Impact of personal protective equipment on psychological and physical health during menstruation: A cross-sectional study among female frontline healthcare workers during COVID pandemic

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**ABSTRACT**

**Introduction:** During the Coronavirus disease 2019 (COVID-19) pandemic, personal protective equipment (PPE) has undoubtedly provided a shield of protection for the healthcare workers fighting the disease. However, the layers of the PPE kit restrict basic human activities and also have been associated with various other problems like dehydration, suffocation, breathlessness, headache, and dermatitis.

**Material and Methods:** A cross-sectional study was done among 180 Female health workers who wore the PPE kit during COVID-19 duty in a tertiary health care center during the period March 2021 to May 2021. The content-validated survey tool developed by Google Forms was sent to 180 Female health workers of COVID-19 hospitals to minimize face-to-face or physical interaction. The Work-Related Quality of Life Scale (WRQoL) was used. **Results:** The majority of the participants were interns (48.9%) and belonged to the age group of 21 to 25 years (67.7%). The approximate duration of wearing a PPE kit was 6 to 12 h for almost half of the study participants. Sanitary pads were used by over 90% of the participants. Only 59 out of 180 (32.7%) were provided with an extra PPE kit during menstruation. About 131 (72.7%) Female Health workers (FHWs) (FHWs) had to remove the PPE kit due to excessive sweat during menstruation; 110 FHW's out of 180 (61.1%) who participated in the study had to remove the PPE kit due to severe thirst and dehydration. Sweating (91%), dehydration (86.7%), rashes (49.9%), extreme thirst (56.5%), abdominal cramps (53.3%), and headache (59.8%) were the major complaints of the participants. The majority of the participants had low quality of life scores based on WRQoL. **Conclusions:** Use of PPE for long hours especially during menstruation can affect one both physically and psychologically compromising the work performance and decision-making. Minor changes in the work place environment can drastically improve the work-related quality of life.

**Keywords:** COVID-19, female frontline healthcare workers, menstruation, personal protective equipment (PPE), psychological and physical health

**Introduction**

Coronavirus disease 2019 (COVID-19) pandemic has been posing a formidable challenge to the healthcare system globally and also in India. As the disease still ravages the world with new strains such as Delta and Omicron, the personal protective equipment (PPE) has unequivocally provided protection to the health care workers fighting the disease.

However, the layers of the PPE kit restrict basic human activities like visiting the restrooms and taking refreshment breaks. There also have been various other problems that are associated with...
wearing PPE like dehydration, suffocation, breathlessness, headache, dermatitis, and so on.

In India, women represent 40% of the health care workers and are a valuable asset to the nation. The use of the PPE kit might have had a daunting effect on the physical and mental health of all HCWs but effect on female HCWs due to the menstrual process is exaggerated.

The environment inside the PPE due to multiple layers is very hot and humid to protect one from disease-causing micro-organisms. This environment is further worsened as every woman’s body temperature is elevated during menstruation, leading to increased sweating inside PPE and also exacerbating issues like dry mouth, rashes, sore skin, and so on. Not only does sweating cause dermatitis, blisters, and irritation but during menstruation, women need to change their menstrual pads/tampons at regular intervals to maintain menstrual hygiene and failure to change them at regular intervals can result in mild rashes, infections, or severe toxic shock syndrome (TSS).

Not only is menstrual hygiene important for your vaginal and reproductive health, it is also important for the urinary tract due to its close vicinity. It can result in both reproductive tract infections and urinary tract infections. India being a tropical country with hot and humid conditions acts as a catalyst making it much more difficult to work wearing the equipment.

Women who bleed in their PPE not only face physical but also psychological distress. Psychosocial stress may impact the severity of peri-menstrual symptoms through activation of the hypothalamic-pituitary-ovarian axis, thus altering ovarian hormone levels. It can affect the professional commitment which may result in absenteeism from the duty.

Medical practitioners are expected to make split-second decisions more often than not and hence are required to be in the best possible state of mental health, any mistake could result in discomfort, disability, or even cost a life. Increased working hours with little or no breaks result in a decreased quality of work, which cannot be compromised in this case. Hence, present study has been conducted to log the effect of PPE on the mental and physical health of female HCW to collectively understand the problem. We have to come up with suitable workplace laws and changes to become more accommodating toward female HCW and improve their work related quality of life.

They comprise a big chunk of the health care system forming the backbone and it is necessary to make sure that we protect and strengthen it. During the study, not only have we shed light upon the major problems but also come up with few realistic and feasible solutions to counter the problem. In the context of COVID-19 pandemic and emerging new strains, health care workers including family physicians are under the constant pressure of dealing with it, whether it is during the routine outpatient, inpatient, or home visit services for the patients. This study focuses on the aspect of the impact of PPE on psychological and physical health during menstruation among female frontline healthcare workers, many of whom would be working as family physicians in their near future.

**Objectives**

1. To evaluate the perceived impact of PPE kits on work performance due to physical and psychological stress during menstruation.
2. To assess the work-related quality of life while wearing PPE during menstruation on Female HCW using Simon Easton’s and Darren Van Laar’s scale.

**Material and Methods**

A cross-sectional study was designed to understand the impact of the PPE kit among female medical staff fighting COVID-19 in a tertiary health care hospital during the period of March 2021 to May 2021. The participants were informed about the purpose of the study and informed consent was taken before the data collection.

Sample Size: 180 female health workers, who wore the PPE kit during COVID duty.

Inclusion criteria were as follows:

- Female health workers who wore the PPE kit cared for the suspicious COVID-19 cases in emergency departments and screening clinics, COVID-19 patients in the infectious department, intensive care units, and isolation wards.
- Females of reproductive age (i.e., between 12 and 51) and have had their menstrual cycle for the past two months.
- Voluntary participants (informed consent was taken).

Exclusion criteria were as follows:

- Participants who did not have their menstrual cycle for the past two consecutive months or have been diagnosed with any medical, gynecological, or psychosis were excluded from the study.

Data collection method: The content-validated survey tool developed by Google Forms used as a platform was sent to 180 female health workers of COVID-19 hospitals to minimize face-to-face or physical interaction. The survey conducted is anonymous, and confidentiality of information was assured. It contained a questionnaire along with a consent form for data collection.

**Study Questionnaire.**

Part 1 of the study included socio-demographic information of the participant (age, weight, Designation, Hospital, etc.).

Part 2 assessed the details of the personal protective kit which included components of PPE kit, donning time, doffing time, number of kits given per day, number of duty days, level of discomfort, and so on.
Part 3 included the physical impact of the PPE kit especially during menstruation like itching, rashes, disability issues, aggravation of symptoms like abdominal pain, generalized body ache, dehydration lower backache, breast tenderness sweating, and giddiness.

Part 4 assessed different emotions and thoughts caused by wearing a PPE kit during the menstrual cycle like anger, anxiety, irritability, tension, depression, insomnia, confusion, headache, fatigue, and appetite increase. These questions were asked using a four-point ordinal scale with anchors at all points: “never,” “mild,” “moderate,” and “severe.”

Part 5 assessed WRQoL (Work-Related Quality of Life Scale). The WRQoL scale consists of 11 items on a 5-point Likert scale (from 1 = “strongly agree” to 5 = “strongly disagree”) and three subscales that measure the work-related quality of life. The subscale “general wellbeing” (GWB) also has six items (q1, q2, q3, q4, q5, and q6) and is related to happiness and life satisfaction. The subscale “stress at work” (SAW) consists of two items (q7 and q8) related to under pressure at work. The subscale “control at work” (CAW) consists of three items (q9, q10, and q11) related to being able to have control over decisions.

It briefly constitutes the following parameters: General wellbeing, Work-home interface, Job and career satisfaction, Control at work, Working conditions, and stress at work.

Data were collected, tabulated, and analyzed with the help of MS Excel and Epi Info software. Data were presented in percentages, bar and pie diagrams, and proportions.

**Results**

**Demographic characteristics and PPE usage**

A total of 180 female health workers responded to the survey. Valid responses were received from 180 of 200 FHW’s who were selected for the study. The majority of the participants were interns (48.9%) and belonged to the age group of 21 to 25 years (67.7%).

The frontline FHW’s working in the dedicated COVID hospital selected for the study were using N95 masks, surgical latex gloves, waterproof long-sleeve full-body gowns, Rubber boots for the feet, face shields/visor, and goggles in routine patient care.

Table 1 depicts that the approximate duration of wearing a PPE kit was 6 to 12 h for almost half of the study participants; 33 out of 180 (18.3%) participants were compelled to wear the PPE kit for more than 12 h. The participating female healthcare workers were wearing the PPE kit for an average of 9 h per day for 7 days continuously.

Only one PPE kit was provided to more than 70% of the study participants. Two PPE kits were provided to 22.2% and more than two PPE kits were provided to 6.1% of the study participants.

| Level of discomfort when wearing a PPE kit | n   | Percentage |
|-------------------------------------------|-----|------------|
| Not at all                                 | 5   | (2.7%)     |
| A very small extent                        | 12  | (6.6%)     |
| To a moderate extent                      | 54  | (50%)      |
| To a very great extent                     | 109 | (60.5%)    |

Totally, 109 out of 180 FHW’s were facing discomfort due to the PPE kit to a very great extent. The majority of the participants in the study were provided with a separate designated area for donning and doffing; 121 out of 180 participants faced size problems with the PPE kits or any of its components.

**Adverse health effects of PPE use**

Table 2 depicts the adverse effects of PPE use Sanitary pads were used by over 90% of the participants. Only 59 out of 180 (32.7%) were provided with an extra PPE kit during menstruation.

Totally, 131 (72.7%) FHW’s had to remove the PPE kit due to excessive sweat during menstruation; 110 FHW’s out of 180 (61.1%) who participated in the study had to remove the PPE kit due to severe thirst and dehydration. So it is evident that wearing PPE is very uncomfortable and inconvenient for a prolonged period.

About 45% of the study participants did not take a leave, whereas 34.4% had taken one day and 16.6% had two days leave.

Totally, 33 out of 180 FHW’s (18.3%) in this study had taken medication to delay the menstrual cycle so that it doesn’t coincide with their duty days.

Figures 1 and 2 depict the physical and psychological adverse effects experienced by the female health workers due to PPE kit, especially during the menstrual cycle.

Sweating (91%), dehydration (86.7%), rashes (49.9%), extreme thirst (56.5%), abdominal cramps (53.3%), and headache (59.8%) were the major complaints of the participants. Excessive sweating was the commonly expressed problem among the study participants.
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The symptoms that were drastically aggravated during the menstrual cycle were rashes, itching, sweating, and dehydration. The minor complaints were nausea, lower backache, abdominal bloating, and breast tenderness.

Female health care workers experienced various psychological symptoms such as anger, anxiety, fatigue, irritability, tension, and headache. A total of 152 FHW's out of 180 (84.5%) feel that irritability was one of the major symptoms that aggravated during the menstrual cycle. The other major psychological symptoms were depression (45%), tension (33.5%), and fatigue (66%). These psychological symptoms faced by the FHW's have influenced the decision-making skills which further compromised the work quality. It was observed that FHW's who experienced depression and irritability were the ones who faced the most stress at work.

Quality of life at work was calculated by the aggregation of these three subscales: General wellbeing (GWB), Stress at work (SAW), and Control at work (CAW). A score of 6 to 18 GWB is considered lower QoWL (Quality of work-life), 19 to 23 GWB is average QoWL whereas 23 to 30 GWB is high QoWL. SAW with a score of 2 to 4 is low QoWL, 5 to 6 is average QoWL whereas 7 to 1 is Higher QoWL. A score of 3 to 9 CAW is considered lower QoWL, 10 to 11 CAW is average QoWL whereas 12 to 15 CAW is high QoWL.

Table 2: Adverse health effects of PPE use

| Menstrual hygiene product | n  | Percentage |
|---------------------------|----|------------|
| Sanitary napkin/Pad       | 170| (94.4%)    |
| Tampon                    | 3  | (1.6%)     |
| Menstrual cup             | 7  | (3.8%)     |
| Re-usable cloth pad       | 0  | 0          |
| Abnormal menstrual cycles | 75 | (41.6%)    |
| Provided with an extra PPE kit during menstruation | 59 | (32.7%) |

Level of discomfort when wearing a PPE kit especially during periods:

- Not at all: 6 (3.3%)
- A very small extent: 12 (6.7%)
- To a moderate extent: 41 (23.3%)
- To a very great extent: 121 (67.7%)

Remove the PPE kit due to severe thirst or dehydration during menstruation: 110 (61.1%)

Remove the PPE kit due to excessive sweat during menstruation: 131 (72.7%)

How many days did you take a leave due to menstrual periods?

- 0: 81 (45%)
- 1: 62 (34.4%)
- 2: 30 (16.6%)
- >2: 7 (3.8%)

Taken tablets to delay the menstrual cycle so that it doesn't clash with the duty days: 33 (18.3%)

Figure 1: Physical health problems experienced by female health workers while using PPE during the non-menstrual phase and menstrual phase

Figure 2: Psychological health problems experienced by FHW while using PPE during the menstrual cycle

Table 3 shows the number of participants with the respective quality of life scores with regard to general wellbeing, stress at work, and control at work.
work, and control at work. SAW was determined by the extent to which an individual perceived they have excessive pressures and feel stressed at work. CAW reflects the level to which a FHW feels they could control their work through the freedom to express their opinions and being involved in decisions at work. Totally, 122 out of 180 (67.7%) participants experienced excessive stress during work; 29.4% had lower QoWL in the aspect of control at work whereas 45.5% had average QoWL. The majority of the participants had low quality of life scores.

Limitation of the study: When the participants filled in the questionnaire, not all of them were perceiving pain and irritation due to difference in menstrual cycles. Hence, resulting in bias on psychological symptoms perceived by participants might have been there.

**Discussion**

One in five women bleed so heavily during their periods, they have to put their normal lives on hold just to deal with the heavy blood flow. The menstrual cycle has been implicated as a cause of a multiplicity of effects ranging from biochemical to psychosocial. Medications such as non-steroidal anti-inflammatories, like ibuprofen and naproxen, have been used over the counter to relieve the pain. Although menstruation is a natural recurring process, it affects us both physically and psychologically hampering work efficiency.

To prevent the COVID-19 transmission, frontline nurses were wearing N95 masks for a prolonged period, which resulted in the nasal bridge scar and friction erosion of the facial skin. Similar findings were echoed in a study conducted in Hubei Province in China. Since the pandemic FHWs are required to wear PPE kits for 6 to 12 long hours sometimes even more without being given extra kits for change due to the scarcity. This has especially affected menstruating FHWs because of the necessity to maintain menstrual hygiene during COVID duties. Putting on and removing PPE prevents quick changing of menstrual hygiene materials, leading women to bleed into protective suits and compromising their hygiene.

It also paves way for bacterial infections like TSS. The rashes, cramps, fatigue that come along with it paired up with dehydration affects the working capacity of the FHWs. Some of the common issues that are faced by the FHWs that play a key role in their work efficiency are as follows:

| Table 3: WRQoL (Work-Related Quality of Life Scale) |
|-----------------------------------------------|
| Subscales                                      | Lower QoWL | Average QoWL | Higher QoWL |
| General wellbeing (GWB)                       | 78 (43%)   | 52 (28.8%)   | 50 (27.7%)  |
| Stress at work (SAW)                          | 122 (67.7%)| 23 (12.7%)   | 35 (19.4%)  |
| Control at work (CAW)                         | 53 (29.4%) | 82 (45.5%)   | 45 (25%)    |

Severe menstrual cramps (dysmenorrhea).

Before/during menstruation, most women experience pain and cramping associated with other symptoms such as bloating, nausea and vomiting, headache and lower back pain/pelvic pain, dizziness, disorientation, and so on. It can last for up to 3 days and affect control at work. In this study, abdominal cramps and headache were the major problems experienced by the participants. It was observed that these symptoms were aggravated due to the PPE kit.

Abnormal menstruation cycles.

For menstruation status, abnormal menstruation cycles were observed more often among female health care workers in the short interval group than those in the long interval group. A long work time and short interval time could increase worker anxiety and dissatisfaction and may deteriorate the menstrual cycle. This in turn affects their cognitive abilities.

Dermatitis.

Pads when worn for long hours especially during the COVID duties can cause rashes and inflammation due to friction and infrequent changing of pads. This not only causes physical symptoms such as pain, itching, swelling, and redness but also vulva irritability and lack of quality performance. This was similar to the findings of the study conducted during Severe Acute Respiratory Syndrome (SARS) in 2006. Long work hours can lead to leakage of menstrual blood and pain due to rashes in turn affecting the concentration and promoting absenteeism. The majority of the participants in the study were facing skin problems due to continuous friction between skin and the tight PPE kit.

Sweating and Dehydration.

During the COVID-19 pandemic, wearing PPE may have become the new normal for healthcare providers including females. For the healthcare workers’ task, multiple layers of non-woven clothing, barrier fabrics, gloves, and eye protection aren’t optional, no matter how hot and humid the environment happens to be and menstruation is no different. PPE causes an increase in body temperature by preventing heat from being lost through sweat dehydration. A study from Doll (2017) stated that overheating due to PPE is quite common. All the participants have described that the main issue is dehydration when putting on PPE is compulsory. Not only dehydrated, sweating due to overheating when they do physical work contribute to uneasiness particularly.

Premenstrual syndrome (PMS).

PMS increases absenteeism, reduces work productivity, impairs household activities, and influences negatively social relationships. It increases anxiety, tension, and proneness to conflict, and ultimately, these symptoms decrease work performance and quality of life. Distractibility and irritability in FHW, which may occur...
due to PMS, may cause incorrect applications and irreparable health outcomes. PMS also negatively affects a FHW’s patient communication and care, which in turn threatens patients’ safety. Wearing PPE during menstruation decreases concentration and cognitive abilities due to fatigue, dizziness, irritability, headache, and other associated symptoms. Perceived control at work is being increasingly recognized as a central concept in the understanding of relationships between stressful experiences, behavior, and health. Control at work within the current QoWL model is influenced by issues of communication, decision-making, and decision control. Namavar Jahromi et al. report that work stress may exacerbate PMS, and consistent with this, our results show that nurses with PMS feel more stress at work.

**Conclusion**

As a doctor, one is constantly required to be alert and decisive but the use of PPE for long hours especially during menstruation can affect one both physically (dermatitis/rashes, dehydration, worsening of the cramps, increased body temperature, and increased risk of TSS) and psychologically (tiredness, irritation, fatigue, mood swings, etc.) compromising the work performance and decision-making.

Following measures could alleviate the symptoms and work-related quality of life satisfaction:

- Allocation of extra PPE kits while keeping in mind the menstrual cycles of FHWs allows window for a break to maintain menstrual hygiene and rehydrate themselves, thereby improving the quality of work.
- Providing chargeable heating pad for the department which can be sanitized after every use by the female HCWs during short breaks in the shift can relieve the cramps.
- Study suggests that the application of local heat can reduce muscle tension and relax abdominal muscles to reduce pain caused by muscle spasms.
- The material of prophylactic dressings could be improved to keep the moisture balanced and prevent dermatitis to deal with the discomfort during menstruation and promote hygiene.
- Providing flexible shifts or duty allotments/leaves can help female health workers cope with menstrual symptoms and reduce cases of medical negligence.
- Promoting habit of drinking plenty of water pre and post shifts.
- Psychological and behavioral researches like this study could help to serve as a guide to health administrators and other HCWs in adopting ways and means to ameliorate the problems encountered in the use of PPE kits.

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**Conflicts of interest**

There are no conflicts of interest.

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