

# Knowledge, Practices and Attitudes Regarding Vitamin D Insufficiency among Health Care Workers' Women with COVID-19

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## Abstract

**Background:** Vitamin D insufficiency is a common health issue widespread throughout the world; however, there are numerous groups that are on the highest risk of insufficiency. The insufficiency of vitamin D is the grand restrainable and preventable challenge throughout the world. COVID-19 outbreak is a significant health issue and has a universal attention with extant the pandemic of COVID-19 and the growing cases infected by it. Health care workers' women have the superior risk of exposure for COVID-19 among the population cannot be overlooked. **Aim:** Assessing knowledge practices, and attitudes, regarding vitamin D insufficiency amongst health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university. Explore the relation between serum vitamin D level of health care workers' women and severity of COVID-19 symptoms. **Methods:** A Descriptive-analysis study was proceeded at COVID -19 outpatient clinic at maternity and gynecological hospital, Ain Shams University, from onset of February to the ending of April 2021. A purposive sample of 68 health care workers' women with confirmed COVID-19. Data were gathered through four main tools. The first, structured interviews questionnaire which consisted of two parts, the first was to assessing demographic and clinical features of the studied health care workers' women with COVID-19. The second part was the laboratory analysis of serum levels of 25-hydroxy vitamin D using the electrochemiluminescence immunoassay technique on Cobas e411 immunoassay analyzer-Hitachi Ltd- Japan. The second, a self-administered google form online questionnaire was utilized to evaluate confirmed COVID-19 health care workers' women knowledge, regarding vitamin D. The third: A self-reported practices google form online questionnaire was utilized to evaluate confirmed COVID-19 health care workers' women practices for vitamin D ingestion and habitual sun exposure, The fourth: A self-administered google form online questionnaire was utilized to assessing confirmed COVID-19 health care workers' women attitude on behalf of vitamin D insufficiency. **Results:** Demonstrated that the confirmed COVID- 19 health care workers women' mean age' was  $40.9 \pm 8.7$  years. Whereas (7%) of studied participants were had vitamin D sufficiency, (78%) had vitamin D insufficiency and (15%) had vitamin D deficiency with total mean  $\pm$  SD ( $16.8 \pm 8.9$ ). Whilst mean  $\pm$  SD of the total vitamin D knowledge scores was ( $49.8 \pm 16.1$ ) and (23.5%) of studied participants had sufficient knowledge and (76.5%) had insufficient knowledge. While (25%) of studied participants had adequate practice, (75%) had inadequate practice. Moreover (51.5%) of studied participants had positive attitude, and (48.5%) had negative attitude. A statistically significant relationship between majority COVID-19 symptoms in confirmed COVID-19 health care workers' women and their vitamin D level. **Conclusion:** The study displayed that mostly of health care workers' women with COVID-19, had insufficient knowledge regarding to vitamin D, had inadequate habitual sun exposure practices and vitamin D ingestion, and nearly half of health care workers' women with COVID-19 had negative attitude toward vitamin D. Virtually, insufficiency of vitamin D in study participants could be a risk factor of COVID-19 infection.

**Keywords:** Attitudes, COVID-19, Health Care workers' women, Insufficiency, Knowledge, Practice, Vitamin D.

## Introduction

Vitamin D is a fat-soluble vitamin, around 90% of it is produced in the skin when sunlight's ultraviolet rays trigger its synthesis, the augmentation skin pigmentation minimized skin capability to vitamin D synthesize. whilst 10% is acquired from dietary supplements (Martineau, et al. 2017). Vitamin D main diet sources are fortified butter, margarine, fatty fish, and cod liver oil (Entrenas, et al. 2020).

Vitamin D insufficiency is worldwide a prevalent health problem and has health impacts on about one billion people (Baktash,2020). The prevalent of vitamin D insufficiency or deficiency in the US population fundamentally return to sedentary lifestyles, diminutive sun exposure and inadequate dietary intake. (Panagiotou, 2020). The estimation of  $\geq 30$  ng/mL of serum level of 25-hydroxy Dis coverings needs of the majority population for vitamin D. (Sowah, et al .2017). Serum levels less than 10 ng/mL are considered as a deficiency of vitamin D while levels  $>10 < 30$  ng/mL is viewed as insufficient, however, levels 50 or 75 ng/ mL is considered as an optimal level, according to Some researchers reported. (Kaufman, et al.2020).

Vitamin D performs a substantial function in human body systems health, vitamin D is steroid hormone which serves out on numerous genes exacted by immune cells. Insufficiency of vitamin D was highlighted in worldwide health reports. Regarding to Gender, the significant association was established with insufficiency of vitamin D, different studies manifesting those men are less developed of insufficiency of vitamin D than women (Virna, et al .2021). recent research points out to potential relationship between wide scope of; infections, cancer, non-skeletal disorders, autism, diabetes, dementia, schizophrenia, muscle pain, multiple sclerosis, and insufficiency of vitamin D, (Griffin, 2020).

Vitamin D has assured that reinforce of modify the adaptive immunity, oxidant inhibitions regarded genes, and enhance the immunity of the cells. Also, vitamin D has immune modification characteristics that involve, lower regulation of inflammatory cytokines (Zdrenghea, et al. 2017). The prophylactic impact of vitamin D with COVID-19 infection is regarding to the inhibition for cytokine restraint and dimensioned seriousness of respiratory distress syndrome. Recent evidence of a meta-analysis exhibits that constant oral intake of

vitamin D by doses above 2000 IU/day, is secure and prophylactic from infection of respiratory tract, particularly with vitamin D insufficiency' subjects, (Martineau, et al.2017).

The regime of vitamin D insufficiency treatment in adult people in case of 25-hydroxy vitamin D is  $<12$  ng/mL, the treatment includes Cholecalciferol 50,000 IU, oral solution, one time or more time per week until six weeks to eight weeks, thereafter. Cholecalciferol 800-1000 IU, capsules, in case of 25-hydroxy vitamin D is  $12$  to  $20$  ng/mL, usually the treatment includes Cholecalciferol 20,000 IU, capsules for a three-month interval. Once vitamin D normal level is achieved, continued Cholecalciferol 800 IU daily is usually recommended (Jolliffe, et al. 2017).

During the COVID-19 pandemic community health nurses make up considerable manpower and they have a worthy role in combating COVID-19. The essential functions of community health nurses in the combated contra COVID-19 are mentoring and monitoring of community health workers, ongoing education of COVID-19 client about self-isolation in home, quarantine procedure through home visits and hotlines, and explicate the fast-shifting instruction from the Centers for Disease Control and Prevention (CDC). Community health nurses play a critical function role in protection from insufficiency of vitamin D, through client's health education. The prevention of VDD through health education. She has to gather accelerated steps through inspire awareness around Vitamin D insufficiency; motivation, raising community knowledge around the significance of vitamin D for health condition, the effect for its insufficiency, The sources of vitamin D and habitual sun exposure importance. accordingly, a combination of adequate intake of dietary sources, habitual exposure to sun, together with supplementation of vitamin D, can prohibits insufficiency of vitamin D occurrence, (Ferri, 2018).

### Significant of the problems

Vitamin D insufficiency protrude as a public health dilemma with potential critical consequences. Health care workers 'women are at the frontline of COVID- 19 pandemic defense and are exposed to, infection with COVID-19 due to their frequent exposure to infected individuals. The transmission of disease amongst health care workers' women are exaggerated Insufficiency of

vitamin D is a pandemic especially in women in childbearing age mainly due to lack of awareness about the vitamin D significance and prevention of its insufficiency. In Egypt, meanwhile the former two decades, accumulating facts on vitamin D levels indicate increasing the spread of insufficiency for vitamin D insufficiency among members of the population. The examination for level of vitamin D is not a routine in the Egyptians clinical setting because of high cost of vitamin D test.

COVID-19 is the most considerable health issue and has universal attention. With extant COVID-19 outbreak and the excessing of infected COVID-19 cases. The World Health Organization (WHO) was confirmed the COVID-19 in March 2020, as pandemic diseases, (*WHO, 2020*). Health care workers 'women have the superior risk of exposure for COVID-19 among the population. At least one hundred and fifteen thousand of health care workers are estimated to missing their lives by COVID infection. (*WHO, 2021*). Accordingly, per numerous recent literature exporters, insufficiency of vitamin D is prevalent among COVID-19 clients, in recent study in India the insufficiency of vitamin D prevalence was established (89.1%) among COVID-19 clients, (*Shruti et al, 2021*).

There is a destitution for the evidence around insufficiency of vitamin D, knowledge, practice and attitude concerning worldwide population, and several studies of different portions from the world show that knowledge, attitude, and behavior have a substantial role in influencing the major risk factors leading to insufficiency of vitamin D. (*Bellavia, et al. 2016*). In Egypt, the realization of health care workers' women knowledge, practice, and attitudes for insufficiency of vitamin D may a share in predicting the consequence of COVID-19. Our study appraising analyses for vitamin D level and evaluating the knowledge, practice, and attitude of the risk of vitamin D insufficiency among confirmed COVID-19 health care workers' women in obstetrics and gynecological hospital Ain shams university.

#### **Aim of the Study:**

Assessment of knowledge, practices, and attitudes regarding vitamin D insufficiency among health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university, Egypt through:

1. Assessing knowledge regarding vitamin D insufficiency among health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university.
2. Assessing practices regarding vitamin D insufficiency among health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university.
3. Assessing attitudes regarding vitamin D insufficiency among health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university.
4. Explore the relation between serum vitamin D levels in health care workers' women & severity of COVID-19 symptoms.

#### **Research questions:**

1. What is knowledge level regarding vitamin D insufficiency among health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university?
2. What are practices regarding vitamin D insufficiency among health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university?
3. What is attitude level regarding vitamin D insufficiency among health care workers' women with COVID-19, in obstetrics and gynecological hospital Ain shams university?
4. Is there relation between serum vitamin D levels in health care workers' women & severity of COVID-19 symptoms?

#### **Subjects and Methods**

##### **Research Design:**

A Descriptive-analysis study was proceeded at COVID-19 outpatient clinic at maternity and gynecological hospital, Ain Shams University.

**Study Setting:** Outpatient clinic for COVID-19 clients at maternity and gynecological hospital, which opened from beginning of COVID-19 pandemic, and serving the outpatient clients, inpatient and health care workers of maternity and gynecological hospital. Choosing the maternity and gynecological hospital because it is an enormous hospital containing the considerable number of health care workers' women, beside that the good infrastructure of special outpatients COVID-19 clinic and will equipped laboratory are available to conduct the research.

**Study Sample:** A purposive sample of health care workers' women with confirmed COVID-19 attending the COVID-19 outpatient clinic at maternity and gynecological hospital,

were enrolled. The researchers interviewed health care workers' women attended in COVID-19 outpatient clinic every day at 10 am to 1pm considering to their availability and their concurrent to participate.

**Sample size:** The study sample size (68) of health care workers' women with confirmed COVID-19. To explore sample size, the calculated sample size was established on the level of significance at 0.05, with 95 % power analysis when  $p=1$ , was used as the significance.

**Eligibility criterion** inclusive of health care workers' women (nurses, laboratory technicians, employees, laborers, Pharmacists, and nursing assistants) with confirmed COVID-19 aged >20 years. **Exclusion criteria** health care workers' women who on chemotherapy, pregnant, and chronic renal disease

#### **Tools of gathering data:**

Data collected through the utilization of the following tools.

#### **The First Tool: Structured interviews questionnaire**

It was designed in Arabic language by our study researchers after reviewing related literature, consisted of two parts.

**First part:** Demographic and clinical features of the studied health care workers' women with COVID-19 IgG Positive or, COVID-19 IgM Positive, it includes (age, social status, occupation, residence, education, family income, height, weight, symptoms such as fever, diarrhea dry cough headache, fatigue, nonspecific headache, and comorbidity as diabetes and hypertension).

**Second part:** This was utilized to evaluate health care workers' women levels of 25-hydroxy vitamin D. The laboratory analysis of serum levels of 25-hydroxy vitamin D was determined by Immunoassay for the in vitro quantitative determination of 25-hydroxyvitamin D in human serum using the electrochemiluminescence immunoassay technique on Cobas e411 immunoassay analyzer-Hitachi Ltd- Japan. The analyzer automatically calculates the analyte concentration for every sample in nanograms per milliliter. Assay accuracy was estimated at three dominance levels. inter- assay and Intra-assay coefficients of diversity range for 25-hydroxy vitamin D were 4.6-8.7% and 5.3-6.7% in the set aforesaid. for the sake of generic health, an eligible concentration of 25-hydroxy vitamin D is  $\geq 30$  ng/mL. Vitamin D insufficiency and

deficiency were determined as 25-hydroxy vitamin D rate of 10-29 ng/mL, and <10 ng/mL respectively (*Phinney,2008*).

#### **The Second Tool: knowledge assessment tool**

A self-administered google form online questionnaire was utilized to evaluate confirmed COVID-19 health care workers' women knowledge, concerning vitamin D sources, importance, and affecting factors on insufficiency of vitamin D. It was designed in Arabic language by our study researchers after revising related literature. Then was adopted and developed based the previous studies examine vitamin D knowledge. In a form of close ended question. (*Boland,2017*).

The **score** of confirmed COVID-19 health care workers' women knowledge questions around vitamin D were calculated as, for portions with one proper answer, (1) point was gifted per question. and for these portions with extra than one proper answer, (1) point was gifted per proper answer and deduct one point per improper answer, according to the correct items of all questions the total score ranges from 0-48. Calculated the total score of knowledge by addition for total scores of all portions and then asserted as; total score  $\geq 60\%$  if health care workers' women have satisfactory knowledge and total score < 60%. if health care workers' women have unsatisfactory knowledge.

**The Third Tool:** A self-reported practices google form online questionnaire was utilized to evaluate confirmed COVID-19 health care workers' women practices for vitamin D ingestion and habitual sun exposure, it includes questions about habitual practice in sunlight exposure, habitual time spent for sun exposure hours and habitual practice of vitamin D ingestion. was adopted and developed based the previous studies examine vitamin D population' practices. In a form of close ended question (*Aljefree,2017*).

Regarding score of practice questions everyone question was mark (0) for improper answer, (1) mark for proper answer. concerning, Repetition use of sunscreen/sun security' the score of question was (0) as regard to constantly, (1) as regard to ordinarily, (2) as regard to sometimes, (3) as regard to scarcely, (4) as regard to never. And about prepared food, the implicated vitamin D question was score (4) as regard to constantly, (3) as regard to ordinarily, (2) as regard to sometimes, (1) as regard to scarcely, (0) as regard to never. The overall total score of

practice was estimated inadequate when overall total practices "<60%" and adequate when was "≥60 %". Regarding confirmed COVID-19 health care workers' women sun exposure hours, to calculate the exposure hours of Sun duration per week, through women's sun exposure hours' time within day multiplying by days within week, which was then classified into ≥ 4 hours within week and < 4 hours/week.

**The Fourth Tool:** A self-administered google form online questionnaire was utilized to assessing confirmed COVID-19 health care workers' women attitude on behalf of insufficiency of vitamin D, it includes questions about interesting of health care workers' women for more knowledge about vitamin D, presence of previous analysis for vitamin D level, worrying around insufficiency of vitamin D level, the influences of skin pigmentation on vitamin D levels, spending time outdoors and daylight exposure.

**The score** of confirmed COVID-19 health care workers' women attitude questions towards sun exposure were calculated as, zero was gifted per Disagree answer, (1) point was gifted per indifferent answer and (2) point was gifted per Agree answer. The overall score of attitude questions was calculated for study subjects. Total score for attitudes was deemed negative when total score was <70%, while deemed positive when total score was ≥70 %.

#### **Procedure:**

**Administrative phase:** Relevant authorities approved all official permissions to perform the study; An authorized written approval letter explaining the purpose of the present study from the director of the obstetrics and gynecological hospital. Ain Shams University, as an approval for data gathering to perform this study.

**Pilot study:** It was tested on 10% of the total research sample for 7 health care workers' women. Questionnaire clarity was assessed. The modifications were done by changing some questions and adding another to prove their contents and clarity. The pilot research sample was included in the main total sample.

**Reliability:** The reliability of study tools was calculated by Cronbach's alpha test, the coefficient test for questionnaire items was 0.86.

**Validity:** The questionnaire was evaluated by a panel of four experts of obstetrics and gynecological medicine professors, community health medicine professors, community health

nursing professors and biochemistry professors who evaluate the comprehensiveness, clarity, relevant, and applicability of the tools for the sample. According to the conformity to their remarks some adjustments were done.

**Ethical consideration:** Prior to conducting the study all ethical issues were considered. All health care workers' women were aware by researchers about the aim of study. Oral consent from all health care workers' women were acquired. All health care workers' women were known that they are volunteers in participation of these study and have rights to withdrawal at any period. All cultures, values, ethics, and beliefs are respected. The confidentiality of all information obtained, and all collected data used only for aim of the present study.

**Fieldwork:** The study was carried out through a period of three months from onset of February 2021 to the ending of April 2021. The researcher interviewed health care workers' women attending in COVID-19 outpatient clinic every day at 10 am to 12pm considering to their availability and their concurrent to participate. The study registers 68 health care workers' women with confirmed COVID-19. Eligible health care workers' women were enrolled in the outpatient clinic of COVID-19, after confirmation of COVID-19 positive swab. The researcher was wearing all personal protective equipment and was keeping social distance of the clinic office space then interviewing the study participants individually at covid -19 outpatient clinic. The researcher was recognizing the health care workers' women, introduced herself and expound the study ' importance and aim. After obtaining oral consent of the study participants, data was gathered by the researcher via structured interviewing questionnaire to take out demographic and clinical features of the studied health care workers' women with COVID-19. Each entrant took, just about, 5-10 minutes for the whole interview; After that, the researchers drew a blood sample and took their phone number. Blood samples were obtained and collected using tubes containing separating gel then samples were delivered to the lab and centrifuged at 3000 r.p.m. for 15 minutes. Sera were separated and kept frozen at -80 °C until analysis. The questionnaire was sent via WhatsApp to health care workers' women infected with COVID-19, which takes about 10-15 minutes to submit. The researchers designed health education PDF brochure online

concerning vitamin D importance, sources, health problems related to insufficiency of vitamin D, and supplementation of vitamin D. The researchers were sent the designed PDF Brochure online through WhatsApp to all interviewed participants, after they submitted the google form questionnaire and vitamin D tests was done in the laboratory, their results were sent via WhatsApp to the participants. Results were presented to the specialist doctor who described the appropriate doses of vitamin D supplementation for the participants suffering from insufficiency of vitamin D, each participant treatment dose according to her condition, with recommendations for follow-up.

**Statistical analysis:** Statistical analysis of the existing study was management by revised, tabulated, and coded the gathered data then SPSS program Version 23 (Statistical Package for Social Sciences) was used. Qualitative data were offered as percentages and frequencies while quantitative mean and standard deviation (SD) were offered for the quantitative variables, ANOVA test, Independent T test, and Post HOC test were applied as tests of significance. significance of results was considered as:  $<0.001$  highly significant,  $P < 0.05$  was significant and  $>0.05$  not significant. To explain insufficiency of vitamin D amongst participants women with COVID-19. The researcher utilized the normal estimated values of the laboratory results for level of vitamin D examination as indicator status of vitamin D.

### Study limitations

The existing study was conducting at maternity and gynecological hospital. Ain shams university, using purposive sample of confirmed COVID-19 health care workers' women attending the COVID-19 outpatient clinic so the existing study was not representing all confirmed COVID-19 health care workers' women in Egypt, so thus futurity studies should be performed on considerable sample size at different governorates' health setting.

### Results:

In aggregate a purposive sample of 68 confirmed COVID-19 health care workers' women in the study.

Table 1: Showed that the confirmed COVID-19 health care workers women' age ranged amidst ( $<30$ -  $\geq 57$ ) years and mean age' was  $40.9 \pm 8.7$  years. (55.9%) of them were implicitly the age group ( $40 \geq 57$  years). Around

(30.8%) of study participants were employees and (39.7%) were nursing technicians. In addition, (80.9%) of them were living in urban areas and (67.6%) of them with a secondary education degree.

Figure 1: Illustrated percentage distribution of studied participants concerning their status of obesity (BMI) and manifested that (3%) of study sample were under weight, (49%) were overweight and (16%) obese, furthermore (32%) of them had normal weight.

Table 2: Summarized clinical features and implicit diseases of confirmed COVID-19 health care workers' women and evident that the clinical symptoms for studied sample (92.6%) were fatigue, (88.2%) were headache, (85.2%) were body aches/pains and (79.4%) were fever. In addition, the Implicit diseases were (13.2%) hypertension and (8.8%) were rheumatoid.

Table 3: Epitomized knowledge of participants concerning vitamin D, (89.7%) of participants had heard of vitamin D. School and university were the generality popular source of vitamin D knowledge (47.7%), while family and friends were seldom source of vitamin D knowledge (4.4%).

Figure 2: Clarified that, the highest percentage of participants total vitamin D satisfactory knowledge scores (11.70%) was the nurse specialist while lowest percentage of participants total vitamin D satisfactory knowledge scores (1.4%) was employees. In addition, the Laborers and nursing assistants had (0.0%) of vitamin D satisfactory knowledge. Mean  $\pm$  SD of total vitamin D knowledge scores was ( $49.8 \pm 16.1$ ) furthermore (23.5%) of study participants had satisfactory vitamin D knowledge and (76.5%) had unsatisfactory knowledge.

Table 4: Showed that the percentage distribution of study participants habitual practice in sun exposure and cleared that (82.3 %) had covering/put on clothing while (51.5%) had repetition use of sunscreen. Concerning study participants habitual time spent for sun exposure hours, the majority of them (92.6%) had sun exposure hours  $< 4$  hours/week. (51.5%) of the study participants sometimes habitually concerned with prepared food implicated vitamin D such as eggs, fish, and dairy products. While (26.4%) had scarcely.

Figure 3: Clarified that (17.65%) all pharmacists had adequate practice, while the highest percentage distribution of study participants (35.29%) was nursing specialists, however inadequate practice (45.10%) was among nursing technicians. The mean  $\pm$  SD of study participants practice for sun exposure and vitamin D habitual ingestion was (61.32  $\pm$  17.23), moreover (25%) of participants had adequate practice, (75%) had inadequate practice.

Table 5: Summarized the study participants attitudes on behalf of sun exposure and vitamin D and demonstrate that majority of them (86.7) % attentive to recognize further concerning vitamin D (22.0%) worried about vitamin D level, and (17.6%) had supporter of the skin pigmentation affects vitamin D status.

Figure 4: Clarified that (7%) all of Laborers had negative attitude regard vitamin D, the highest percentage distribution of study participants' positive attitudes regard vitamin D (22.1%) was nursing technicians. Mean  $\pm$ SD of study participants' attitudes regard vitamin D was (70.18  $\pm$  15.98), moreover (51.5%) of participants had a positive attitude and (48.5%) had a negative attitude.

Table 6: Demonstrated that a highly statistically significant between the study participants' age and total of their vitamin D attitude and knowledge at p-value  $\leq$  (0.0001) however a statistically significant between the study participants' total vitamin D knowledge, practice and attitude and their occupation at p-value (0.000), (0.0001), and (0.012) respectively while with participants' residence at p-value (0.001), (0.011), and (0.013) respectively and with participants' education at p-value (0.001), (0.000) and (0.003) respectively. While there is insignificant difference between the study participants' age and practice at p-value  $>$  (0.05).

Figure 5: Revealed that the minority (7%) of them had sufficient vitamin D, about (78%) of the study participants had insufficient vitamin D, while (15%) of them had deficient vitamin D. Furthermore, With regard to vitamin D total mean  $\pm$  SD (16.8  $\pm$  8.9) and the Median  $\pm$  IQR (13.8  $\pm$  9.21). However, the mean  $\pm$  SD (8.8  $\pm$  0.5) and the median  $\pm$  IQR (8.7  $\pm$  0.7) with regard to vitamin D deficient. While the mean  $\pm$  SD (15.8  $\pm$  4.6) and the median  $\pm$  IQR (14.0  $\pm$  7.6) with regard to vitamin D insufficient.

Figure 6: Displayed that highly proportion (100%) of COVID-19 symptoms such as fever,

diarrhea, cough, breathlessness, headache, body aches/pains, fatigue, nonspecific headache and anosmia, loss of taste. in study participants with deficiency vitamin D level. While no proportion (0.0%) of COVID-19 symptoms such as diarrhea, cough, breathlessness, anosmia, loss sense of taste in study participants with adequate vitamin D level.

**Table :** Revealed a statistically significant relationship between the study participants' body mass index, occupation, family income per month and study participants' vitamin D levels  $P < 0.05$ . However, no significant relation between study participants' age, education, residence, and study participants' vitamin D levels  $P > 0.05$ .

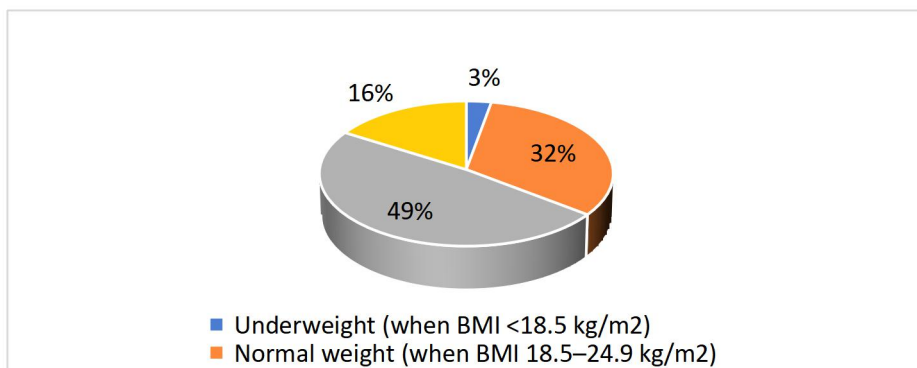
**Table :** Explored that a statistically significant relation between COVID-19 symptoms in confirmed COVID-19 health care workers' women and status of their vitamin level except the COVID-19 symptoms of chills, conjunctival congestion, nasal congestion there was no statistically significant relationship.

**Table 1 -** Distribution of socio-demographic features of confirmed COVID-19 health care workers' women (n =68).

<b>Health care workers' women characteristics</b>	<b>N</b>	<b>%</b>
<b>Age</b>		
<30	5	7.3%
30 >40	25	36.8
40 ≥ 57	38	55.9%
Mean ± SD	40.9± 8.7	
<b>Social status</b>		
Single	7	10.3%
Married	61	89.7%
<b>Occupation</b>		
Nursing technicians	27	39.7%
Nursing specialists	8	11.8%
Nursing assistants	3	4.4%
Lab technicians	1	1.5%
Employees	21	30.8%
Laborers	5	7.4%
Pharmacists	3	4.4%
<b>Residence</b>		
Urban	55	80.9%
Suburban	7	10.3%
Rural	6	8.8%
<b>Education</b>		
Secondary	46	67.6%
University	22	32.4%
<b>Income of family per month</b>		
Fewer than 1500 LE	5	7.3%
1500 to 2500 LE	31	45.6%
2500 to 3000 LE	17	25.0%
Higher than 3000 LE	15	22.1%
<b>Body Mass Index (BMI) according to WHO Category of BMI Mean ± SD 26.9±1.67</b>		

Abbreviations: Number of frequency (n); the percentage (%)





**Figure 1** - Illustrated percentage distribution of confirmed COVID-19 health care workers' women concerning their status of obesity (BMI) (n=68).

**Table 2** - Distribution of clinical features and implicit diseases of confirmed COVID-19 health care workers' women (n=68).

Clinical features of confirmed COVID-19 health care workers' women	No	%
<b>Clinical symptoms**</b>		
Fever	54	79.4%
Diarrhea	29	42.6%
Cough	38	55.9%
Breathlessness	30	44.1%
Headache	60	88.2%
Body aches/pains	58	85.2%
Fatigue	63	92.6%
Nonspecific headache	57	83.8%
Anosmia / lost taste sense	23	33.8%
Sore throat	21	30.8%
Vomiting	6	8.8%
Chills	33	48.5%
Sweating	11	16.1%
Palpitation	7	10.2%
Conjunctival congestion	9	13.2%
Nasal congestion	10	14.7%
Rhinorrhea	6	8.8%
<b>Implicit diseases**</b>		
Diabetes	5	7.3%
Hypertension.	9	13.2%
Rheumatoid	6	8.8%
Respiratory disease	3	4.4%
Hypothyroid	1	1.4%
Sinusitis	6	8.8%

Abbreviations: Number of frequency (n); the percentage (%), The sign of (\*\*) clarify the Participants specify extra than single answer thus the total percentages did not gather up to 100%

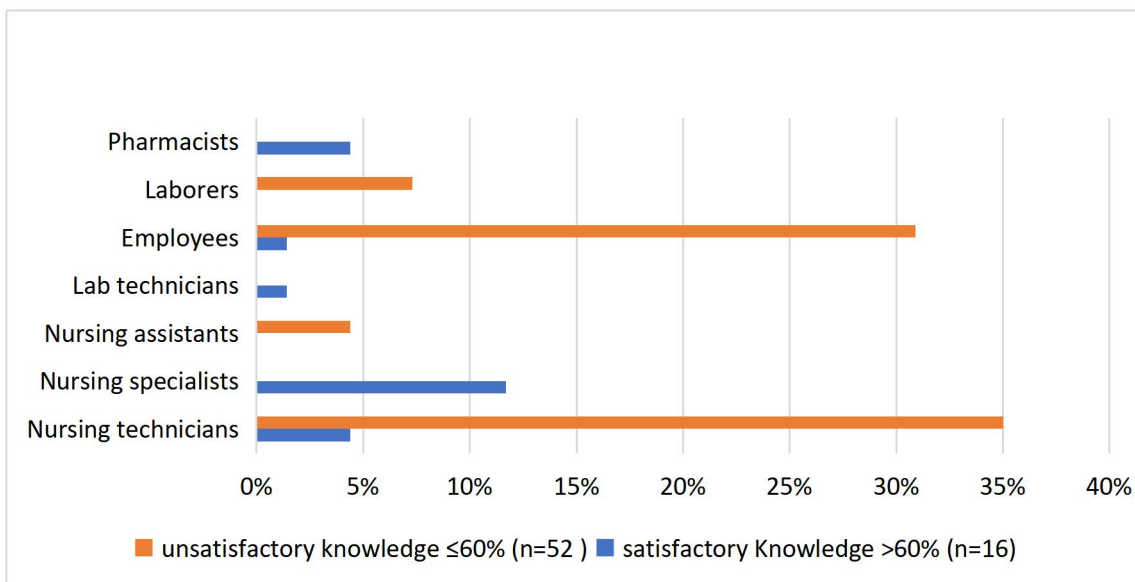
**Table 3** - Distribution of confirmed COVID-19 health care workers' women concerning Vitamin D knowledge (n =68).

Statements of knowledge items	No	%
<b>Heard anything with relevance to vitamin D</b>		
Yes	59	89.7%

Statements of knowledge items	No	%
No	7	10.3%
<b>knowledge Sources**</b>		
Physician	17	25%
Media	13	19.1%
Friends/ Family	3	4.4%
School/university	35	47.7%
<b>The Sources which inclusive of vitamin D**</b>		
Don't know	10	14.7%
Exercise	3	4.3%
Food*	46	67.6%
Vitamin D supplement*	11	16.2%
Sun *	43	63.2%
<b>Superior source for vitamin D</b>		
Food	24	35.2%
Vitamin D Supplement	11	16.2%
Sunlight*	33	48.6%
<b>The food Sources for vitamin D**</b>		
Don't know	15	22.1
Oily Fish*	14	20.6%
Red meat*	30	44.1%
Egg yolks*	43	63.2%
Dairy products	46	67.6%
Nuts	18	26.4%
Fruit and Vegetables	37	54.4%
Fortified foods*	43	63.2%
Chicken*	7	10.3%
<b>Are vitamin D levels maintained by sufficient dietary sources</b>		
No*	33	48.6%
Yes	35	51.4%
<b>Factors simulating synthesis of vitamin D from sunlight**</b>		
Don't know	35	51.5%
Pigmentation of Skin*	12	17.6%
The Season of year*	10	14.7%
Utilize of sunscreen *	9	13.2%
High fatty diet	12	17.6%
Pollution*	7	10.3%
The time of the day*	10	14.7%
The cloud cover*	9	13.2%
Smoking	8	11.8%
<b>Vitamin D health benefits**</b>		
Don't know	28	41.2%
Health of bone*	43	63.2%
Rickets Prevention*	43	63.2%
Osteoporosis Prevention*	43	63.2%
Growth of Hair	17	25%
Health of skin	6	8.8%
Boost immunity*	43	63.2%
Eyesight health	7	10.3%
<b>Persons most at hazard vitamin D insufficiency**</b>		
Persons oftentimes not outdoors	17	25%
persons of dark skin*	12	17.6%
Institutionalized persons*	28	41.2%
persons who do not eat fish	30	44.1%
covering the skin when abroad*	33	48.6%
Not given	35	51.5%

Abbreviations: Number of frequency (n); the percentage (%)

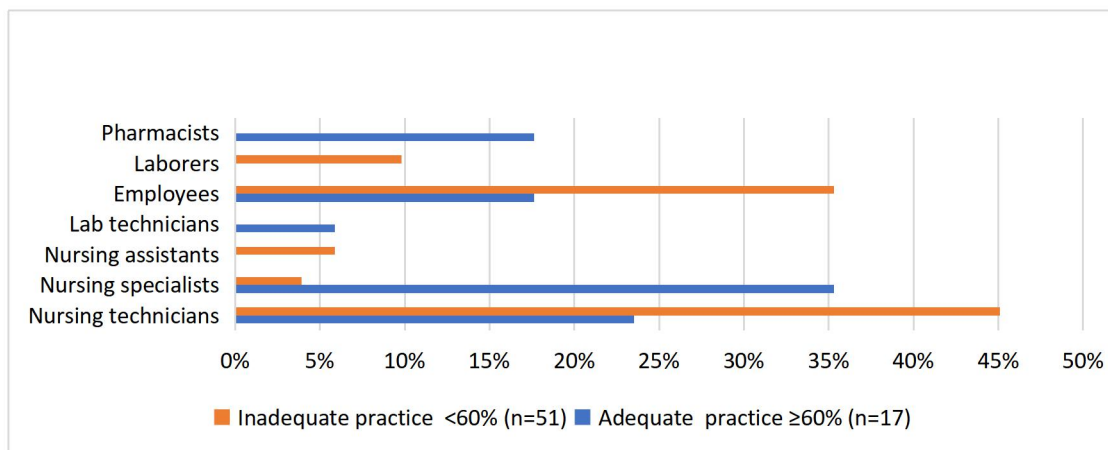
The sign of (\*) is the right answer, the sign of (\*\*) clarify the Participants specify extra than single answer thus the total percentages did not gather up to 100%



**Figure 2** - Clarified percentage distribution of total vitamin D knowledge scores of confirmed COVID-19 health care workers' women according to their occupation

**Table 4** - Distribution of confirmed COVID-19 health care workers' women for sun exposure practices and vitamin D habitual ingestion

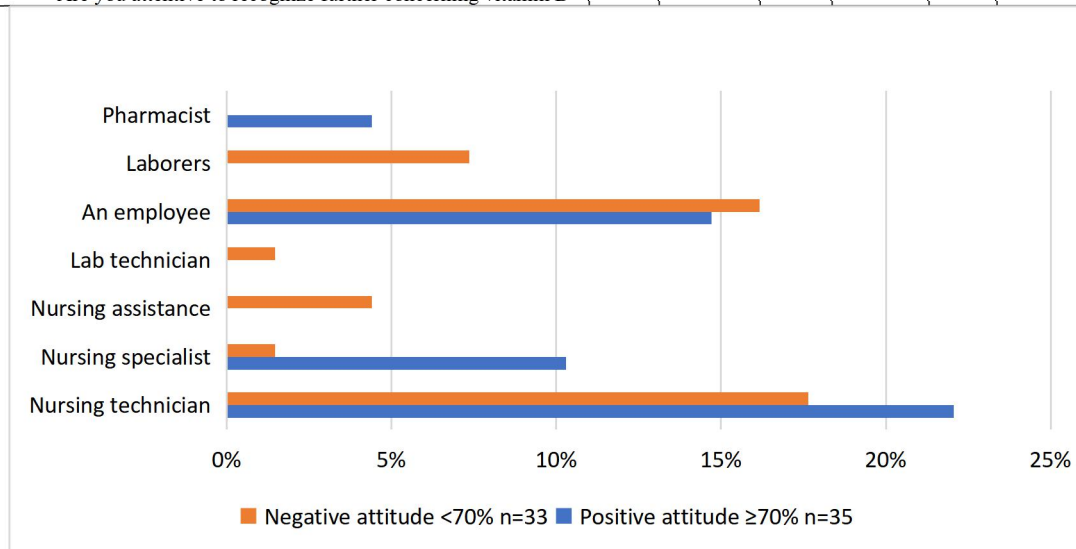
Items	No	%
<b>Sunlight Exposure</b>		
• Habitual practice in sunlight exposure		
Seek to umbra	5	7.4%
Research direct sun	7	10.3%
Covering/put on clothing	56	82.3 %
Do not go outdoors	0	0.00%
• Repetition use of sunscreen/sun security		
Ordinarily	35	51.5%
Sometimes	18	26.4%
Scarcely	3	4.4%
Never	5	7.4%
Constantly	7	10.3%
• Health care workers' women habitual time spent for sun exposure hours		
Sun exposure hours ≥ 4 hours/week	5	7.4%
Sun exposure hours < 4 hours/week	63	92.6%
<b>Habitual practice of vitamin D ingestion</b>		
• Currently ingestion of vitamin D supplementation		
Yes	5	7.4%
No	63	92.6%
• Health care workers' women habitually concerned with prepared food implicated in vitamin D such as eggs, fish, and dairy products.		
Ordinarily	5	7.4%
Sometimes	35	51.5%
Scarcely	18	26.4%
Never	3	4.4%
Constantly	7	10.3%



**Figure 3** - Clarified percentage distribution of confirmed COVID-19 health care workers' women for sun exposure practices and vitamin D habitual ingestion

**Table 5** - Distribution of confirmed COVID-19 health care workers' women attitudes on behalf of sun exposure and vitamin D

items	Agree		Indifferent		Disagree	
	NO	%	NO	%	NO	%
<b>Attitude on behalf of sun exposure- Are you in supporter of</b>						
• Those with darker skin pigmentation are more at-risk of vitamin D insufficiency	12	17.6%	20	29.5%	36	52.9%
• Skin pigmentation affects vitamin D level	12	17.6%	42	61.9%	14	20.5%
• If I regularly protect my skin from the sun, I may be in danger of not getting enough vitamin D	12	17.6%	51	75.0%	5	7.4%
• If I orderly conserve my skin from the sun, I may be in risk of not acquire adequate vitamin D	12	17.6%	51	75.0%	5	7.4%
<b>Attitude on behalf of vitamin D</b>						
• Are you worried about your vitamin D level.	15	22.0%	5	7.4%	48	70.6%
• Have you tested your vitamin D ever	5	7.3%	60	8.3%	3	4.4%
• Are you support of catching vitamin D supplementation during covid-19 infection?	5	7.4%	15	22.0%	48	70.6%
• Are you attentive to recognize further concerning vitamin D	59	86.7%	5	7.4%	3	4.4%



**Figure 4-** Clarified percentage distribution of confirmed COVID-19 health care workers' women attitudes toward vitamin D according to their occupation

**Table 6** - Relation between socio-demographic features of confirmed COVID-19 health care workers' women and total of their vitamin D knowledge, practice, and attitude

Items	(Mean ± SD) of Total knowledge	(Mean ± SD) of Total practice	(Mean ± SD) of Total attitude
<b>Age</b>			
<30	46.12 ± 16.20	66.57 ± 17.23	69.15 ± 12.25
30 >40	45.31 ± 17.36	64.23 ± 15.19	67.18 ± 14.67
40 ≥ 57	36.24 ± 15.26	62.31 ± 13.32	65.64 ± 17.33
<i>P-value</i>	0.001*	0.128	0.000*
<b>Occupation</b>			
Nursing technician	42.31 ± 17.33	42.63 ± 15.33	66.53 ± 18.22
Nursing specialist	49.51 ± 13.2	64.23 ± 15.19	69.15 ± 12.25
Nursing assistance	20.66 ± 16.76	33.15 ± 12.65	55.12 ± 10.22
Lab technician	47.44 ± 11.2	62.31 ± 13.32	67.18 ± 14.67
An employee	41.12 ± 22.50	42.29 ± 11.30	65.64 ± 17.33
Laborers	18.22 ± 13.55	23.12 ± 15.32	53.23 ± 11.13
Pharmacist	48.2 ± 16.50	66.57 ± 17.23	70.17 ± 14.87
<i>P-value</i>	0.000*	0.0001*	0.012*
<b>Residence</b>			
Urban	45.13 ± 27.20	65.34 ± 19.46	68.22 ± 13.49
Suburban	43.23 ± 16.13	63.46 ± 13.22	66.33 ± 22.34
Rural	35.13 ± 11.48	61.21 ± 15.64	64.23 ± 16.25
<i>P-value</i>	0.001*	0.011*	0.013*
<b>Education</b>			
Secondary	39.46 ± 21.22	53.89 ± 22.99	61.33 ± 15.96
University	46.86 ± 18.45	60.34 ± 18.43	69.45 ± 11.65
<i>P-value</i>	0.001*	0.000*	0.003*
<b>Income of family per month</b>			
Fewer than 1500 LE	28.23 ± 9.16	59.11 ± 17.86	55.12 ± 10.22
1500 to 2500 LE	36.78 ± 16.53	60.19 ± 13.61	65.64 ± 17.33
2500 to 3000 LE	44.75 ± 12.62	61.64 ± 18.18	66.53 ± 18.22
Higher than 3000 LE	47.81 ± 14.93	62.18 ± 15.42	70.17 ± 14.87
<i>P-value</i>	0.001*	0.371	0.249

\*P-value significant is (<0.05) and p-value ≤ .0001 highly significant, test of ANOVA was used.

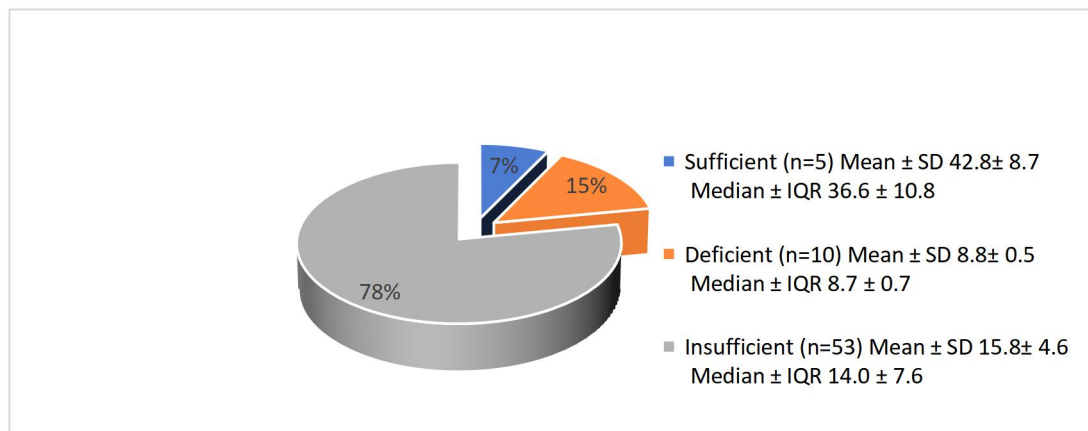


Figure 5 - vitamin D level distribution among confirmed COVID-19 health care workers' women

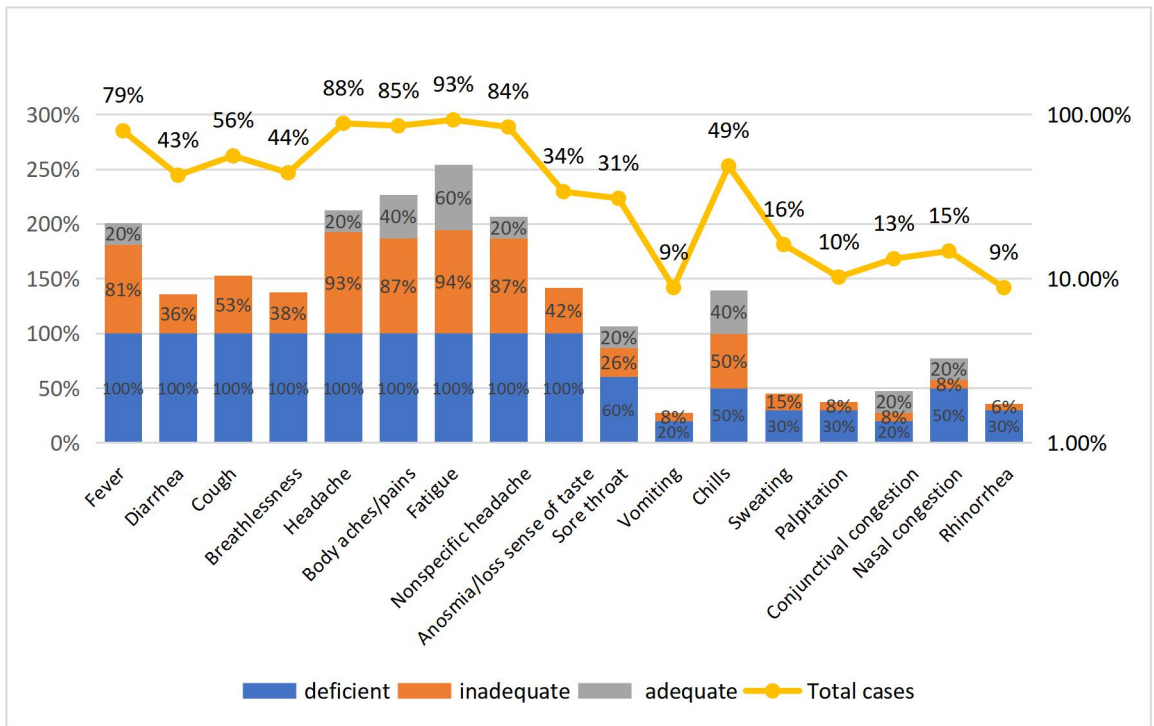


Figure 6- Prevalence of COVID-19 symptoms in confirmed COVID-19 health care workers' women with diverse vitamin D levels .

**Table 7** - Relation between demographic features of confirmed COVID-19 health care workers' women and status of their vitamin D

Items	status of 25hydroxy vitamin D						Chi-Square	
	vitamin D sufficient $\geq 30\text{ng/ml}$		vitamin D deficient & insufficient $<30\text{ng/ml}$		Total		X2	P value
	No	%	No	%	No	%		
<b>Age</b>								
<30	3	60%	2	3.2%	5	7.3%	-1.88874	0.065971
30 >40	1	20%	24	38.1	25	36.8%		
40 $\geq$ 57	1	20%	37	58.7	38	55.9		
<b>BMI (kg/m2)</b>								
BMI <18.5 kg/m2	1	20%	1	1.6%	2	2.90%	-2.13501	0.038338*
BMI 18.5–24.9 kg/m2	4	80%	18	28.6%	22	32.40%		
BMI 25.0 -29.9kg/m2	0	0.0%	33	52.3%	33	48.50%		
BMI >30.0 kg/m2	0	0.0%	11	17.5%	11	16.20%		
<b>Occupation</b>								
Nursing technician	0	0.0%	27	42.8%	27	39.7%	-2.05369	0.031232 *
Nursing specialist	2	40%	6	9.7%	8	11.8%		
Nursing assistance	0	0.0%	3	4.7%	3	4.4%		
Lab technician	0	0.0%	1	1.5%	1	1.5%		
An employee	0	0.0%	21	33.4%	21	30.8%		
Laborers	0	0.0%	5	7.9%	5	7.4%		
Pharmacist	3	60%	0	0.0%	3	4.4%		
<b>Education</b>								
Secondary	0	0.0%	46	73.1%	46	67.6	1.97092	0.093759
University	5	100%	17	26.9%	22	32.4		
<b>Residence</b>								
Urban	5	100%	50	79.3%	55	80.9%	-1.32435	0.127994
Suburban	0	0.0%	7	11.1%	7	10.3%		
Rural	0	0.0%	6	9.6%	6	8.8%		
<b>Income of family per month</b>								
Fewer than 1500 LE	0	0.0%	5	7.9%	5	7.3%	-2.50678.	0.023052*
1500 to 2500 LE	0	0.0%	31	49.3%	31	45.6%		
2500 to 3000 LE	0	0.0%	17	26.9%	17	25.0%		
Higher than 3000 LE	5	0.0%	10	15.9	15	22.1%		

**BMI (kg/m2):** Underweight (when BMI <18.5 kg/m2), Normal weight (when BMI 18.5–24.9 kg/m2), Overweight (when BMI 25.0–29.9 kg/m2) and Obese (when BMI >30.0 kg/m2), \* result is significant at  $p < 0.05$ .

**Table 8** - Relation between COVID-19 symptoms in confirmed COVID-19 health care workers' women and status of their vitamin level.

COVID-19 symptoms	Deficient vitamin D level (n=10)		Insufficient vitamin D level (n=53)		Sufficient vitamin D level (n=5)		Total study participants (n=68)		P value
	No	%	No	%	No	%	No	%	
Fever	10	100%	43	81.1%	1	20%	54	79.4%	0.009
Diarrhea	10	100%	19	35.8%	0	0.0%	29	42.6%	0.004
Cough	10	100%	28	52.8%	0	0.0%	38	55.9%	0.004
Breathlessness	10	100%	20	37.7%	0	0.0%	30	44.1%	0.019
Headache	10	100%	49	92.5%	1	20%	60	88.2%	0.001
Body aches/pains	10	100%	46	86.8%	2	40%	58	85.2%	0.012*
Fatigue	10	100%	50	94.3%	3	60%	63	92.6%	0.028*
Nonspecific headache	10	100%	46	86.7%	1	20%	57	83.8%	0.009*
Anosmia/loss sense of taste	10	100%	22	41.5%	0	0.0%	23	33.8%	0.001**
Sore throat	6	60%	14	26.4%	1	20%	21	30.8%	0.009*
Vomiting	2	20%	4	7.5%	0	0.0%	6	8.8%	0.001**
Chills	5	50%	26	49.5%	2	40%	33	48.5%	0.867
Sweating	3	30%	8	15.1%	0	0.0%	11	16.1%	0.002*
Palpitation	3	30%	4	7.5%	0	0.0%	7	10.2%	0.004*

COVID-19 symptoms	Deficient vitamin D level (n=10)		Insufficient vitamin D level (n=53)		Sufficient vitamin D level (n=5)		Total study participants (n=68)		P value
	No	%	No	%	No	%	No	%	
Conjunctival congestion	2	20%	4	7.5%	1	20%	9	13.2%	0.323
Nasal congestion	5	50%	4	7.5%	1	20%	10	14.7%	0.105
Rhinorrhoea	3	30%	3	5.6%	0	0.0%	6	8.8%	0.001**

\* Result is significant at  $p < 0.05$  and \* \*result is highly significant at  $p < 0.001$

## Discussion:

Health care workers' women are the exclusive one noteworthy occupant at jeopardy of diseases and premier line in the public and community health service system. Vitamin D has particular functions in bone metabolism and the additional functions extra-skeletal. The existing conception theorized in the diverse populations through novel decennium, this conception futurity is corroborative and potentiated the feature of vitamin D level upon preventative medicine for at-risk citizens. *Again, et al, (2016)*.

In this study, the researchers endeavored to examine the level of vitamin D amongst confirmed COVID-19 health care workers' women investigate attitude and knowledge of confirmed COVID-19 health care workers' women concerning vitamin D importance. Investigate the practices of them towards vitamin D, its supplementation and sunlight exposure. Individual characteristics can manipulate a considerable part in the decisiveness of the accurate lineaments of confirmed COVID-19 health care workers. Concerning socio-demographic features of confirmed COVID-19 health care workers' women, the current findings clarified that the age ranged amidst less than thirty years to an equal and nearly fifty-seven years and mean age' was  $40.9 \pm 8.7$  years. Around one third of studied participants were employees and extra than one third were nursing technicians. The plurality of them were living in urban areas and extra than two third of them with a secondary education degree.

These results were matched with *Again, et al. (2016)*, who conducted a study in "Prevalence of vitamin D Deficiency and Insufficiency among Healthcare Professionals in Hospital Setting", in Tehran-Iran. and declared that participant 'age ranged amidst from twenty-five years to fifty-eight years and age' mean  $\pm$  SD was  $39.8 \pm 8.6$  years. Around one third of studied subject were staff and extra than one third were nurses. Considering residence of study participants, the

reason for this finding could be that application of geographical distribution for health care worker. From the researcher's point of opinion, the educational degree of the convergence of these results may be due to the educational similarity of the study participants.

Based on the exiting study results, the preponderance COVID-19 infection was less than half amongst nurses. Our study results are compatible with *Sabetian, et al. (2021)* "COVID-19 infection among healthcare workers" in Iran and demonstrated that the preponderance of COVID-19 infected condition was extra than half amongst nurses. From the researcher's standpoint this result may be due to ordinarily, nurses contacting patients more time.

Concerning studied participants' status of obesity (BMI) the result manifested that minority of them were underweight and nearly half were overweight, furthermore one third of them had normal weight, these results came in harmony with *Alireza, et al. (2021)* who mentioned that half of patient were overweight, nearly one quarter of them had normal weight. This finding referred that the obesity has been confirmed as a risk factor for developing COVID-19 infection.

Considering to clinical features and implicit diseases of the study participant. The existing study results evident that, the clinical symptoms of majority of them were fatigue, more than three-quarters of them had headache, body aches and fever. The implicit diseases, the minority of them were had hypertension and rheumatoid. These results resemble those of *Aduragbemi, et al. (2021)* who study by titled "Vitamin D status and seroconversion for COVID-19 in UK healthcare workers." and displayed that the plurality of healthcare workers' self-reported symptoms inclusive, fatigue fever body aches/pains and one third of them had, anosmia /loss sense of taste.

In addition, this result was in consistent with *Alireza, et al. (2021)* who studied "The association between the level of serum 25-hydroxy vitamin D, obesity and underlying



diseases with the risk of developing COVID-19 infection' and found that the most popular implied diseases in COVID-19 clients were hypertension, diabetes and rheumatoid. This result evidence that the clients at risk of evolving infection, acquire COVID-19, distinguished for having pre-existing diseases such as diabetes, cardiovascular disease, hypertension and rheumatoid.

As regards knowledge of participants concerning vitamin D, plurality of them had heard of vitamin D. Nearly half of them, the school and university were the popular vitamin D knowledge source, while the minority the family and friends were seldom sources. That disagreed with *Clodagh, et al. (2018)* who conducted a study entitled "Knowledge, Attitudes and Perceptions towards Vitamin D in a UK Adult Population" and found that most commonly source reported of information was media. Our study findings where disparity of the latter study findings might be due to difference of selected criteria.

Furthermore, mean  $\pm$  SD of the total knowledge scores was ( $49.8 \pm 16.1$ ), less than one-quarter of study participants had sufficient knowledge and above three-quarters had insufficient knowledge, this study findings are similar to *Kung, et al. (2016)* who conducted study knowledge of vitamin D, and attitudes toward sunlight among Chinese women, in Hong Kong and found the mean of knowledge score was (56.6). Another study conducted by *Aljefree, et al. (2017)*, to Exploring knowledge and attitudes about vitamin D among adults and reported poor knowledge among adults in Saudi Arabia. This result from the researchers' point of concept may be related to our high exemplification of study participants with a secondary education degree. Therefore, the researchers highlight the prospective reliability of transferred information in universities and unreliability of it to the common public.

As regarded habitual sun exposure practices and habitual ingestion of vitamin D, the study finding cleared that majority of study participants had covered/put on clothing while above half of them had utilize of sunscreen repeatedly, these finding in disagreement with *Annie, et al (2016)* who studied the attitudes toward sunlight among Chinese women, the finding showed that nearly half shade themselves by a parasol, however the plurality of them did not utilize sunscreen protection. While from the researchers' point of

view, the reason for covering/putting on clothing completely is due to customs, traditions, religion, and the extension for obligation uses of mask as personal protection against the transport of Coronavirus infection outside door, which leads to a lack of direct sunlight exposure.

Concerning study participant habitual time spent for sunlight exposure hours, the plurality had sun exposure hours < 4 hours/week this study finding agreed with (*Ho-Pham, (2017)* from Vietnam who studied attitudes of sunlight exposure in population of urban areas and reported that study population have negative attitudes to exposure of sun, while comparison together with other countries is convoluted because of their preference light skin color and variation of cultures towards sun exposure. Of note, of the researchers' point of thought, this result might be due to some factors limiting exposure for sun, such as prolonged indoor working hours in hospital, which may lessen likelihood of enough sun exposure hours which result in insufficiency of vitamin D.

Furthermore it, above half of participant sometimes habitually prepared food implicated vitamin D such as eggs, fish, and dairy products. Comprise, one quarter had scarcely concerned, from the researchers' concept, his is because of the fact that nearly half of study participants have a small monthly income that is insufficient, in addition to, of the researchers' point of cogitation the fact that generality of the study participant spend an extended time working inside the hospital, which affects the quality and pattern of food choices.

Considering sun exposure practice, vitamin D habitual ingestion according to study participant occupation, all pharmacists had adequate practice, while the elevated percentage distribution of participants was nursing specialists, however inadequate practice nearly half was among technician nurses. Mean  $\pm$  SD of study participants practice for sunlight habitual exposure and vitamin D habitual ingestion was ( $61.32 \pm 17.23$ ), more over one quarter of study participants had an adequate practice and three quarter had an inadequate practice. This result is incompatible with *Clodagh, et al. (2018)* from UK who reported that plurality of citizens had great practice toward sunlight exposure and ingestion of vitamin D. But compatible with *Ho-Pham, (2017)* from Vietnam and reported that

majority study population have poor practice to exposure of sun.

Furthermore, this suggests that comparison with other countries is convoluted on account of cultural differences. Of note, it is worth observation that, mostly study participants had inadequate practice for vitamin habitual ingestion and sunlight exposure, from the researchers' point of introspection these was due to the prolonged time indoors hospital working hours which may reach up to 24 hours per day and by another hand the application of precautionary measures and staying at home for a long time.

Regarding study participants' attitudes on behalf of vitamin D and sunlight habitual exposure. The result of present study demonstrates that the mean  $\pm$  SD of study participants' attitudes concerning vitamin D were (70.18  $\pm$  15.98), moreover extra half of study participants had positive attitude, and nearly half had negative attitude. This result is compatible with *Clodagh, et al. (2018)*. Who studied attitudes toward vitamin D in adult UK residents and showed that above half of study residents have affirmative attitudes to exposure to sun. In contrast, other studies *Kung, et al. (2016)* from China and *Ho-Pham, (2017)* from Vietnam have reported negative attitude to sunlight exposure of the studied residents. In addition the elevated percentage distribution of participant positive attitudes concerning vitamin D accordingly their occupation was nursing technician and all of Laborers had negative attitude. Such a finding points out that from the researchers' point of visibility, nursing technicians were exceedingly careful to prevent diseases and improve sustaining health. while those laborers probably do not understand that they are at risk.

Concerning relation between demographic feature of study participants and total of their knowledge, practice, and attitude concerning vitamin D, result of the existing study proved that a highly statistically significant relation between the participants' age and their total knowledge and attitude of vitamin D. However, a statistically significant relation between the participants' occupation, residence and education with participants' total knowledge, practice, and attitude concerning vitamin D. While there is insignificant difference relation between study participants' age and practice. This result was covenanted with *Aziz et al. (2019)* who studied behavior and awareness of the public population

about vitamin D in Abha city", in Saudi Arabia and found that positive significant relation between total score knowledge regarding vitamin D of public population and personal features of study participants.

As regard total score of participants practice and its relation to personal feature of them, finding of present study agreed with *Esraa, et al. (2020)* who studied female awareness about vitamin D insufficiency in Helwan University, Egypt and found that a significant relation between female's total practice score and their personal feature such as educational level and residence. from the researchers' point of visibility, such a finding points out the average knowledge of participants regarding vitamin D insufficiency and significant of sun exposure.

Concerning vitamin D level categories, the existing study manifested that extra three quarter of the study participants were had vitamin D insufficiency, while nearly a sixth of them were had vitamin D deficiency, while the minority of them were had vitamin D sufficiency. These result harmony with *Again, et al. (2016)* who studied vitamin D deficiency Prevalence among health professionals at Altitude in hospital placing in Iran and indicated that level of vitamin D among three quarter of study population was insufficient, less than one quarter was deficiency and two percent was sufficient level. Nevertheless, the existing study result was convergent with *Shruti, et al. (2021)* who studied, level of vitamin D prevalence among COVID-19 clients in India and found that insufficiency vitamin D level was two third among female study population. Moreover, a new article by *Paige, et al. (2021)*. who study vitamin D clinical pharmacology the significance to pathogenesis of COVID-19 and demonstrated that vitamin D deficiency is probably a significant risk factor behind deaths between Latino and black populations moreover to high rate of COVID-19 cases.

Regarding the relationship between different features of participant and Vitamin D level, our present study manifested a statistically significant relations between the study participants' body mass index, occupation, family income per month and participants' vitamin D levels. However, no significant relation between study participants' age, education, residence, and participants' vitamin D level. This result is compatible with *Aduragbemi, et al, (2021)*. who study" Vitamin D status and seroconversion for COVID-19 in UK

healthcare workers” and demonstrated that, the result displayed that there were significant differences in body mass index, occupation between those with vitamin D deficiency and those without. The interpretation of the increment in vitamin D insufficiency seen in nursing technicians, resonance of prior findings of nursing technicians has lower levels than others health care workers women’s, which may be returned to increment of nursing technician’s frontline vocation and diverse shift patterns in a constant or rotative methods.

Vitamin D insufficiency was pertinent for healthcare worker women. As regard vitamin D level among participants accordingly their occupation, the existing study result displayed that minority of them had vitamin D sufficient level were Pharmacists, all laborers had vitamin D deficient level, while majority of nursing technician had vitamin D insufficient, and the finding indicated to significant differences between vitamin D levels and study participants’ occupation. This result was compatible with *Aduragbemi, et al. (2021)*. who reported that vitamin D level below the normal point was detected within the entire study population occupation in hospital setting and it was closely pertinent to the nursing staff occupation than other occupation subsets. In addition, positive significant differences between Vitamin D levels and study population function. This may be returned to, ordinarily, the nurse technician has more contact time with patients contrasted to other health care worker teams. Furthermore, of note, from researcher point of concept this result might be related to deprived of nursing staff from sunshine exposure Where they are working inside the closed units for long periods, may last 18 hours or more per day, it has been repeated more than two or three times a week, with no access to diets rich in fortified vitamin D during work.

Of annotation, vitamin D level for confirmed COVID-19 health care worker women, the study results proved that robustly of confirmed COVID-19 health care workers ‘women at enormous risk of vitamin D insufficiency. Accordingly, confirmed COVID-19 health care workers’ women necessitate distinctive attention as likewise the risk people. Furthermore, in fact, thought of health organizations, health care workers’ women construct a major part of them. It is worthiness elucidating that, there was highly proportion of COVID-19 symptoms such as fever,

diarrhea, cough, breathlessness, headache, body aches/pains, fatigue, nonspecific headache and anosmia, loss sense of taste, had demonstrated among participants with deficiency vitamin D levels. This result is supported by *McCartney, et al. (2020)*, who studied vitamin D levels Optimization used for enhanced immune-protection against COVID-19” and reported that, the first role of vitamin D by modulating the reaction of immune to COVID-19. A reverse relationship was detected between vitamin D levels and respiratory infection COVID-19 symptoms. Of researchers note, vitamin D level, deficiency may give a share in increased risk of including COVID-19.

One of more considerable findings of our existing study is that significant relationship between COVID-19 symptoms in confirmed COVID-19 health care workers’ women and status of vitamin level except the COVID-19 symptoms of chills, conjunctival congestion, nasal congestion there was no significant relationship. This result was propped by *Marta, et al. (2020)* who conducted study in Córdoba Spain. Who studied, calcifediol treatment effect among COVID-19 cases. who reported that the vitamin D may have an assortment of activities on cells and tissues implicated in COVID-19 progression. of researcher’s opinion, in the fact, supplementation of vitamin D reduced effect of inflammation, thrombosis, cytokines and infection severity of viral COVID-19 upper respiratory tract, then actuality is, supplementation of vitamin D would propound comparatively easy choice to reduction the pandemic effect.

## Conclusion

Based on current research finding, the existing study replied to the study questions, our study exhibited that mostly of health care workers’ women with COVID-19, had insufficient knowledge regarding to vitamin D insufficiency. As regarded habitual sun exposure practices and habitual ingestion of vitamin D mostly of health care workers’ women with COVID-19, had inadequate practices. Regarding to attitude level of vitamin D insufficiency nearly half of health care workers’ women with COVID-19 had negative attitude toward vitamin D. Lastly, vitamin D insufficiency was highly prevalent in confirmed COVID-19 health care workers ‘women and could be a risk factor of COVID-19 infection. Statistically significant relationship between COVID-19 symptoms in confirmed

COVID-19 health care workers' women and status of their vitamin level except the COVID-19 symptoms of chills, conjunctival congestion, nasal congestion there was no statistically significant relationship.

## Recommendations

The following suggested recommendations are based on the light of existing research findings:

- Health educational program intervention for health care workers' women about importance of vitamin D, a healthy lifestyle following as, related with a normal BMI, inclusive an assorted diet containing vitamin D, and sufficient time for outdoor activities and exposure to sunlight.
- Vitamin D awareness campaigns, which display importance of vitamin D level analysis for high-risk health care workers' women, provide vitamin D supplementation and sunlight exposure encouragement.
- Adopting hospital policies aimed at improving vitamin D status including ensuring oral supplementation of vitamin D for health care workers with COVID-
- Food fortification, promotion of dietary reference, and applied fixed schedule break time during day shift for health care workers who are mostly indoors to encourage sun exposure behaviors during the day shift.

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