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Original article

COVID-19 risk perception after vaccination era among a sample of Egyptians: A cross sectional study

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ABSTRACT

Background: The high rates of infection and mortalities initially caused by COVID-19, made anxiety and fear very common. With the increase of vaccination coverage, it is expected to detect changes in risk perception and fear of COVID-19, especially with the emergence of what so called "Pandemic Fatigue". The aim of this study was to assess COVID 19 risk perception after the vaccination era. **Methods**: This is a cross-sectional analytical study, using an online questionnaire including socio-demographic questions and COVID-19 risk perception questions. **Results**: The questionnaire was filled by 509 participants. Sociodemographic characters of the participants didn't affect the COVID-19 risk perception. The mean and median perceived efficacy scores were significantly higher in participants with no prior history of COVID-19 infection. Participants with positive attitude towards COVID-19 vaccine had significantly higher risk perception. **Conclusion**: COVID-19 risk perception is still query and not fully understood. This necessitates more studies to be conducted to explore it among different groups which may relate it to different determinants. Social media is the main source of knowledge among participants and should be professionally used for enhancing positive attitudes towards COVID-19 vaccination.

Introduction

The global pandemic caused by the recently emerged coronavirus has led to a huge public health concern with great losses in lives and economy as well [1]. COVID-19 was declared by WHO on January 30, 2020, as a "global health crisis of significant global consequence". On March 11, 2020 the WHO officially reported it as a pandemic [2,3]. Till the 3rd of March 2024 the total cumulative confirmed COVID-19 cases reached 516,023. Currently circulating COVID-19 variants of interest (VOIs) as of 18 December 2023 were XBB.1.5, XBB.1.16, EG.5, BA.2.86, and JN. The currently circulating COVID-19 variants under monitoring (VUMs) as of 29 January 2024 were XBB, XBB.19.1, and XBB.2.3 [4].

Several papers indicated that demographic variables, such as employment, education, income, gender, and age, result in an important effect on the risk perception of COVID-19 and the adoption of preventative measures [5].

Precautionary measures were the only preventive measures present from the beginning of

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the pandemic till the introduction of first FDA approved COVID-19 vaccine in December 2020 [6]. COVID-19 vaccine first administered in Egypt in 24th of January 2021. Till November 2023, 56% of the Egyptian population received at least one dose of COVID-19 vaccination, with 112.67 million total COVID-19 vaccine doses administered [4].

With the increase of vaccination coverage, it was expected to detect changes in risk perception and fear of COVID. The main goal behind vaccination campaigns was to speed up the return to normal social life. However, the appearance of a phenomenon known as the "pandemic fatigue", due to decreased risk perception, was a result of the over confidence that was induced by COVID 19 mass vaccination [7]. The challenge of the entwining effect of both the vaccination impact on adherence to safety measures and the newly emerging COVID19 variants will impose risks of increased infection [8].

Risk compensation is usually driven and enhanced by cognitive biases which are supported by the received information [9]. Propagated health information during the pandemic, played an important role in shaping the population perception as well as response. A variety of health information sources were in the scene, with special focus on social media which was chosen by WHO to be an important risk communication channel [10].

A number of studies were conducted to asses COVID19 risk perception and its relation to vaccination and source of information, but to our best of knowledge, few studies explored such relation in the post-vaccination period. The current study findings may help in figuring out explanations for public perception and attitude, in order to design better communication strategies and approaches.

Aim of the study

The aim of the current paper was to evaluate the risk perception of COVID-19 after the vaccination era after January 2021.

Specific objectives

1. Explore the risk perception of COVID-19 after availability of COVID-19 vaccines.
2. Assess the risk perception of COVID-19 based on the participants´ sociodemographic background and source of knowledge.
3. Evaluate the risk perception of COVID-19 based on participants´ attitude towards COVID-19 vaccination and vaccination status.

Methods

- ***Study design:*** The present paper presents an observational cross-sectional analytical study.
- ***Sample type:*** convenient sample (easy access).

Sampling technique and sample size*:* The study covered a sample of 503 participants, who were calculated by the online sample size calculator of www.openepi.com [11] , keeping an anticipated frequency of 68% risk perception, ranging from high to moderate towards COVID-19 in accordance to a study of public perception of COVID-19 in Australia [12] with 95% confidence interval, supposing the non-response rate to be 50%.

The criteria of including a participant defined that the participant should be an Egyptian, residing in Egypt, adult (≥18 years old), and showing willingness to join the study.

The google form was designed to roll out who didn't match the inclusion criteria; for example, adding a question in the beginning of the questionnaire, if the participant is Egyptian or not. If he/ she was Egyptian, he/she will continue the questionnaire, otherwise the rest of questions won't open and the form will be submitted.

Questionnaire design, validity, and reliability

- A pre-tested 2- pages (screen) e-questionnaire was utilized for collecting data from the subjects. It was a four-section questionnaire:
  - i) Socio-demographic features: age in years, gender, education, occupation, as well as residence.
  - ii) Disease and vaccination status: chronic diseases, history of COVID-19 infection, history of COVID-19 infection in family member and COVID-19 vaccination status.
  - iii) Attitude towards COVID-19 vaccination: 4 questions; I believe that a vaccine can help control the spread of the coronavirus, If I knew I had the corona virus before, I wouldn't get the vaccine even if it was available, then anyone else is vaccinated against the Corona virus, I do not need to be vaccinated, and I think everyone should

be vaccinated against the Corona virus [13].

iv) COVID-19 risk perception as per the extended parallel process model (EPPM) [14] : 29 validated questions by selecting 3 set domains:

- 1. Efficacy (perceived self-efficacy and perceived response efficacy): The domain contained thirteen items.
- 2. Defensive response (avoidance, reactance, and denial): The domain covered 8 items to measure the beliefs of people about their perceptions of COVID-19 risk.
- 3. Perceived threats (susceptibility and severity). The domain covered 8 items to measure the beliefs of people about COVID-19 magnitude, as well as the risk of the disease experience.

A group of 2 language experts translated the items into Arabic, and another group of two independents experts of language translated the items back to English. A pilot test was carried out among fifty subjects (excluded from the study results) in order to evaluate question clarity.

Cronbach's alpha coefficient of 0.831 demonstrated the risk perception questionnaire reliability.

Study duration: from March to May 2022.

Data collection technique: The authors employed an online data collection technique. They created a Google form and invited participants through personal communication (via Facebook groups, WhatsApp contacts, email… etc.) to complete the form and submit it.

Data analysis

- The data collected were revised to ensure that they were complete and logically consistent. They were extracted from the Google form to an Excel sheet (Microsoft Office Excel Software, Vr. 2019). After that, they were analyzed statistically after being transferred to SPSS (Statistical Package of Social Science, vr. 26).
- COVID-19 risk perception 29 questions were rated by the 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree) for each item. Therefore, the overall raw score ranged from 145 to 29. Then, they were transformed into this simple linear transformation [Row score – the lowest possible raw score/highest possible raw score – the lowest possible raw score] × 100, the row scores were transformed into a score of 0 to 100. The lower scores (<60%) suggested lower risk perception, whereas the higher scores (≥60%) suggested higher risk perception [14,15].

Describing the quantitative variables took the form of mean, SD, median, and interquartile range (IQR), were compared using the Mann Whitney U test for 2 independent groups, and Kruskal Wallis test for more than 2 independent groups. Describing the qualitative variables was based on percentage and frequency. A comparison of these data utilized the chi square test and fisher exact test. The P value was set significant at $p \leq 0.05$.

Ethical considerations

The approval of the study protocol was made by the scientific committee and from the Ethical committee (N-8-200), date of approval was 16/2/2022. The research subjects delivered an electronically signed informed consent after informing them about the objectives of the study and the significance of the online form prior to collecting data. Only the participants who offered agreement were included, and the others who refused were excluded from the research by presenting empty forms after responding "Not willing to participate." All data collection procedures were confidential following the Helsinki Declarations of biomedical ethics. The subjects were told that the survey was anonymous and that their participation was voluntary.

Results

The questionnaire was opened with 514 participants; response rate was 99%, as 5 participants didn't complete the questionnaire. So, the total participants who completed the questionnaire were 509 participants.

The Median total score of the COVID-19 risk perception was 104 with IQR (97,111). Median total score % was 64.7% (IQR 58.6, 70.7%), with self-efficacy median score of 24, IQR (22, 27), response median score 28, IQR (25, 31), defensive median score 22, IQR (18, 25), and perceived threat median score of 31, IQR (28, 33) **(Table 1)**.

Table 2 showed the risk perception based on EPPM by participants´ socio-demographic characteristics, in which there was a lack of statistically significant difference on the COVID-19

risk perception scores according to age, occupation, gender, education, income, and residence of the participants. The mean and median perceived efficacy scores were significantly higher in participants with no previous history of COVID-19 infection (p value 0.003). No other statistically significant difference between COVID risk perception domains and past personal and family history of COVID-19 infection as well as the presence of chronic diseases.

Table 3 showed that participants with positive attitude towards COVID-19 vaccine; such as that everyone should get the vaccine even if everyone else was vaccinated had significantly higher risk perception (p value ≤ 0.05).

Figure 1 illustrated the relation between participants´ COVID-19 vaccination status and risk perception, there was no statistical significance difference (P=0.69).

Figure 2 illustrated the main sources of knowledge; in which the most prevalent source of knowledge was the social media (58%). **Figure 3** showed the relation between different sources of knowledge and participants´ COVID-19 risk perception (p value was not significant p>0.05).

Table 1. Participants' COVID-19 risk perception score based on EPPM (n=509)

Risk perception score	**Mean ± SD**	**Median (IQR)**
- **Self-efficacy**	24 ± 4	24 (22, 27)
- **Response**	28 ± 4	28 (25, 31)
- **Defensive**	22 ± 6	22 (18, 25)
- **Perceived threat**	31 ± 4	31 (28, 33)
Total risk perception score	105 ± 12	104 (97, 111)
Total risk perception score %	65.1% ± 9.9%	64.7% (58.6%, 70.7%)

Table 2. Participants´ COVID-19 risk perception based on EPPM by demographic characteristics, and disease status (n=509)

	Total	**Efficacy**		**Defensive**		**Perceived threat**	
	N (%)	Mean± SD	Median (IQR)	Mean± SD	Median (IQR)	Mean± SD	Median (IQR)
Age							
<30	217 (42.7)	26.2±3.4	26.0 (24.0, 28.5)	21±6	21 (17,25)	30±4	30 (27,33)
30-60	275 (54.1)	26.2±3.6	26.0 (24.0, 29.0)	22±6	21 (18,25)	31±5	31 (28,33)
>60	16 (3.1)	26.5±3.9	26.8 (23.0, 29.3)	22±4	22 (20,24)	32±4	32 (29,35)
P value		0.906		0.856		0.504	
Gender							
Male	93 (18.3)	26.1±3.7	26.0 (23.5, 29.0)	22±7	21 (18,25)	31±4	31 (28,33)
Female	416 (81.7)	26.2±3.5	26.0 (24.0, 28.5)	21±6	21 (18,25)	31±4	31 (28,33)
P value		0.751		0.673		0.961	
Education							
Below university education	41 (8.1)	25.2±3.5	25.0 (22.5, 27.5)	24±7	23 (19,27)	30±5	30 (27,32)
University	341 (67.0)	26.3±3.6	26.0 (24.0, 29.0)	21±6	21 (18,24)	31±5	31 (27,34)
Postgraduate	127 (25.0)	26.4±3.3	26.5 (24.0, 28.5)	22±7	21 (17,25)	31±4	31 (29,33)
P value		0.117		0.068		0.699	
Income							
It is not enough and we have a big debt	11 (2.2)	25.7±4.2	25.0 (24.5, 27.5)	22±7	21 (18,25)	31±5	31 (27,35)

It is not enough and we have a small debt	27 (5.3)	24.9±3.7	25.5 (22.5, 27.5)	22±6	23 (18,27)	29±3	29 (27,31)
Just enough	144 (28.3)	26.5±3.3	26.5 (24.5, 28.8)	22±6	22 (18,25)	30±5	30 (27,33)
Enough	327 (64.2)	26.2±3.6	26.0 (24.0, 29.0)	21±6	20 (17,25)	31±4	31 (28,33)
P value		0.276		0.409		0.321	
Residence							
Urban	458 (90.0)	26.2±3.6	26.0 (24.0, 28.5)	22±6	21 (18,25)	30±5	30 (28,33)
Rural	51 (10.0)	26.9±3.2	26.5 (25.0, 29.0)	21±6	21 (19,24)	31±4	31 (28,34)
P value		0.141		0.888		0.237	
Occupation							
Working	264 (51.9)	26.2±3.6	26.0 (24.0, 29.0)	22±6	21 (18,25)	30±5	30 (27,33)
Not working	245 (48.1)	26.3±3.5	26.0 (24.0, 28.5)	21±6	21 (18,25)	31±4	31 (28,34)
P value		0.614		0.883		0.283	
History of COVID infection							
Yes, and confirmed	136 (26.7)	26.1±3.4	26.0 (24.0,28.3)	21±6	21 (17,25)	31±4	31 (29,34)
Yes, but not confirmed	191 (37.5)	25.7±3.4	25.5 (23.5,27.5)	22±6	22 (18,25)	30±5	30 (27,33)
No	182 (35.8)	26.9±3.6	26.5 (24.5,30.0)	22±6	22 (18,25)	30±4	30 (28,33)
P value		0.003*		0.866		0.499	
History of COVID infection in family member							
Yes	490 (96.3)	26.2±3.5	26.0 (24.0,28.5)	21±6	21 (18,25)	31±4	31 (28,33)
No	19 (3.7)	27.6±3.3	26.5 (25.0,30.5)	23±7	23 (19,28)	29±3	29 (28,31)
P value		0.137		0.093		0.131	
Presence of chronic disease							
Yes	118 (23.2)	26.4±3.6	26.3 (23.5,29.5)	22±7	22 (18,26)	31±4	31 (28,33)
No	391 (76.8)	26.2±3.5	26.0 (24.0,28.5)	21±6	21 (17,25)	30±4	30 (28,33)
P value		0.64		0.135		0.624	

*Statistically significant

Table 3. Participants´ attitude towards COVID-19 vaccine and it´s relation with COVID-19 risk perception

	Risk perception		
	Low (<60%)	High (≥60%)	p value
I think a vaccine can help control the spread of the corona-virus			
Strongly disagree	7 (4.8)	5 (1.4)	<0.001*
Disagree	27 (18.5)	26 (7.2)	
Neutral	45 (30.8)	82 (22.6)	
Agree	51 (34.9)	149 (41.0)	
Strongly agree	16 (11.0)	101 (27.8)	
If I knew I had the corona virus before, I wouldn't get the vaccine even if it was available			
Strongly disagree	26 (17.8)	66 (18.2)	0.498
Disagree	63 (43.2)	143 (39.4)	
Neutral	30 (20.5)	79 (21.8)	
Agree	22 (15.1)	48 (13.2)	
Strongly agree	5 (3.4)	27 (7.4)	
When anyone else is vaccinated against the Corona virus, I do not need to be vaccinated			
Strongly disagree	45 (30.8)	91 (25.1)	0.047*
Disagree	68 (46.6)	165 (45.5)	
Neutral	25 (17.1)	53 (14.6)	
Agree	6 (4.1)	33 (9.1)	
Strongly agree	2 (1.4)	21 (5.8)	
Do you think everyone should be vaccinated against the Corona virus?			
Strongly disagree	7 (4.8)	7 (1.9)	<0.001*
Disagree	24 (16.4)	27 (7.4)	
Neutral	46 (31.5)	60 (16.5)	
Agree	38 (26.0)	106 (29.2)	
Strongly agree	31 (21.2)	163 (44.9)	

*Statistically significant

Figure 1. Relation between participants´ COVID-19 vaccination status and risk perception P=0.69

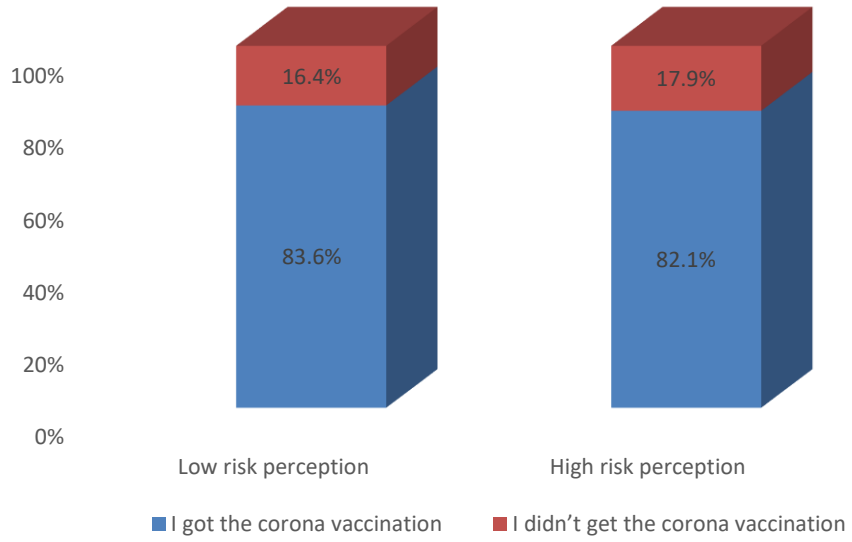
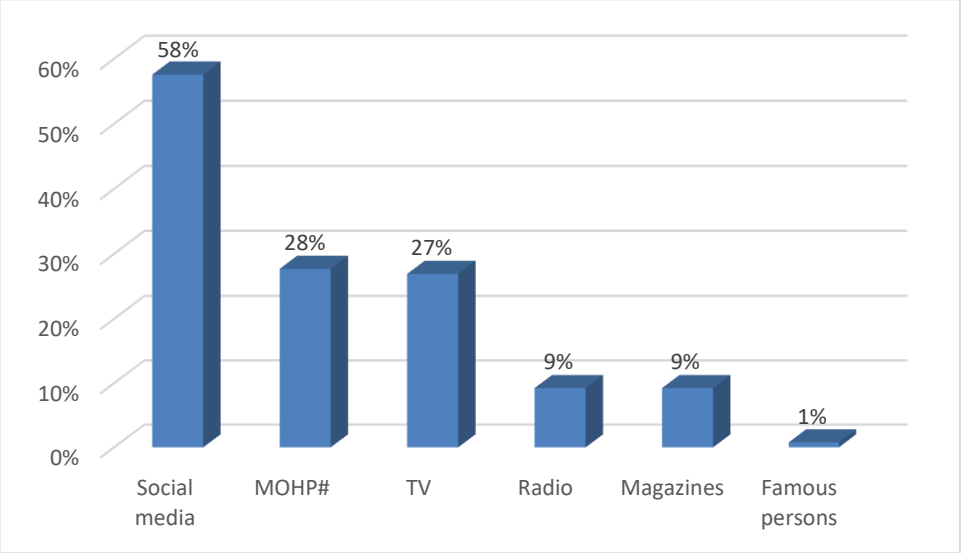
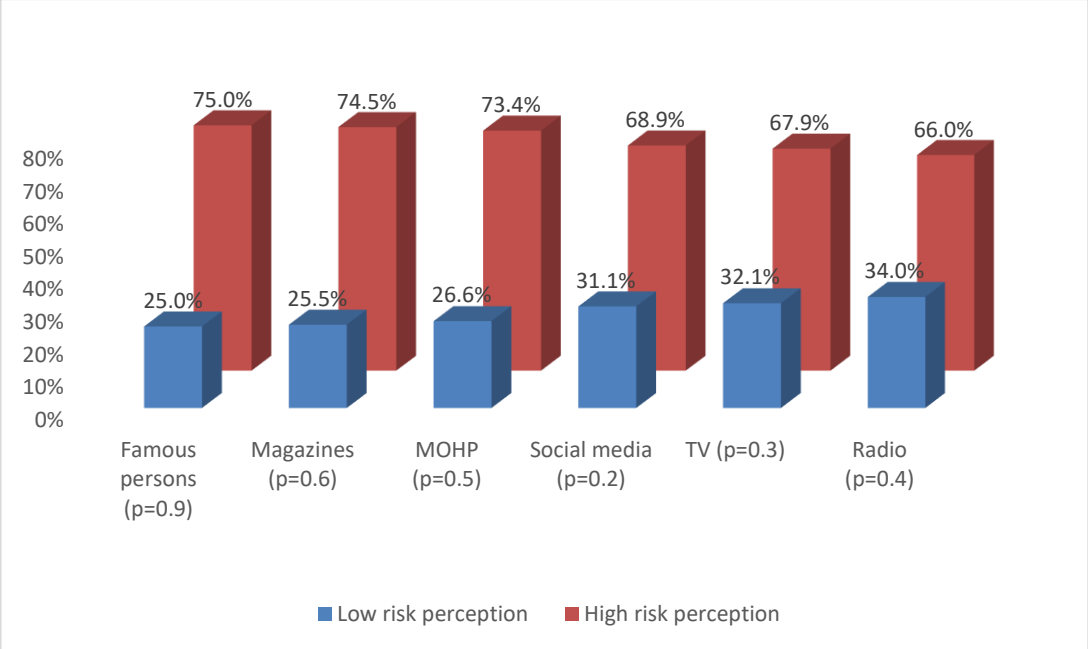


Figure 2. Participants´ source of knowledge



#MOHP: Ministry of health and population

Figure 3. Relation between different sources of knowledge and participants´ COVID-19 risk perception



Discussion

Risk perception is the personal difference in the way of information processing and reacting to risky events. It is highly important for the health conduct and is a key for decision- making about reducing certain health dangers [2]. It was assessed via 3 domains of the EPPM, namely efficacy (self-efficacy and response efficacy), defensive response (denial, reactance, and avoidance), as well as threat (susceptibility and severity). The median score percent of the risk perception of COVID-19 was 64.7% with IQR (58.6, 70.7). In this study that was conducted in Egypt (low/middle income country), [16] the overall risk perception was relatively acceptable; this goes with a systematic review that compared risk perception studies in thirty countries, suggesting that the only differences were that those from developing/ low-income/ countries reported lower risk perception [5]. A study done among the general population of Riyadh region to assess COVID-19 risk perception after the vaccination era during the period of June 2021 to December 2021, it was found that the perception of 30.2% of

participants did not change after vaccination [17]. A study that compared the findings of 2 cross-sectional online surveys, concluded that the scores of the perceived risk perception were low between late (from 11 to 16 May 2020) and early (From 26 to 31 March 2020) lockdown [18]. Another study done among 2273 medical students from 18 governmental medical schools in Egypt after receiving COVID-19 vaccination to assess the perception of COVID-19 risk, the researchers noticed a slow decline in the perceived risk of vulnerability and susceptibility to COVID-19 infection among students in parallel to a growing perception of self-efficacy and controllability [19].

Risk perception wasn't significantly affected by the socio-demographic characters of our study participants (p value > 0.05). Despite the literature revealing that the risk perception of the COVID-19 was affected by age, gender, education, occupation, presence of chronic diseases. Being older, female, with a higher income, serving as a healthcare professional, and being a university student or holding an academic degree were all prediction factors of a higher risk perception [5,7]. Risk perception wasn't significantly affected by presence of chronic diseases (p value > 0.05) and that doesn't go with similar studies that found that having a chronic condition presented a positive correlation with risk perception [20,21].

In this study, it was found that perceived efficacy was significantly higher in participants with no previous history of COVID-19 infection, which agreed with the study findings conducted by Jahangiry et al. where they found that participants having previous corona virus infection had significant low self-efficacy [14]. This is inconsistent with facts about self-efficacy and its relation with disease status, which implies for further investigations targeting possible reasons for such findings.

The current study revealed that risk perception was not affected by the vaccination status of participants, which is consistent with a study conducted in USA stating that partial vaccination didn't cause a significant change in risk perception. In contrast, the same study findings highlighted that fully vaccinated subjects had a reduction in their risk perception towards COVID19 and consequently a rapid rebound in socializing activities [22].

This finding can be explained by the timing of the current study (March- May 2022), being conducted during the post-vaccination period in Egypt (January 2021), with more than 6-8 months passed after the last vaccination dose. People are almost practicing their normal life with less restrictions and vaccination obligation.

Participants with positive attitude towards COVID-19 vaccine had significantly higher risk perception. This goes with Chinese research that illustrated that 91.3% of the participants argued that they would not refuse vaccination against COVID-19. Additionally, the higher perceived risk of COVID-19 was related with this attitude [22]. Another study showed that most participants had positive attitudes towards the COVID 19 vaccines [23,24].

In terms of the knowledge sources, social media was ranked the highest among 58% of participants. In another study in China, social media was a primary source for COVID-19 information [25]. No significant impact was detected on participants' risk perception in the current study. This doesn't match the results by another study which explored the contribution of exposure to social media to risk information about COVID-19 in predicting the risk perception of the study participants, the findings showed a major significant effect of social media on risk perception [26].

Conclusion

COVID-19 risk perception is still query and not fully understood. This necessitates more studies to be conducted to explore it among different groups which may relate it to different determinants. Social media is ranked the highest in terms of the knowledge sources among participants and should be professionally used for enhancing positive attitudes towards COVID-19 vaccination.

Study limitations

While using an online Google form for data collection in a cross-sectional study offers convenience, it also comes with several inherent limitations. One such limitation is the potential for sampling bias, as participants self-select and may not fully represent the diversity of the population due to factors like internet access. Additionally, the absence of direct supervision during data collection raises concerns about data quality, including the possibility of response errors or incomplete submissions. Furthermore, the inability to establish causality between variables and the lack of depth in responses may limit the study's ability to provide comprehensive insights. It's also important to

acknowledge that generalizability may be constrained due to the convenience sampling method used and potential technology-related issues like browser compatibility.

Declarations

Ethical consideration

The approval of the study protocol was made by the Scientific Committee of the Public Health Department, Faculty of Medicine, Cairo University and by the Ethical Committee of the Faculty of Medicine, Cairo University (N-8-200), date of approval was 16/2/2022. Only the participants who offered agreement were included, and the others who refused were excluded from the research by presenting empty forms after responding "Not willing to participate." All data collection procedures were confidential following the Helsinki Declarations of biomedical ethics. The subjects were told that the survey was anonymous, and that their participation was voluntary.

Consent for publication

Null

Availability of data and materials

The datasets utilized and/or analyzed in the present study are available from the corresponding author on reasonable request.

Competing interests

The researchers declare that they do not have any competing interests.

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self-funded.

Authors' contributions

M.M.Z: study design, data interpretation and statistical analysis, revised the manuscript and approved the final version.

A.M.S: Data collection, revised the manuscript and approved the final version.

A.M.S: Data collection, revised the manuscript and approved the final version.

R.M.M.: Study design, writing up, revised the manuscript and approved the final version

S.M.F: Methodology writing, revised the manuscript and approved the final version.

R.I.A.H: Study design, writing up the manuscript, approved the final version

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Clinical impact (what´s new)

COVID-19 is of public health impact on Egyptian population till the end of 2023, the total confirmed cases of COVID-19 in Egypt reached more than half million cases with around 25 thousand death. A total of 112,673,353 vaccine doses have been administered in Egypt till November 2023. As COVID-19 preventive measures are not mainly by the vaccine but with the general preventive measures of droplet infections. This study aimed at assessment of the COVID-19 perception after the introduction of vaccine as if the population's perception decreased, this may affect the adherence to general preventive measures that may later lead to increase in the number of cases and in addition the number of deaths.

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