Original Article

Associations between Conspiracy Ideation, Covid-19 Conspiracy Ideation with Adherence to Preventive Measures among Adults in Kuwait: A Cross-Sectional Study

Nourah K. Alajmi[1], Ahmed N. Albatineh[1,2*]

[1]Department of Community Medicine and Behavioral Sciences, College of Medicine, Kuwait University, Kuwait.
[2]Department of Community Medicine and Behavioral Sciences, Faculty of Medicine, Kuwait University, Kuwait.

ARTICLE INFO	ABSTRACT

Introduction: A lack of knowledge about COVID-19 has led people to believe in conspiracy theories, their origins, and their purposes. These theories influence people's compliance with preventive strategies and accepting vaccination, thus affecting the overall community health. This study investigated the association between compliance with preventive measures, conspiracy ideation, and COVID-19 conspiracy ideation.

Methods: Data from 554 participants ≥18 years were collected using a questionnaire distributed over social media platforms. Associations between compliance with preventive strategies and several covariates were investigated. To quantify/test the effect of belief in conspiracy theory and COVID-19 conspiracy while accounting for other covariates, a multiple logistic regression model was implemented to estimate odds ratios (OR) and their 95% confidence intervals (CI).

Results: Participants were mainly males (58.3%), employed (61.2%), and Kuwaiti nationals (79.1%) with a median (IQR) age of 32 (20) years. The prevalence of generic conspiracy ideation, COVID-19 conspiracy, and poor compliance with preventive measures were 33%, 28.3%, and 34.7%, respectively. After adjustment for several covariates, believers in conspiracy theory (aOR=1.97, 95%CI:1.24-3.14), believers in COVID-19 conspiracy (aOR=1.96, 95%CI:1.2– 3.21), compared to none/low believers, were significantly associated with poor compliance with preventive measures.

Conclusion: Believers in conspiracy theories and COVID-19 conspiracy theories are significantly more likely to be poorly compliant with preventive measures against COVID-19. This has a negative effect on the community health. Policymakers need to address conspiracy theories on public platforms which will help promote the adaptation of correct public health practices and preventive strategies leading to better health of the community.

Introduction

Coronavirus (COVID-19) is a novel disease that has shocked the world and spread globally making the current world crisis. It is caused by the new coronavirus, named later as Severe Acute Respiratory Syndrome (SARS-CoV-2) which was first discovered in Wuhan, China in

*.Corresponding Author: ahmed.albatineh@ku.edu.kw

December 2019.[1] As the disease spread out and the number of cases increased substantially across the world, the World Health Organization (WHO) declared it a pandemic on March 11, 2020.[2] On February 24, 2020, Kuwait announced the first case of COVID-19.[3] COVID-19 is highly contagious and can spread quickly which forced governments across the world to take action to stop or even slow down its spread. Many countries around the world adopted a lockdown strategy as a first solution to prevent the spread of COVID-19. Another action to control the spread of the virus was adopting certain preventive measures and practices. These measures included washing hands and using sanitizers, social distancing, wearing masks, banning indoor activities, and avoiding crowded places, curfews, and home quarantine.

Many conspiracy theories have evolved on the origin, objective, and development of COVID-19 disease. The lack of knowledge about COVID-19 disease and the spread of conflicting information made many people vulnerable to conspiracy ideation which is the belief in conspiracy theories. Conspiracy theories are unwarranted beliefs that certain events are planned and carried out by secret, malevolent, and powerful organizations.[4] Belief in conspiracy theories can be driven through motives mainly epistemic, existential, and social motives.[5] Epistemic motive is the need to gain certainty and comprehension, while the existential motives refer to the feeling of control and safety, and the social motives refer to the feeling of being special and having a positive image in the group they belong to.[5] Theories like COVID-19 is a bioweapon, a virus escaped from a lab, COVID-19 is a myth to force vaccinations on people, Big Pharma is encouraging the spread of COVID-19 to make money, and 5G network is causing COVID-19 to control people using a microchip implanted with the vaccine[6] have emerged since the beginning of the pandemic. The belief in these theories is a challenge to control the spread of the COVID-19 disease because of its association with health behaviors and poor adherence to preventive practices.[7]

Belief in conspiracy theories is associated with less adherence to the public health policies[8] and has a negative effect on adherence to public health practices.[9] Belief in COVID-19 conspiracy theories predicted compliance with preventive measures. It showed that lower compliance with COVID-19 preventive measures was directly associated with belief in COVID-19 conspiracy theories and indirectly associated with conspiracy beliefs.[10] Another study indicated that belief in COVID-19 conspiracy theories may reduce adherence to social distancing.[11]

In the Middle East and North Africa (MENA) region and in particular Kuwait, there is a lack of studies on conspiracy ideation and its effect on health behaviors through adherence to preventive measures. Conspiracy ideation and COVID-19 conspiracy belief influence adherence to public health policies, health-related behaviors, and adherence to preventive measures to control the spread of the COVID-19 disease. Therefore, this study aimed to investigate the association between compliance with preventive measures, conspiracy ideation, and COVID-19 conspiracy ideation.

Materials and Methods

Study Design

This is a cross-sectional study designed to measure the prevalence of conspiracy ideation among adults in Kuwait, identify the factors associated with conspiracy ideation, COVID-19 conspiracy and evaluate its association with compliance to preventive measures. The study was conducted between October 2021 and January 2022. The protocol design was approved by the research ethics committee at the Health Science Center, Kuwait University, and the Ministry of Health in Kuwait (Ref No. 4712). All recruited participants read and signed an informed consent form.

Study Participants

Due to the COVID-19 pandemic and the restrictions by health authorities in Kuwait, there was no direct contact with participants. The survey along with instructions and informed consent was distributed by a link through social media (WhatsApp, Instagram, Twitter, emails). Therefore, a non-probability convenient sampling method was used for data collection in this study. Participants living in Kuwait, males, and females, Kuwaiti and non-Kuwaiti nationals, who are 18 years or older were invited to participate in the study. A sample of 565 eligible participants were invited to participate in the study and 554 participants completed the questionnaire giving a response rate of 98.1%.

Data Collection

Data were collected using self-reported and self-administered questionnaire that was distributed using social media applications. The questionnaire consists of five sections. The first section included questions about sociodemographic characteristics including age, nationality, gender, level of education, employment status, income, marital status, and source of information about current news. Section two measured conspiracy ideation using the generic conspiracist belief scale (GCB).[12] The GCB is a validated tool with Cronbach alpha of 0.95. The GCB has five-factor structure that includes government malfeasance, extraterrestrial cover-up, malevolent global conspiracies, personal wellbeing, and control of information. The GCB consists of 15-items which are scored using a 5-points Likert scale (Definitely not true, probably not true, not sure/cannot decide, probably true, definitely true) and has no cut-off point, but higher scores indicate higher belief in conspiracy theories. Some of the questions used in the GCB scale includes: "The government is involved in the murder of innocent citizens and/or well-known public figures, and keeps this a secret", "the government permits or perpetrates acts of terrorism on its own soil, disguising its involvement", "a small, secret group of people is responsible for making all major worlds decisions, such as going to war", and "the spread of certain viruses and/or diseases is the result of deliberate, concealed efforts of some organizations".

Section three contained seven questions that were developed based on the published literature to measure belief in COVID-19 related conspiracy theories of which two were validated with Cronbach alpha of 0.81[4] and the other five questions were developed based on the published literature. Some of the questions used in the COVID-19 conspiracy theory are: "Corona virus was developed and spread around the world by certain people for their own purposes", "there is no intentional

plan of a person or a group behind the spreading of coronavirus around the world", "COVID-19 is a virus that was developed by humans but escaped from a lab", "COVID-19 is a virus that was intended as a bioweapon", and "COVID-19 was intended to be placed on a chip with the vaccine to control humans through 5G networks". These questions are scored using a 7-points Likert scale (strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree) with no cutoff point but also with higher scores implying higher belief in COVID-19 conspiracy theories. Section four aimed to measure the degree of compliance with COVID-19 preventive measures. This tool[13] contained 18 items which are scored using a 5-points Likert scale with no cut-off point, but higher scores mean higher compliance with preventive measures.

For the instruments that have no cutoff points, the GCB scores and COVID-19 conspiracy ideation instruments were fitted as a continuous covariate. Furthermore, tertiles from the data were used to categorize the scores into three levels: none/mild, moderate, and high believers. This allowed a comparison of believers in conspiracy (top scores) relative to non/low believers (low scores).

Statistical Analysis

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS) version 26.[14] Data were coded and cleaned from any abnormalities. The distributions of continuous variables were checked for normality. Descriptive statistics were used to measure proportion/frequency for categorical variables. For continuous variables, mean (SD)

were reported if normality holds, otherwise, median (IQR) were reported. To compare two groups across a continuous variable, the two-sample t-test was used if normality holds, otherwise, the Mann-Whitney U test was used. To compare three or more levels of an exposure across a continuous outcome, analysis of variance (ANOVA) was implemented if normality and homogeneity of variances were satisfied, otherwise, the non-parametric Kruskal-Wallis test was implemented. To test the association between two categorical variables, the Pearson chi-square test of independence was if the expected cell counts were more than five for 80% of the cells, otherwise Fisher exact test was used.

For the instruments with no cut-off points, tertiles obtained from the data were used to categorize the scores. For the GCB scale, its total score ranges between 11 and 55 which was used as a continuous variable and then was categorized into the tertiles: none/low believer T1: ≤ 28, moderate believer T2: 29-36, and high believer T3: ≥ 37. For the COVID-19 conspiracy belief scale, the score ranges between 7 and 49, and the tertiles were coded none/low believer T1: ≤ 22, moderate believer T2: 23-28, and high believer T3: ≥ 29. For the compliance with preventive measures scale, the total score ranges from 18 to 90 and was categorized as none/low T1: ≤ 50, moderate T2: 51-64, and high compliant T3: ≥ 65. The association between a binary outcome and several exposure variables was quantified and tested using multiple logistic regression modeling. Univariable and multiple logistic regression were used to obtain crude and adjusted odds ratios (OR) between compliance with preventive measures and belief in conspiracy theories as measured by GCB scale

and COVID-19 conspiracy, after adjusting for potential confounders. All tests were two-tailed, and a significance level was set at 5%.

Results

Out of 565 participants approached in the study, 554 agreed to participate (response rate= 98.1%). All 554 participants completed all sections of the questionnaire. Data on sociodemographic variables are presented in Table 1. Participants were mainly males (58.3%), Kuwaiti nationals (79.1%), have bachelor's degree (59.4%), employed (61.2%), with income more than 1500 KD (33%), living in Al-Jahra area (31.4%), married (56.1%), vaccinated (85.4%), were not infected by COVID-19 (67.5%), have an intention to vaccinate their children (42.6%), use expert or official spokesman as a source of information (49.3%), were not/low believers in conspiracy theories and COVID-19 conspiracy theories (35%) and (35.9%) respectively, were highly compliant with preventive strategies (35.2%),

Table 1. Characteristics of the study participants in Kuwait (N= 554).

Variables	N (%)	Variables	N (%)
Nationality		Vaccination Status	
Kuwaiti	438 (79.1%)	Yes	473 (85.4%)
Non-Kuwaiti	116 (20.9%)	No	81 (14.6%)
Gender		COVID-19 Infection Status	
Male	323 (58.3%)	Yes	180 (32.5)
Female	231 (41.7%)	No	374 (67.5%)
Education Level		Child Vaccination Intention	
Less than High School	14 (2.5%)	Yes	236 (42.6%)
High School or Diploma	124 (22.4%)	No	122 (22%)
Bachelor's degree	329 (59.4%)	I don't have children	196 (35.4%)
Master's /Ph.D. degree	87 (15.7%)	Source of Information	
Employment Status		Television/Newspaper	45 (8.1%)
Student	169 (30.5%)	Expert or official spokesman	273 (49.3%)
Employed	339 (61.2%)	Social Media	179 (32.3%)
Unemployed	24 (4.3%)	Family members/ friends/neighbors	16 (2.9%)
Retired	22 (4%)	Others	41 (7.4%)
Income Level		**GCB†	
Less than 500 KD	168 (30.3%)	T1: ≤ 28	194 (35%)
501-1000	110 (19.9%)	T2: 29-36	177 (31.9%)
1001-1500	93 (16.8 %)	T3: ≥ 37	183 (33%)
More than 1500 KD	183 (33%)	**COVID-19 Conspiracy	
Residency		T1: ≤ 22	199 (35.9%)
Al-Asimah	116 (20.9%)	T2: 23-28	198 (35.7%)
Al-Jahra	174 (31.4%)	T3: ≥ 29	157 (28.3%)
Al-Ahmidi	103 (18.6%)	**Preventive measures	
Al-Farwaniya	51 (9.2%)	T1: ≤ 50	192 (34.7%)
Hawalli	63 (11.4%)	T2: 51-64	167 (30.1%)
Mubarak Alkabeer	47 (8.5%)	T3: ≥ 65	195 (35.2%)
Marital Status		Age (years)	
Single	225 (40.6%)	Median	32
Married	311 (56.1%)	IQR	20
Divorced/Widowed	18 (3.2%)	(Min, Max)	(18, 65)

†GCB, Generic Conspiracy Belief scale;

**Categorized into Tertiles;

and have median (IQR) age of 32 (20) years old with minimum=18 and maximum=65 years old.

Table 2 presents the association between compliance with preventive measures and sociodemographic factors, GCB, and COVID-19 conspiracy theory. Compliance with preventive measures has a score that ranges between 18 and 90 with no cutoff point, but a higher score is indicative of stronger compliance with preventive measures. Since no cutoff point is available, the tertiles method was used to categorize compliance with preventive measures into poor compliance T1: ≤50, moderate compliance T2: 51-64, and good compliance T3: ≥ 65. This categorization resulted in 192 (34.7%) participants being poorly compliant, 167 (30.1%) of them being moderately compliant, and 195 (35.2%) were extremely compliant (Table 1). As indicated in Table 2, the compliance with preventive measures was significantly associated with GCB score (P-value=0.002), COVID-19 conspiracy theory (P-value=0.008), gender (P-value=0.008), income (P-value=0.039), marital status (P-value=0.039), source of information (P-value=0.004). Participants who have higher beliefs in conspiracy theories are more likely to be poorly compliant with preventive measures compared with those with lower beliefs (43.2% vs. 28.4%). Participants who have higher beliefs in COVID-19 conspiracy theories are more likely to be poorly compliant with preventive measures (42.7%). Males were more likely to be poorly compliant with preventive measures compared to females (39.6% vs. 27.7%). For income status, people who have an income of more than 1500 KD are more likely to be poorly compliant with preventive measures (37.7%).

Marital status was significantly associated with compliance with preventive measures (P-value=0.039) with about one-third of singles, married, divorced/widowed being not compliant. For source of information, people using other sources of information are more likely to be poorly compliant with preventive measures compared to those using expert/ official spokesman (46.3% vs. 27.8%).

In general, having poor compliance with preventive measures was significantly associated with high beliefs in conspiracy theories and COVID-19 conspiracy theories, being a male, having an income of more than 1500 KD, married, using other sources for information.

Our goal was to estimate and test the association between compliance with preventive measures and some exposures while accounting for some confounders. For that purpose, a logistic regression modeling technique was conducted to estimate and test the association between compliance with preventive measures and each of three exposures analyzed each in a separate model. A univariable and multiple logistic regression analysis was conducted to estimate and test the association between compliance with preventive measures and GCB scores and belief in COVID-19 conspiracy theory while adjusting for the socioeconomic and demographic variable.

Univariable logistic regression revealed that gender and generic conspiracy belief scale were independently and significantly associated with compliance with the preventive measures with results presented in Table 3. Results indicated that females have 0.58 times the odds of being poorly compliant with preventive measures compared with males (OR=0.58, 95% CI: 0.41-0.84). For the GCB

Table 2. Associations between participants characteristics and compliance with preventive measures in Kuwait (N= 554).

Characteristics	Preventive measures			P-value
	T1: 0-50	T2: 51-64	T3: >= 65	
**GCB				0.002[a]
T1: 0-28	(28.4%) 55	(33.5%) 65	(38.1%) 74	
T2: 29-36	(32.8%) 58	(36.7%) 65	(30.5%) 54	
T3: >= 37	(43.2%) 79	(20.2%) 37	(36.6%) 67	
**COVID-19 Conspiracy				0.008[a]
T1: 0-22	(30.2%) 60	(30.7%) 61	(39.2%) 78	
T2: 23-28	(32.8%) 65	(36.9%) 73	(30.3%) 60	
T3: >=29	(42.7%) 67	(21%) 33	(36.3%) 57	
Nationality				0.066[a]
Kuwaiti	(34%) 149	(32.4%) 142	(33.6%) 147	
Non-Kuwaiti	(37.1%) 43	(21.6%) 25	(41.4%) 48	
Gender				0.008[a]
Male	(39.6%) 128	(26.3%) 85	(34.1%) 110	
Female	(27.7%) 64	(35.5%) 82	(36.8%) 85	
Education Level				0.611[b]
Less than High School	(35.7%) 5	(28.6%) 4	(35.7%) 5	
High school or diploma	(37.1%) 46	(30.6%) 38	(32.3%) 40	
Bachelor	(32.5%) 107	(32.2%) 106	(35.3%) 116	
Master or PhD	(39.1%) 34	(21.8%) 19	(39.1%) 34	
Employment Status				0.182[a]
Student	(30.8%) 52	(36.7%) 62	(32.5%) 55	
Employed	(35.4%) 120	(26.5%) 90	(38.1%) 129	
Unemployed	(45.8%) 11	(29.2%) 7	(25%) 6	
Retired	(40.9%) 9	(36.4%) 8	(22.7%) 5	
Income Status				0.039[a]
Less than 500 KD	(31.5%) 53	(37.5%) 63	(31%) 52	
KD 501-1000	(36.4%) 40	(22.7%) 25	(40.9%) 45	
KD 1001-1500	(32.3%) 30	(37.6%) 35	(30.1%) 28	
More than 1500 KD	(37.7%) 69	(24%) 44	(38.3%) 70	
Residency				0.688[a]
Al-Asimah	(34.5%) 40	(25%) 29	(40.5%) 47	
Al-Jahra	(29.3%) 51	(34.5%) 60	(36.2%) 63	
Al-Ahmadi	(37.9%) 39	(28.2%) 29	(34%) 35	
Al-Farwaniya	(41.2%) 21	(31.4%) 16	(27.5%) 14	
Hawalli	(38.1%) 24	(31.7%) 20	(30.2%) 19	
Mubarak Alkabeer	(36.2%) 17	(27.7%) 13	(36.2%) 17	
Marital Status				0.039[a]
Single	(30.2%) 68	(36.9%) 83	(32.9%) 74	
Married	(37.9%) 118	(24.8%) 77	(37.3%) 116	
Divorced/Widowed	(33.3%) 6	(38.9%) 7	(27.8%) 5	
Source of information				0.004[a]
TV/Newspaper	(31.1%) 14	(31.1%) 14	(37.8%) 17	
Expert/official spokesman	(27.8%) 76	(29.3%) 80	(42.9%) 117	
Social Media	(43%) 77	(31.8%) 57	(25.1%) 45	
Family, friends, Neighbors	(37.5%) 6	(43.8%) 7	(18.8%) 3	
Others	(46.3%) 19	(22%) 9	(31.7%) 13	
COVID-19 Infection Status				0.587[a]
Yes	(36.7%) 66	(31.1%) 56	(32.2%) 58	
No	(33.7%) 126	(29.7%) 111	(36.6%) 137	

[a] Derived from Pearson chi-square test; [b] Derived from fisher's exact test. **Categorized into Tertiles.

Table 3. Associations between compliance with preventive measures (compliant=0, non-compliant=1) and generic conspiracy belief scale categorized and other socio-demographic factors in Kuwait (N=554)

Covariates	Univariable Analysis			Adjusted Analysis		
	OR	CI	P-value	aOR	CI	P-value
Age	1.01	0.99-1.02	0.45	0.98	0.95-1.00	0.10
Nationality						
Kuwaiti	0.88	0.57-1.34	0.54	1.01	0.58-1.74	0.98
Non-Kuwaiti	1			1		
Gender						
Male	1			1		
Female	0.58	0.41-0.84	0.004	0.46	0.29-0.73	0.001
Education level						
Less than high school	1			1		
High school or diploma	1.06	0.34-3.36	0.92	0.9	0.24-3.40	0.87
Bachelor's degree	0.87	0.28-2.65	0.80	0.96	0.25-3.65	0.95
Master's degree/ PhD	1.16	0.36-3.74	0.81	1.05	0.25-4.39	0.95
Employment status						
Student	1			1		
Employed	1.23	0.83-1.83	0.3	1.09	0.49-2.42	0.84
Unemployed	1.90	0.80-4.53	0.15	2.65	0.95-7.42	0.06
Retired	1.56	0.63-3.87	0.34	1.96	0.5-7.73	0.34
Income						
Less than 500 KD	1			1		
KD 501-1000	1.24	0.75-2.06	0.41	1.26	0.62-2.53	0.52
KD 1001-1500	1.03	0.60-1.78	0.91	0.989	0.41-2.37	0.98
More than 1500 KD	1.31	0.84-2.04	0.23	1.17	0.51-2.72	0.71
Residency						
Al-Asimah	1			1		
Al-Jahra	0.79	0.48-1.30	0.35	0.68	0.39-1.19	0.17
Al-Ahmidi	1.16	0.67-2.01	0.60	1.14	0.62-2.10	0.68
Al-Farwaniya	1.33	0.68-2.62	0.41	1.47	0.71-3.05	0.31
Hawali	1.17	0.62-2.21	0.63	1.23	0.62-2.45	0.56
Mubarak Alkabeer	1.08	0.53-2.19	0.84	0.985	0.46-2.10	0.969
Marital status						
Single	1			1		
Married	1.41	0.98-2.03	0.06	1.57	0.89-2.76	0.12
Divorced/Widowed	1.15	0.42-3.20	0.78	1.49	0.48-4.61	0.49
Source of information						
Television/Newspaper	1			1		
Expert or official spokesman	0.85	0.43-1.69	0.65	0.84	0.40-1.73	0.63
Social media	1.67	0.83-3.36	0.15	1.63	0.79-3.38	0.19
Family/Friends/Neighbors	1.33	0.40-4.38	0.64	1.36	0.37-5.05	0.65
Others	1.91	0.79-4.61	0.15	1.46	0.57-3.72	0.43
**GCB score						
T1: ≤28	1			1		
T2: 29-36	1.23	0.79-1.92	0.36	1.11	0.69-1.79	0.66
T3: ≥37	1.92	1.25-2.95	0.003	1.97	1.24-3.14	0.004
*GCB total score	1.03	1.01-1.05	0.002	1.03	1.01-1.05	0.004

*Separate model was conducted using GCB as a continuous variable; **Categorized into Tertiles

scale, the odds of being poorly compliant with preventive measures among high believers is 1.92 times the odds of those considered low believers (OR= 1.92, 95% CI: 1.25-2.95). To further ascertain this association, the GCB scale was modeled as a continuous covariate, and the results indicated that for every one-unit increase in the total GCB score, there was a 3% increase in the odds of being poorly compliant with preventive measures (OR= 1.03, 95% CI: 1.01-1.05).

Results of the univariable logistic regression that investigated the association between compliance with preventive measures and COVID-19 conspiracy theories were presented in Table 4. Results indicated that belief in COVID-19 conspiracy theories was significantly associated with compliance with preventive measures. Specifically, high believers in COVID-19 conspiracy theories have 1.73 times the odds of being poorly compliant with preventive measures compared to low believers in COVID-19 conspiracy theories (OR= 1.73, 95% CI: 1.11-2.67). To ascertain this association, belief in COVID-19 conspiracy theories was modeled as a continuous covariate and the results indicated that it was significantly associated with compliance with preventive measures. In particular, results indicated that for every one-unit increase in the total score of belief in COVID-19 conspiracy theories, there was a 3% increase in the odds of being poorly compliant with preventive measures (OR= 1.03, 95% CI: 1.002-1.05).

To account for the effect of other covariates on the association between the outcome and the covariates of interests, an adjusted analysis was conducted. Table 3 presents the results of the multiple logistic regression analysis between

compliance with preventive measures and the GCB score after adjustment for socioeconomic and demographic factors. Results indicated that gender and GCB scores remain significant after the adjustment for the effect of other covariates. For gender, compared to males, females have 0.46 times the odds of being poorly compliant with preventive measures (aOR= 0.46, 95% CI: 0.29-0.73) after adjustment for other covariates, indicating that, being female is a protective factor against poor compliance with preventive measures. For the GCB score, people with higher belief in conspiracy theories have 1.97 times the odds of being poorly compliant with preventive measures compared to those with lower beliefs (aOR= 1.97, 95% CI: 1.24-3.14) after adjustment for other covariates. When the GCB was modeled as a continuous covariate and after adjustment for sociodemographic factors, results showed that for every one-unit increase in the total GCB score, there was a 3% increase in the odds of being poorly compliant with preventive measures (aOR= 1.03, 95% CI: 1.01-1.05) while holding all other covariates fixed.

Table 4 presents the multiple logistic regression analysis which models the association between compliance with preventive measures and belief in COVID-19 conspiracy theories after adjustment for socioeconomic and demographic factors. The adjusted analysis indicated a significant association between compliance with preventive measures and gender and with belief in COVID-19 conspiracy theories. In particular, the odds of being poorly compliant with preventive measures among females was 0.48 times the odds of males after adjusting for other covariates (aOR= 0.48, 95% CI: 0.30-0.75). For the belief in COVID-19 conspiracy theories, people who were highly believers

Table 4. Associations between compliance with preventive measures (compliant=0, non-compliant=1) and COVID-19 conspiracy belief scale and other socio-demographic factors in Kuwait (N=554).

Covariates	Univariable Analysis			Adjusted Analysis		
	OR	CI	P-value	aOR	CI	P-value
Age	1.01	0.99-1.02	0.45	0.97	0.95-1.00	0.08
Nationality						
Kuwaiti	0.88	0.57-1.34	0.54	0.99	0.58-1.71	0.97
Non-Kuwaiti	1			1		
Gender						
Male	1			1		
Female	0.58	0.41-0.84	0.004	0.48	0.30-0.75	0.001
Education level						
Less than high school	1			1		
High school or diploma	1.06	0.34-3.36	0.92	0.89	0.24-3.38	0.87
Bachelor's degree	0.87	0.28-2.65	0.80	0.90	0.24-3.44	0.88
Master's degree/ PhD	1.16	0.36-3.74	0.81	1.00	0.24-4.18	0.997
Employment status						
Student	1			1		
Employed	1.23	0.83-1.83	0.3	1.16	0.52-2.59	0.72
Unemployed	1.90	0.80-4.53	0.15	2.76	0.99-7.71	0.052
Retired	1.56	0.63-3.87	0.34	2.12	0.53-8.45	0.29
Income						
Less than 500 KD	1			1		
KD 501-1000	1.24	0.75-2.06	0.41	1.19	0.59-2.39	0.63
KD 1001-1500	1.03	0.60-1.78	0.91	0.98	0.41-2.34	0.96
More than 1500 KD	1.31	0.84-2.04	0.23	1.16	0.50-2.69	0.72
Residency						
Al-Asimah	1			1		
Al-Jahra	0.79	0.48-1.30	0.35	0.64	0.36-1.11	0.11
Al-Ahmidi	1.16	0.67-2.01	0.60	1.13	0.62-2.08	0.69
Al-Farwaniya	1.33	0.68-2.62	0.41	1.53	0.74-3.2	0.25
Hawali	1.17	0.62-2.21	0.63	1.25	0.63-2.5	0.52
Mubarak Alkabeer	1.08	0.53-2.19	0.84	1.001	0.47-2.13	0.999
Marital status						
Single	1			1		
Married	1.41	0.98-2.03	0.06	1.54	0.87-2.71	0.14
Divorced/Widowed	1.15	0.42-3.20	0.78	1.35	0.44-4.19	0.60
Source of information						
Television/Newspaper	1			1		
Expert or official spokesman	0.85	0.43-1.69	0.65	0.91	0.44-1.88	0.8
Social media	1.67	0.83-3.36	0.15	1.66	0.80-3.45	0.17
Family/Friends/Neighbors	1.33	0.40-4.38	0.64	1.46	0.39-5.48	0.57
Others	1.91	0.79-4.61	0.15	1.69	0.66-4.32	0.27
**COVID-19 conspiracy score						
T1: ≤22	1			1		
T2: 23-28	1.13	0.74-1.73	0.57	1.31	0.83-2.06	0.25
T3: ≥29	1.73	1.11-2.67	0.015	1.96	1.2-3.21	0.007
*COVID-19 conspiracy total score	1.03	1.002-1.05	0.03	1.03	1.01-1.06	0.017

* Separate model was conducted using COVID-19 conspiracy total score as a continuous variable;
** Categorized into Tertiles.

in COVID-19 conspiracy theories have 1.96 times the odds of being poorly compliant with preventive measures compared to low believers in COVID-19 conspiracy theories after adjusting for other covariates (aOR= 1.96, 95% CI: 1.2-3.21). When belief in COVID-19 conspiracy theories score was modeled as a continuous covariate, results indicated that for every one-unit increase in the total score of belief in COVID-19 conspiracy theories, there was a 3% increase in the odds of being poorly compliant with preventive measures after controlling of sociodemographic factors (aOR= 1.03, 95% CI: 1.01-1.06).

Discussion

To the best of our knowledge, the use of the GCB scale and the study of conspiracy ideation and its association with compliance with preventive measures against COVID-19 is one of the first studies conducted in the MENA region. Our goal was to investigate the association between compliance with the preventive measures against COVID-19 and belief in conspiracy theories in general and COVID-19 related conspiracy theories as well. The chi-square test indicated a significant association between compliance with preventive measures and believing in both general and COVID-19 related conspiracy theories, gender, income, marital status, and source of information. The univariable and multiple logistic regression analysis indicated a significant association with gender and belief in conspiracy theories. In the current study, 34.7% of the participants had poor compliance with preventive measures, those who were believers in conspiracy theories, males, with income more than 1500 KD, married, using other sources

of information were more likely to have poor compliance. In Saudi Arabia,[15] 53.3% had poor compliance with preventive measures in which males and those with a school education level were more likely to have poor compliance with the preventive measures which support our findings. Contrary to our findings, they have indicated that married participants exhibit good compliance with preventive strategies.[15] Similarly, a study among a multinational sample that included 45,772 participants from 66 countries indicated that females were more likely to have better compliance with preventive measures compared to males.[16]

In the current study, data revealed a negative association between compliance with preventive measures and belief in both general and COVID-19 related conspiracy theories. Similarly, a study conducted in the USA among 1050 adults revealed that belief in COVID-19 related conspiracy theories was negatively associated with compliance with preventive measures.[17] Also, data in the current study indicated that females are less likely to be not compliant with preventive measures compared to males. Furthermore, a study conducted in Croatia among 1882 adults revealed a negative association between compliance with preventive strategies and belief in COVID-19 related conspiracy theories.[18] Another study that included two phases conducted among French adults indicated that belief in conspiracy theories was positively associated with non-normative prevention behaviors and negatively associated with normative prevention behaviors.[19] Additionally, a study was conducted among 1325 Finnish adults indicated that lower compliance with preventive strategies was associated with higher beliefs in conspiracy theories and

lower trust in information sources. Along with this line, another study has indicated that those who have poor compliance with preventive strategies have less intention to be vaccinated, which is in line with our findings.[20] On the other hand,[4] indicated no association between belief in COVID-19 conspiracy theories and compliance with preventive strategies. Furthermore,[21] indicated that belief in conspiracy theories was not associated with compliance with preventive strategy, but rather it predicted only negative attitudes towards preventive strategies.

Finally, this study illuminated the critical impact of conspiracy ideation on controlling the spread of COVID-19 in the current pandemic as indicated by refusal to get the vaccination. The concept of conspiracy ideation as it pertains to the causes and spread of COVID-19 is scarcely researched in the Middle East and North Africa (MENA) region. This study is one of the very few studies that investigated the association between conspiracy ideation and compliance with preventive strategies in the MENA region. One of the advantages is the use of the GCB which is a validated and reliable tool for measuring conspiracy ideation[12] Compliance with the preventive strategy is one of the main procedures to combat and control the spread of COVID-19 and eventually end the pandemic. As a result, investigating the association between compliance with preventive strategies and belief in conspiracy ideation is important to ensure the health of the general population. Additionally, we have investigated the association and accounted for the effect of some key sociodemographic variables that could have a role in predicting the individuals' tendency to comply with preventive strategies which makes the estimates more reliable.

The use of a non-probability sampling method and resorting to social media for data collection, due to COVID-19 restrictions, was the main limitation. This sampling method most likely left out people who are not connected to / savvy about social media. The ethics committee at the Health Sciences Center, Kuwait University, recommended that four out of the 15 items from the GCB scale were removed due to their "sensitive content". This removal affects the total GCB score, and it is unclear if that has a major effect on the GCB score results. Furthermore, some outcomes we investigated as well as some main exposures, e.g., GCB and COVID-19 scores, that were used in the analysis had no cutoff point. In such a case we have used the tertile methods to dichotomize the covariate.

Conclusion

The prevalence of conspiracy ideation among Kuwaitis is 33% and it is significantly associated with being non-Kuwaiti, females, and using other sources of information. The prevalence of poor compliance with preventive strategy was 34.7% and its odds were higher among believers in conspiracy theories (OR= 1.92), believers in COVID-19 conspiracy theories (OR=1.73), and among unvaccinated (OR=4.55). Conspiracy ideation has a negative association with compliance with preventive measures against COVID-19 and therefore has a negative effect on the health of the general population. For that reason, health policymakers need to focus on this aspect and address/expose the issue of conspiracy theories that spread in social media and public platforms which will help to promote the adaptation of correct public health practices

and governmental preventive strategies. This will eventually improve the general health of the population.

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Conflicts of interest/Competing interests

Authors declare that they don't have any conflict of interest to report.

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