC1 and KoC5 compared with students studying in their second, third and fourth year ($p < 0.05$).

3.3 Attitudes Towards COVID-19

In all the 9,595 responses 5,455 (56.85%) indicated positive attitude (Table 3). Analysis of the positive attitudes to the pandemic among the students, displayed in Table 2, shows that the feminine gender got significantly higher points than males in positive attitude, A2 (return to school soon), but not in A1 (transmission from man to man), A3 (eating wild animal), A4 (ability to endure emergency) and A5 (effect on study). Students studying pure biology outperformed those studying biology education in positive attitude (A1, A2, A4 and A5), but biology education students outperformed pure biology counterparts in positive attitude, A3, and these different observations were significant statistically ($p < 0.05$).

3.4 Practices Linked with COVID-19

Practice linked with COVID-19 was evaluated using 5 items as described with corresponding graded points in Table 4. Among the 9,595 responses collected, 6,252 (65.16%) exhibited proactive practice. Further analyses in Table 2 shows that science students obtained

Table 2: Correct knowledge, attitude (positive) and practice (proactive) related to COVID-19 based on categories

Measure *	Gender (n, %)				Course of study (n, %)				Grade of study (n, %)			
	Male	Female	X ²	P	Biology	Biology Edu	X ²	P	First Year	Other Years	X ²	P
K1-Correct	491 (74.3)	932 (74.1)	0.009	0.486	122 (88.4)	1301 (73.0)	15.759	0.000	265 (64.3)	1158 (76.8)	26.465	0.000
K2-Correct	452 (68.4)	899 (71.5)	1.974	0.088	125 (90.6)	1226 (68.8)	29.054	0.000	282 (68.4)	1069 (70.9)	0.962	0.179
K3-Correct	409 (61.9)	767 (61.0)	0.150	0.368	102 (73.9)	1074 (60.3)	10.000	0.001	254 (61.7)	922 (61.2)	0.030	0.455
K4-Correct	307 (46.4)	614 (48.8)	0.969	0.175	83 (60.1)	838 (47.1)	8.796	0.002	200 (48.5)	721 (47.8)	0.064	0.422
K5-Correct	419 (63.4)	896 (71.2)	12.334	0.000	122 (88.4)	1193 (67.0)	27.248	0.000	265 (64.3)	1050 (69.7)	4.301	0.023
A1-Positive	499 (75.5)	952 (75.7)	1.522	0.467	123 (89.1)	1328 (74.6)	17.367	0.000	316 (76.7)	1135 (75.3)	1.818	0.403
A2- Positive	475 (71.9)	980 (77.9)	10.297	0.006	132 (95.7)	1323 (74.3)	32.132	0.000	318 (77.2)	1137 (75.4)	1.969	0.374
A3- Positive	305 (46.1)	511 (40.6)	5.947	0.051	36 (26.1)	780 (43.8)	22.446	0.000	166 (40.3)	650 (43.1)	2.715	0.257
A4- Positive	444 (67.2)	841 (66.9)	2.026	0.363	114 (82.6)	1171 (65.7)	19.988	0.000	278 (67.5)	1007 (66.8)	0.487	0.784
A5- Positive	502 (75.9)	969 (77.0)	0.283	0.316	123 (89.1)	1348 (75.7)	12.933	0.000	317 (76.9)	1154 (76.6)	0.024	0.467
P1-Proactive	504 (76.2)	985 (78.3)	1.132	0.568	122 (88.4)	1367 (76.8)	10.874	0.004	326 (79.1)	1163 (77.2)	0.892	0.640
P2-Proactive	417 (63.1)	757 (60.2)	3.616	0.164	94 (68.1)	1080 (60.6)	3.134	0.209	258 (62.6)	916 (60.8)	3.212	0.201
P3-Proactive	456 (69.0)	909 (72.3)	2.443	0.295	123 (89.1)	1242 (69.7)	25.095	0.000	305 (74.0)	1060 (70.3)	2.187	0.335
P4-Proactive	356 (53.9)	717 (57.0)	2.029	0.363	91 (65.9)	982 (55.1)	7.430	0.024	221 (53.6)	852 (56.5)	1.815	0.404
P5-Proactive	379 (57.3)	772 (61.4)	5.875	0.053	106 (76.8)	1045 (58.7)	18.140	0.000	248 (60.2)	903 (59.9)	0.489	0.783

The items and correct/positive/proactive response of each knowledge/attitude/practice measure are detailed in Tables 1, 3, & 4 respectively. Chi-square was used for comparison between different bivariate groups

Table 3: Attitude of study participants towards COVID-19

Measure	Responses	Point	N (%)
A1: Afraid of man-to-man spread of Covid-19?	<ul style="list-style-type: none"> Yes, but I think rationally and I can shield myself. I do not care; I have the same feeling. I panic and confused about what to do. 	Positive/ 2 Neutral/ 1 Negative/ 0	1451 (75.6) 265 (13.8) 203 (10.6)
A2: Do you wish it ends soon so you can go back to school?	<ul style="list-style-type: none"> Yes. I do not care. No, I prefer to be at home as much as possible. 	Positive/ 2 Neutral/ 1 Negative/ 0	1455 (75.8) 206 (10.7) 258 (13.4)
A3: What do you feel about eating of wild animals?	<ul style="list-style-type: none"> I do not take wild animals, and will fault those who consume. I do not (me), but I will not prevent others. I won't mind having a try 	Positive/ 2 Neutral/ 1 Negative/ 0	816 (42.5) 748 (39.0) 355 (18.5)
A4: Do you feel you can bear such kind of public health emergence?	<ul style="list-style-type: none"> Yes, I have more awareness and I am more capable. I will remain the same. No, I'm too afraid to endure it any longer 	Positive/ 2 Neutral/ 1 Negative/ 0	1285 (67.0) 320 (16.7) 314 (16.4)
A5: Do you feel the pandemic has affected your study?	<ul style="list-style-type: none"> Yes, it has No, I'm self-disciplined and my study wasn't impacted at home. 	Negative/ 0 Positive/ 2	1471 (76.7) 448 (23.3)

Table 4: Practices expressed concerning COVID-19

Measure	Responses	Point	N (%)
P1: What action will you take if you feel feverish and have dry cough?	<ul style="list-style-type: none"> I will assess the case rationally. Stay indoor for observation and quarantine or visit the hospital for treatment. I want to visit the hospital, but I'm scared of being infected. I panic; I do not have idea of what to do 	Proactive/ 2 Neutral/ 1 Passive/ 0	1489 (77.6) 317 (16.5) 113 (5.9)
P2: If your nation needs you, will you wish to assist the frontline rescue?	<ul style="list-style-type: none"> Yes, the nation's problem is our collective responsibility. I am not certain and require opinion of my family. No, it is very dangerous. 	Proactive/ 2 Neutral/ 1 Passive/ 0	1174 (61.2) 410 (21.4) 335 (17.5)
P3: What action will you take if there was close contact between you and confirmed cases?	<ul style="list-style-type: none"> Proactively alert the public and remain in quarantine if needed. Similar to before. I panic; I do not have idea of what to do 	Proactive/ 2 Neutral/ 1 Passive/ 0	1365 (71.1) 326 (17.0) 228 (11.9)
P4: What action will you take if a person cured of COVID-19 desired to meet you?	<ul style="list-style-type: none"> I will go ahead to meet with them and express extra kindness. I will go ahead to meet with them like before. I will look for excuse to stay away from them. 	Proactive/ 2 Neutral/ 1 Passive/ 0	1073 (55.9) 421 (21.9) 425 (22.1)
P5: What will you prioritise most when the pandemic ends?	<ul style="list-style-type: none"> I will return to school and resume normal academic activities. Similar to before. The pandemic is very frightening. I have to enjoy myself as much as possible. 	Proactive/ 2 Neutral/ 1 Passive/ 0	1151 (60.0) 449 (23.4) 319 (16.6)

Table 5: COVID-19-linked knowledge, attitude and practice points by groups

Variables*		(n)	Knowledge			Attitude			Practice			Total KAP		
			$\bar{x} \pm SD$	t	P	$\bar{x} \pm SD$	T	P	$\bar{x} \pm SD$	t	P	$\bar{x} \pm SD$	t	P
Gender	Male	661	3.14 \pm 1.19	-2.059	0.040	7.53 \pm 2.38	-0.302	0.762	7.43 \pm 2.40	-1.162	0.246	18.10 \pm 4.69	-1.273	0.203
	Female	1258	3.27 \pm 1.26			7.57 \pm 2.34			7.56 \pm 2.30			18.39 \pm 4.67		
Major	Pure Biology	138	4.02 \pm 1.00	7.952	0.000	8.33 \pm 1.46	4.023	0.000	8.33 \pm 1.92	4.25	0.000	20.67 \pm 3.14	6.243	0.000
	Biology Education	1781	3.16 \pm 1.23			7.49 \pm 2.40			7.46 \pm 2.35			18.11 \pm 4.73		
Year	First	412	3.07 \pm 1.21	-2.807	0.005	7.61 \pm 2.30	0.473	0.636	7.57 \pm 2.26	0.515	0.607	18.25 \pm 4.53	-0.244	0.807
	Others	1507	3.26 \pm 1.24			7.54 \pm 2.37			7.50 \pm 2.35			18.31 \pm 4.72		

*Scores of KAP between different bivariate groups were compared by T-test.

significantly higher points than the non-science ones in proactive practices: P1 (self-protection), P2 (help frontline rescue), P3 (meet confirmed patients), P4 (meet cured patients), and P5 (return to school). Biology students significantly outperformed non-biology students in proactive practices: (P1, P3, P4 and P5).

3.5 COVID-19-Associated KAP Scores by Groups

The overall point for Knowledge was 3.22 ± 1.23 (range: 0 - 5), Attitude was 7.55 ± 2.35 (range: 0 - 10), and Practice was 7.52 ± 2.33 (range: 0 - 10) while the total KAP point was 18.30 ± 4.68 among the students (Table 5). Knowledge about COVID-19 correlated positively with Attitude ($r = 0.380$, $p < 0.001$) and Practice ($r = 0.301$, $p < 0.001$) towards COVID-19. There was also a moderately positive correlation between Attitude and Practice scores ($r = 0.499$, $p < 0.001$). Subgroup analysis in Table 5 revealed that Knowledge level was greater in female, biology major, and science-based students than those students who are males, non-biology majors, at first year of study and non-science based respectively ($p < 0.05$). Attitude and Practice points were observed to be significantly higher only in biology majors and science students than in non-biology majors and non-science students ($p < 0.001$). Total KAP scores were significantly different by major ($p < 0.001$) and by college ($p < 0.001$).

3.6 Fear of COVID-19 in Relation to KAP Variables

The highest point that one could get from the FCV-19S scale was 35 while the least score was 7. Hence, the fear of COVID-19 point ranged from 7 - 35. Mean score for the summation of items 1-7 representing the total FCV-19S was 19.48 out of 35, indicating that the students' fear of COVID-19 was moderately low. Bivariate analysis showed that fear of COVID-19 did not significantly differ by gender, major, or year of study ($p > 0.05$). Fear score had a weak but significant correlation with knowledge of COVID-19 score ($r = 0.068$, $p < 0.01$) but not with attitude and practice scores.

4. Discussion

This present study assessed the knowledge, attitudes, practices and fear of COVID-19 among biology students of Tai Solarin University of Education, exploring its implications for future communicable genetic diseases and found that majority of the students showed adequate level of COVID-19 related knowledge, exhibited optimistic attitude, proactive practice and moderately low fear against the pandemic, showing that effective health enlightenment was done by all the governmental and non-governmental agencies through the massive public enlightenment programmes. These findings agree with the results of similar investigations on COVID-19 and H1N1 related knowledge, attitude and practice among university undergraduates in China and Korea (Peng *et al.*, 2020; Park *et al.* 2010). This present investigation also

revealed that the female students demonstrated significantly better knowledge about the 'major medical symptoms of COVID-19'; agreeing with several other related findings that females possess superior knowledge to males in terms of knowledge and practices related to some other infectious diseases such as H1N1, SARS & MERS (Peng *et al.*, 2020; Al-Hazmi *et al.*, 2018; Park *et al.*, 2010). The observed gender difference in the knowledge of COVID-19 was not replicated in the attitude, practice, total KAP and fear scores of the male and female students.

Biology majors had better knowledge of COVID-19 than biology education students. This can be explained by the fact that the biology majors take more health-related biology courses and some of them engage in industrial attachment in health-related facilities where they gained first-hand practical experiences, unlike the biology education students whose exposure to health-related biology courses might be limited. Notably, the biology majors take courses such as genetics, microbiology, invertebrates, virology, bacteriology, among others, which are relevant to having adequate knowledge and understanding of COVID-19 and this could explain the better knowledge exhibited by biology majors relative to others. Also, some biology majors may be interested in pursuing career in biomedicine or public health and this perhaps explains their more positive attitudes and more proactive practices during the COVID-19 pandemic.

Though the study did not investigate the information sources used by the students to obtain knowledge about COVID-19, it is possible that their KAP had been influenced by their prior knowledge/training coupled with newly acquired knowledge, especially at the initial period of lockdown which compelled the students to bank on on news and social media when at home and, consequently, improved their knowledge (Gallè *et al.*, 2020; Carducci *et al.*, 2019). In the COVID-19 era, mass media gave incessant and timely updates and information on the evolution of the pandemic. The role of mass media in significantly influencing knowledge, attitudes and people's risk perception cannot be overemphasised (Gallè *et al.*, 2020; Bennett *et al.*, 2010). A number of ways for curbing the COVID-19 spread have been reported such as identifying novel mutations, vaccination and other necessary treatments in addition to effectively educating the general public about risks and safety measures (Gallè *et al.*, 2020; Brug *et al.*, 2004). Therefore, the wide alliance seen across public health facilities and media channels has been highly key for delivering valuable and highly vital health material to various sectors of the public.

This present study also observed that the fear associated with COVID-19 was lower in male, first year, and biology education students than their corresponding counterparts, albeit not statistically significant, in line with previous reports (Ahorsu *et al.*, 2020; Nguyen *et al.*, 2020). Expectedly, pure biology

students had more knowledge and fear towards COVID-19 and correlational analysis showed that increased knowledge of COVID-19 modestly correspond to increased fear towards COVID-19. In a related study, Martinez-Lorca *et al.* (2020) also found fear associated with COVID-19 to be higher among students in health science departments compared with those in other departments. These findings are consistent with the findings of Pappas *et al.* (2009), who reported that increased knowledge of an infectious disease induces higher fear levels in individuals but contradicts the reports of Ali *et al.* (2021) who found no correlation between knowledge and fear among people from eight different countries.

This study is not without some limitations. First, as may be seen in cross-sectional research studies, cause and effect association was impossible for the measures in the study. Second, the assessment of fear through a self-report is subjective and as such could not rule out the possibility of subjects' responses affected by reporting bias and social desirability influences. Third, a paucity of similar research among Nigerian undergraduate populations has limited the contrast and discussion of research findings. Fourth, all the subjects were all enrolled from the same university and at such; they may not reflect the wholistic picture of Nigerian undergraduate students at large. Therefore, the findings of this present study should be interpreted carefully and not be generalised. Finally, this research was conducted at a time when vaccination had not gained full public acceptance among Nigerians; with various emerging research on vaccination and possible treatment of the virus still in on-going, the level of fear linked to COVID-19 among respondents may change later.

5. Conclusion

This study provided clearing understanding of public health enlightenment and preventive campaigns in Nigerian university setting during the post-COVID-19 pandemic era. The findings show that majority of the students have attained basic knowledge, showed positive attitude, proactive practice and moderately low fear level toward COVID-19, but their knowledge, attitude and practice levels may vary according to gender, majors and college. It was also shown, in the results that increased knowledge of COVID-19 modestly corresponds to increased fear towards COVID-19. Holistically, these results suggest that factors such as gender, majors and college of study play important role in determining student's responses to the infectious diseases and how they acquire necessary public health education, and these have implication for the health and educational sectors. These findings could be explored in developing contingency interventions or trainings for students in cases of future similar public health issues. Future research involving study populations that are nationally representative and diverse across various universities could help validate the results herein.

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