The Association of Sociodemographic Characteristics of Blood Donors with Primary Preventive Measures (PPM) During COVID-19 Pandemic

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Abstract

Background: The recent COVID-19 epidemic outbreak is an ongoing crisis that is causing global uncertainty on an unrivaled scale. During this outbreak, blood banks worldwide continue serving patients at risk of a contagious status.

Objectives: This study aimed to evaluate the relation between the sociodemographic characteristics including age, gender, education level, income, and job type with primary preventive measures including avoiding the crowd, washing hands, wearing masks, wearing gloves, and social distancing during COVID-2019 pandemic. Additionally, the other goal was to help the central blood bank/Tripoli (CBB/T) to assign suitable donors for collecting COVID-2019 Convalescent Plasma (CCP), which is used to treat COVID-19 patients.

Materials and Methods: A combined questionnaire-rapid test-based study was attained in the Faculty of Medicine, the University of Tripoli in collaboration with the CBB/T and the Libyan Centre for Biotechnology Research, Tripoli, Libya. Questionnaires were distributed, signed consent, and filled by blood donors of CBB/T. Whole blood and serum samples were collected for the Wondfo SARS-CoV-2 antibody test and serological chemiluminescent assay (i-Flash-COVID-19 Analyzer). **Results:** analysis of data collected revealed that there were 49 (5%) positive tested blood donors out of 961 for Wondfo SARS-CoV-2 antibody test. The primary preventive measures (PPM) were significantly higher in the positive high-income group than in the negative high and low-income groups. Moreover, the PPM was significantly higher in the positive participants in the pre-university level group than in the negative pre-university

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group. The positive participants at the university level showed higher PPM than the negative university and pre-university level groups. In regards to age, PPM was significantly higher in the positive participant 30^{th} and 40^{th}-decade groups than in the negative 30^{th} and 40^{th}-decade groups, respectively. In regard to the gender, PPM was significantly higher in the positive males and females groups than in the negative male group. Finally, PPM score was significantly higher in the positive medical and non-medical sector groups than the negative non-medical sector group.

Conclusion: The present study reported adverse results that although the blood donor participants followed the PPM during the COVID-19 pandemic, they were highly affected by the infection with disregard to the sociodemographic characteristics including high income, education levels, age, gender, and job type.

Introduction

Coronavirus disease (COVID-2019), is an acute respiratory disease, caused by a novel coronavirus (SARS-CoV-2), previously known as (2019-nCoV) associated with human to human transmission and severe human infection (Zhu et al., 2020).

COVID-2019 has recently detected in December 2019 among an outbreak of a cluster of cases of pneumonia of unknown etiology in Wuhan city, Hubei province, China, and received worldwide attention (Huang et al., 2020). Most of the original cases had close contact with local fresh seafood and an animal market (Perlman, 2020; Zhu et al., 2020). Within the next 12 weeks, it has spread globally to the extent that the World Health Organization (WHO) officially declared the SARS-COV-2 a global pandemic as a public health emergency of international concern on March 11, 2020 (WHO, 2020a). In addition to China, as of 14th March 2020, several exported cases have been confirmed in more than 150 countries, predominantly Italy, South Korea, Iran, Hong Kong, Macau, USA and Vietnam (Sahu et al., 2020). the current clinical diagnostic method for COVID-2019 virus is a reverse-transcription polymerase chain reaction (RT-PCR) test which detects the presence of the virus-specific nucleic acid in the nasal, throat, or other respiratory tract swab samples (WHO, 2020b). This test has several limitations including long turnaround times, requiring certified laboratories, and some number of false negatives for RT-PCR (Xie et al., 2020). These limitations led to the progressive development of rapid serological tests which detect anti- COVID-2019 antibodies

(IgG and IgM) simultaneously or separately for the diagnosis of COVID-2019 antibodies during the peak of the virus outbreak (Li et al., 2020; Whitman et al., 2020). These rapid serological diagnostic kits were also known as lateral flow immunoassays.

There are various risk factors influencing the severity of COVID-2019. The age of affected patients is found to be a strong risk factor (Arentz et al., 2015; Bialek et al., 2020; Guan et al., 2020; Jin et al., 2020; Livingston and Bucher, 2020; Wang et al., 2020; Wu et al., 2020; Yang et al., 2020; Zhou et al., 2020). The highest fatality rate increased among the older (more than 60 years) compared to the younger (0.2 years) population (Bialek et al., 2020). Moreover, the gender of the affected COVID-2019 patients was also considered a risk factor. Although men and women with COVID-2019 have the same prevalence, men with SARS-CoV-2 are more at risk for worse outcomes and death, independent of age (Jin et al., 2020; Yang et al., 2020). It was also suggested that the level of knowledge and attitudes toward covid-19 could contribute to controlling the transmission of covid-19 (Olum et al., 2020; Rugarabamu et al., 2020; Salman et al., 2020; Zhong et al., 2020). Some occupations and industries are at higher risk for COVID-19, particularly those employed by healthcare workers. they are at the frontline of the COVID-19 pandemic response and are exposed to the infection, psychological distress, fatigue, occupational burnout and stigma, and physical violence (World Health Organization, 2020). Over 100 health workers died of COVID-19, a tragedy to the world and a barrier to the fight against the disease (MedScape., 2020).

So far, there is no effective vaccination available against the COVID-2019. Therefore, the best way to reduce the risk of getting the infection is to follow the primary preventive measures including social distancing, wearing masks, and gloves, and regular washing of hands with soap (Borchgrevink et al., 2013; Chang et al., 2020; Cheng et al., 2020; Eikenberry et al., 2020; Lu et al., 2020). It is also important to avoid unnecessary travel, public transport, and contact with sick people, and crowded places. People who do not use protection policies are at higher risk of COVID-2019 infection.

Libya was one of the countries affected by COVID-2019. The first official confirmed case of this epidemic disease was reported in Libya on March 24, 2020, by an senior Libyan male who arrived from Saudi Arabia (Elhadi et al., 2020). Since then the spread of cases developed slowly due to the fast governmental protective actions including a partial lockdown by closing airports, mosques, educational institutions, and crossing borders, and other many measures (Gasibat et al., 2020). Unfortunately, by mid of May 2020, the number of cases was elevated

gradually due to the new travel arrivals from infected countries (National center for disease control).

During the COVID-19 pandemic, the blood donation centers continue serving the patients who need blood transfusions under CDC policy. Additionally, the blood banks serve to collect convalescent plasma for the prevention and treatment of COVID-2019 (Cai et al., 2020). Therefore, the aims of this study were to:

i) Carry out a survey at the CBB/T using a questionnaire to find out the relation between the sociodemographic characteristics with PPM during the COVID-19 pandemic. This was combined with a blood COVID-19 rapid test to detect the IgG/IgM antibodies which may give answers to the fewer cases reported in Libya compared to other countries and also to find out if there were asymptomatic cases.

ii) The other goal was to help the CBB/T to assign suitable donors for the collecting of CCP, which will be used to treat COVID-19 patients.

2. Material and methods

2.1. Population and study design

This cross-sectional study was carried out at the Faculty of Medicine, University of Tripoli (UOT) in collaboration with CBB/T and Libyan Centre for Biotechnology Research, Tripoli, Libya. The study participants of this questionnaire-based study included (961) blood donors at the CBB/T from May to July 2020. The objective of this study was explained to all participants and assurance was given that the information to be collected would be used for research purposes only. Ethical approval for this study was obtained from the Libyan centre for biotechnology research, Tripoli, Libya ethics service and all participants provided written informed consent, which was signed and returned to the research team.

The questionnaire used in this study consisted of two sections; the first section was about the age, gender, educational level, income level, and job type whereas the second section investigated the PPM applied by participants during the breakout including social distancing, wearing the mask, wearing gloves and regular hand washing.

2.2. Blood collection

Blood samples were collected under an aseptic technique in the CBB/T from May to July 2020. EDTA anti-coagulant-containing tubes were used to collect 5ml of whole blood from

each blood donor participant during the donation immediately for the Wondfo SARS-CoV-2 antibody test. 145 out of 961 blood samples were separated using EDTA tubes to analyze IgG/ IgM by using the iFlash- COVID-19 Immunoassay. All reactive samples for HBV, HCV, and HIV were excluded.

2.3. Laboratory testes

2.3.1. Wondfo SARS-CoV-2 antibody test

Wondfo SARS-CoV-2 antibody test (Lateral flow method) was performed to detect the presence of SARS-CoV-2 IgG/IgM antibodies in whole blood, serum or plasma samples. When the specimen is added to the test device, the specimen is absorbed into the capillary action, mixes with the SARS-CoV-2 antigen dye conjugate, and flows across the pre-coated membrane. The antibodies bound to the antigen-dye conjugate and produce a colored test band that indicates a positive result. 10 µl of whole blood was transferred to the sample well and then added 80 µl of buffer solution to the buffer well. Colored bands appear at both test (T) and control (C) lines indicating a positive result for SARS-CoV-2, whereas the appearance of a colored band at the (C) line only indicates negative results according to manufacturers' instructions.

2.3.2. Validation of Wondfo SARS-CoV-2 antibody test

- Test was used to evaluate the sensitivity and specificity of the Wondfo SARS-CoV-2 antibody test. Serum of 145 out of 961 samples were retested by iFlash- COVID-19 Analyzer to confirm the results obtained by the Wondfo SARS-CoV-2 antibody test.
- The Wondfo SARS-CoV-2 antibody test recommended using 10 µl of whole blood to test the presence of SARS-CoV-2 antibodies and the blood samples could be saved up to 7 days at 2-8 C^{o}.

3. Statistical analysis:

Data were analyzed using GraphPad Prism statistical software (version 6.0b; GraphPad Software Inc, La Jolla, CA, USA). Results are expressed as mean ± SEM and the analysis of data between groups was performed using Mann Whitney test and statistical significance between groups was accepted at $p < 0.05$.

4. Result:

The validation test showed that serum of 145 (Wondfo rapid tests) out of 961 samples were retested by iFlash-COVID-19 Analyzer. Ninthly five out of 145 samples were tested true negative for COVID-19 by both the Wondfo SARS-CoV-2 antibody test and the iFlash-COVID-19 Analyzer. Fifty samples out of 145 samples were positive by Wondfo test but when

retested by iFlash-COVID-19 Analyzer, 45 were positive and 5 samples were negative (False positive). We then contact the Wondfo SARS-CoV-2 antibody test company regarding these results. They recommended checking the rheumatoid factor (RF) for these participant as it might have cross reactivity with the Wondfo SARS-CoV-2 antibody and gave the false positive result. Interestingly, the result of RF for one out of 5 samples was positive. Therefore, the false positive result was excluded and considered as negative. Based on these results the Wondfo SARS-CoV-2 antibody test showed a sensitivity of (100%) and specificity of (95%).

All 961 blood donors of CBB/T signed consent, and completed and returned the questionnaires with a response of 100%. This study included 946 (98.4%) male and 15 (1.6%) female blood donors. The average age varied between 18-65y with a mean (34.75) of blood donors of Tripoli central blood bank. The 897 blood donors were from Tripoli and 82 were from other cities.

Wondfo SARS-CoV-2 antibody test showed that there were 49 (5%), positive tested blood donors, out of 961. Analysis of 910 negative and 51 positive blood donors with PPM representing (*P<0.001*), (Figure 1).

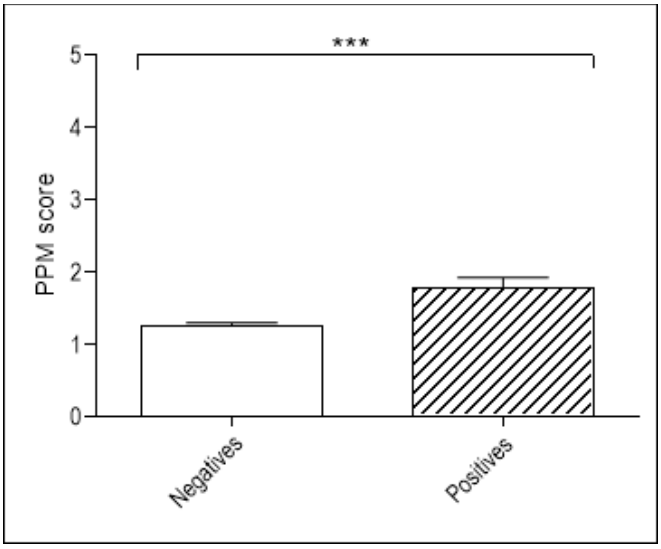

Figure 1. Association of PPM with the Wondfo antibody rapid test.

PPM score was significantly higher in the positive group than the negative group. Values were analyzed by Mann Whitney test and columns represents the mean ± SEM of 910 negative and 51 positive blood donors with *** representing *P < 0.001*.

The PPM was significantly higher in the positive high-income group than in the negative high and low-income groups. The positive high income, and positive low-income blood donors, when correlated with PPM showed values ($P<0.01$) and (0.001), respectively (Figure 2).

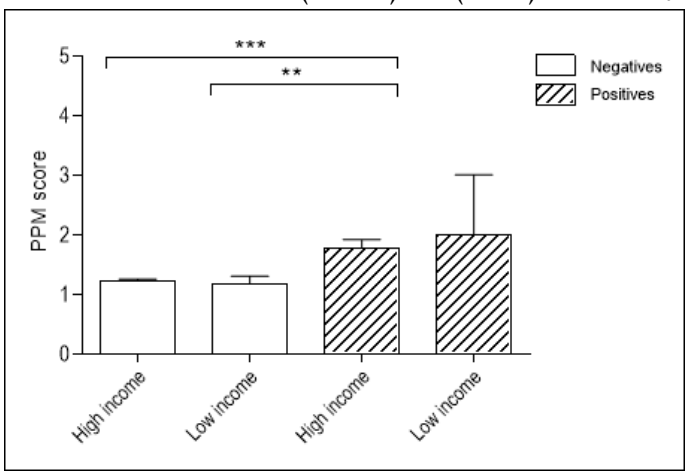

Figure 2. Association of PPM with income.

PPM score was significantly higher in the positive high income group than the negative high and low income groups. Values were analyzed by Mann Whitney test and columns represents the mean ± SEM of 800, 46, 49 and 2 negative high income, negative low income, positive high income and positive low income blood donors respectively with ** and*** representing $P < 0.01$ *and* 0.001 respectively.

The PPM was significantly higher in the positive pre-university level group than in the negative pre-university group. The positive university level showed higher PMM than the negative university and pre-university level groups with. Values were analyzed and reported that of 536, 310, 32, and 11 negative university level, negative pre-university level, positive university level, and positive pre-university level blood donors, respectively with Wondfo positive and negative tested blood donors PPM and education level representing ($P < 0.05$), (0.001) and (0.0001), respectively (Figure 3).

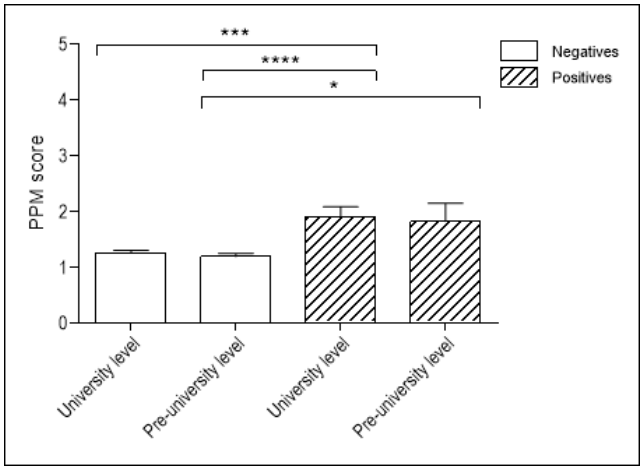

Figure 3. Association of PPM with education level.

PPM score was significantly higher in the positive pre-university level group than the negative pre-university group. The positive university level showed higher precaution measures score than the negative university and pre-university level groups. Values were analyzed by Mann Whitney test and columns represents the mean ± SEM of 536, 310, 32 and 11 negative university level, negative pre-university level, positive university level and positive pre-university level blood donors respectively with *, *** and**** representing $P < 0.05, 0.001$ and 0.0001 respectively.

As it is shown in figure 4, the PPM was significantly higher in the positive 30^{th} and 40^{th}-decade groups than in the negative 30^{th} and 40^{th}-decade groups respectively. Values were analyzed and of 24, 2, 272, 13, 319, 16, 220, 15, 57, and 3 negative 10^{th}, positive 10^{th}, negative 20^{th}, positive 20^{th}, negative 30^{th}, positive 30^{th}, negative 40^{th}, positive 40^{th}, negative 50^{th}, and positive 50^{th}-decade blood donors respectively compared with PPM representing ($P < 0.01$).

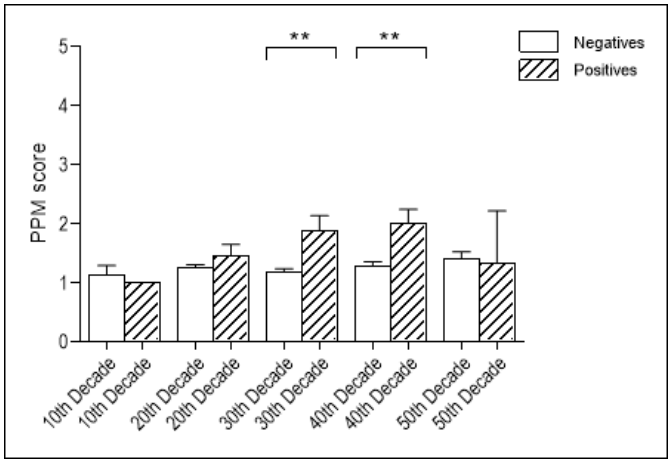

Figure 4. Association of PPM with age.

PPM score was significantly higher in the positive 30th and 40th decade groups than the negative 30th and 40th decade groups respectively. Values were analyzed by Mann Whitney test and columns represents the mean ± SEM of 24, 2, 272, 13, 319, 16, 220, 15, 57 and 3 negative 10th, positive 10th, negative 20th, positive 20th, negative 30th, positive 30th, negative 40th, positive 40th, negative 50th, and positive 50th decade blood donors respectively with ** representing $P < 0.01$.

PPM was significantly higher in the positive males and females groups than in the negative males' group. Values were analyzed and reported of 901, 9, 45, and 6 negative males, negative females, positive males, and positive females blood donors respectively with PPM representing ($P < 0.01$), (Figure 5).

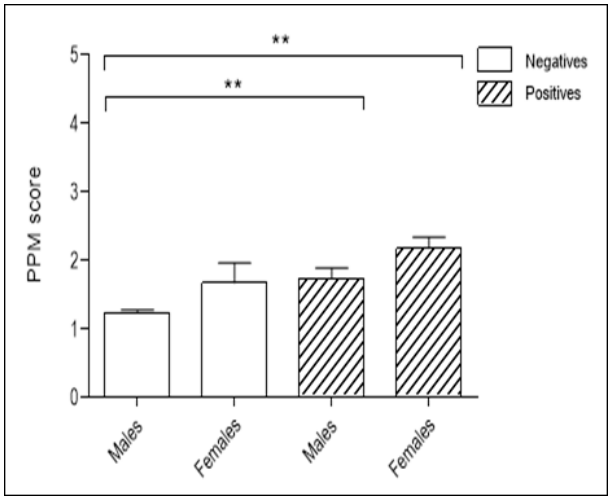

Figure 5. Association of PPM with gender.

PPM score was significantly higher in the positive males and females groups than the negative males group. Values were analyzed by Mann Whitney test and columns represents the mean ± SEM of 901, 9, 45 and 6 negative males, negative females, positive males and positive females blood donors respectively with ** representing $P < 0.01$.

Figure 6, showed the PPM was significantly higher in the positive medical and non-medical sector groups than the negative non-medical sector group. This showed that of 27 negative, 843 negative, and 6 positive and 39 positive blood donors from medical, non-medical, medical and non-medical sectors respectively with representing ($P < 0.05$) and (0.001) respectively.

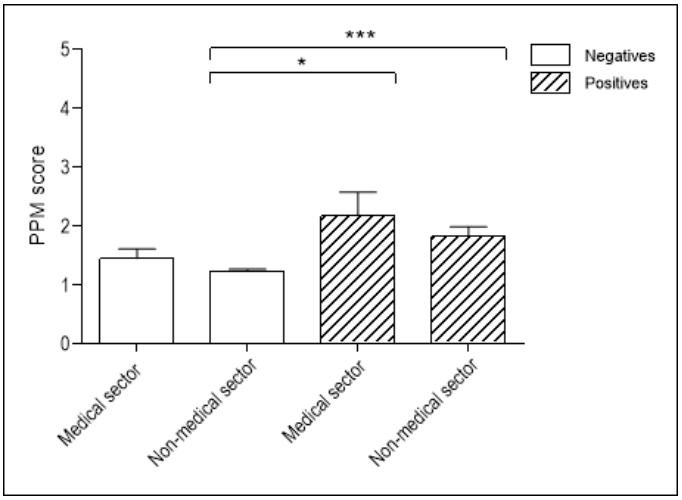

Figure 6. Association of PPM with Job type.

PPM score was significantly higher in the positive medical and non-medical sector groups than the negative non-medical sector group. Values were analyzed by Mann Whitney test and columns represents the mean ± SEM of 27 negative, 843 negative, 6 positive and 39 positive blood donors from medical, non-medical, medical and non-medical sectors respectively with * and *** representing P < 0.05 and 0.001 respectively.

5. Discussion:

The blood donation process was adversely affected by the COVID-19 pandemic due to a dramatic decrease in blood donors. Even though, the CBB/T continued to serve the public and meet patient blood needs. They also provide the hospitals with CCP obtained from blood donors who have recovered from coronavirus disease 2019 (Covid-19). We, therefore, chose to perform our study in this centre with great welcoming and cooperation of the staff and population who made our work easy and simple.

This study was established by validating the results of the Wondfo SARS-CoV-2 antibody test with iFlash analyzer. The validation of the sensitivity and specificity of the Wondfo SARS-CoV-2 antibody test showed that the sensitivity was 100%. This result gave us the confidence to use the Wondfo SARS-CoV-2 antibody test reliably. However, the validation of the Wondfo SARS-CoV-2 antibody test in this study was (100%) compared with a previous study held in Brazil (96%) (Aguilar-Shea et al., 2021; Dos Santos et al., 2020).

Following the validation, the authors became more confident using the Wondfo SARS-CoV-2 antibody test and continue the study and all the samples were tested. The number of affected participants with covid-19 detected in this study is lower than that reported worldwide at this time. This may be was due to several factors, the first important reason was the closing of airports, which delayed the importance of the COVID-19. Additionally, the early partial lockdown and limiting movements between the cities was applied by the government could be another reason for the few cases reported in Libya (Gasibat et al., 2020).

The questionnaire held in this study was analyzed and reported the correlation between sociodemographic characteristics in blood donors and PPM during COVID-19 using the Wondfo SARS-CoV-2 antibody test. **Firstly**, the analysis of the income of positive and negative covid-19 participants reported high significant PPM in the positive high-income group than in the negative high and low-income groups. In 2020, during the ongoing research, there were neither approved vaccines nor specific antiviral drugs for treating COVID-19 infections were available (Lu, 2020; Sheahan et al., 2020). The majority of countries applied control preventive strategies to stop further spreading of this potentially deadly virus. Of these strategies applied in Libya, is imposing restricted preventive measures such as wearing masks, hand washing, and avoiding the crowd. These preventive measures need enough income to be applicable. Therefore, we tried to find out the relation of the income of the blood donor participants with their ability to apply it. Unexpectedly, in this study, although the high-income participants applied the PPM, they were more affected by the COVID-19 than those lower-income. In some studies, the lower-income people were at high risk of COVID-19 than those of higher-income as they could not apply the PPM (Abdelhafiz et al., 2020; Zhong et al., 2020). This was opposite to the finding of our results.(Morawska et al., 2020) **Secondly**, the analysis of PPM and the education levels found that the PPM was significantly higher in the positive pre-university level group than in the negative pre-university group. In addition, the positive university level showed higher PPM than the negative university and pre-university level groups. This result indicated that those who followed the PPM were highly influenced by

the COVID-19 apart from their educational level (pre-and university levels). Many studies related the educational levels to the awareness and good knowledge about COVID-19, and a positive attitude towards using PPM, which is important to decrease the transmission of the disease (Abdelhafiz et al., 2020; Zhong et al., 2020).

Thirdly, PPM was significantly higher in the positive 30th and 40^{th} -decade groups than in the negative 30th and 40^{th} -decade groups, respectively. Again this study revealed unexpected results as those who followed the PPM were highly affected than the negative participants. This may be due to those affected participants being in active age groups who were responsible to lead and communicate for their work and life. Finally, comparing both genders with PPM recorded that the PPM was significantly higher in the positive males and females groups than in the negative males' group. Some studies reported that more than 50% of their positive COVID-19 participants were males (Li et al., 2020; Zhang et al., 2020). Another study reported an equal susceptibility to COVID-19 between males and females (Jin et al., 2020). The correlation between PPM and genders in this study showed that both positive males and females had similar susceptibility to the COVID-19 than the negative participants despite they followed the PPM.

To summarize, this adverse effect could be explained by that those positive participants may be exposed to the COVID-19 during their regular work and they may lack the experience to follow the PPM most of the time. It may also be due to high exposure to the pandemic in particular jobs and could occur if the facemasks were not properly worn and hand hygiene and social distancing were not appropriately practiced.

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