

RESEARCH ARTICLE

B Vitamins, work-related stress and emotional mental disorders: a cross-sectional study among nurses in Indonesia

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Abstract**Aim:** The aim of this study was to examine the relationship between intake of vitamins B1, B6, B9 and B12 with emotional mental disorders among nurses in Indonesia.**Design:** This cross-sectional study included nurses who have worked at least six months at a private hospital in Indonesia from March to April 2021.**Methods:** We used the Food Frequency Questionnaire, Self-Reporting Questionnaire 20 and the Expanded Nursing Stress Scale questionnaire to assess the B-vitamin intake, emotional mental disorders and work-related stress.**Results:** Of 80 interviewed nurses, 8.8% experienced severe work-related stress, and 22.5% had emotional mental disorders. Most nurses had inadequate intake of vitamins B1 and B9 but had adequate intake of vitamins B6 (72.5%) and B12 (56.3%). Emotional mental disorders are more probably to occur in nurses with less intake of vitamins B6 and B12, with respective aOR of 20.06, 95% CI 4.14–97.09 ($p < .001$) and 4.49, 95% CI 1.19–16.83 ($p = .026$).**KEYWORDS**

B vitamins, emotional mental disorders, nurse, occupation health, stress

1 | INTRODUCTION

Mental disorders among health workers have been a concern globally. This condition is often preceded by stressful conditions that, in the long term and chronically experienced, it can lead to the development of emotional mental disorders (Birhanu et al., 2018; Dall'Ora, 2020; Moustaka, 2011). The disorders can manifest as depression, anxiety or other disorders (Pinhatti et al., 2018). If health workers experience the disorders, it can also impact their productivity, increase absenteeism, increase disease and accident rates, and high turnover rates (Dyrbye et al., 2019; Enns et al., 2015). Given that the healthcare industry often drives job stressors that can cause emotional mental disorders among its workers, the disorders should be avoided to ensure a good quality of service and patient safety (World Health Organization, 2009).

Nurses are among health workers who are at risk of emotional mental disorders. The prevalence of the disorders among nurses is high—18% in the United States and 30% in Australia (Letvak et al., 2012; Maharaj et al., 2019). In Indonesia, the prevalence of emotional mental disorders among nurses was 23.5% (Fitriani et al., 2020). An Indonesian national survey showed that 50.9% of Indonesian nurses had experienced work stress, often feel dizzy, tired, less friendly and very tired (Pragholapati, 2020), and at a high risk of psychological distress (Prasanty et al., 2018). After the COVID-19 outbreak, the risk of emotional mental disorders among nurses increased, and they have a higher risk for psychological trauma than other health professionals (Marthoenis et al., 2021; Sunjaya et al., 2021).

Various factors cause mental health disorders, including dietary intake, which has an important role in psychological

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development. Many studies have assessed the relationship between B-vitamin intake and mental health (Choda et al., 2020; Herbison et al., 2012). B vitamins, especially vitamins B1 (thiamine), B6 (pyridoxine), B9 (folate) and B12 (cyanocobalamin), have an essential role in the synthesis of neurotransmitters, such as norepinephrine, dopamine, serotonin, *gamma aminobutyric acid* and acetylcholine (Calderón-Ospina & Nava-Mesa, 2020; Mikkelsen et al., 2016). These neurotransmitters will affect the mood associated with symptoms of mental disorders.

Vitamin B deficiency, especially vitamins B1, B6, B9 and B12, is associated with mood disorders that eventually cause stress or depression due to neurotransmitter disorders and increased homocysteine in the blood (Calderón-Ospina & Nava-Mesa, 2020; Gougeon et al., 2016; Mikkelsen et al., 2016; Milanlioğlu, 2011). The leading cause of deficiency in B vitamins is the result of inadequate consumption.

However, there has been a lack of studies assessing the relationship between the intake of B vitamins with emotional mental disorders among nurses. This study aimed to assess the relationship of B-vitamin intake with emotional mental disorders in nurses working in hospitals.

2 | METHODS

2.1 | Study design

We conducted a cross-sectional study at a private hospital in Bogor, Indonesia, from March to April 2021.

2.2 | Study population

We included nurses who have worked at least six months at the hospital and agreed to join the study and excluded nurses who have been undergoing treatment for mental disorders or were on leave for at least one month. In calculating sample size, we used some assumptions: prevalence of emotional mental disorders among nurses with vitamin B deficiency is 74.4% (P1), while the prevalence among those with adequate vitamin B is 25.5% (P2; Fereidouni et al., 2018; Tolmunen et al., 2004). Using a non-paired categorical variable sample size formula, we required at least 36 nurses in this study. Since the number of nurses in the hospital was 98, we applied a total sampling by inviting all nurses in the hospital who met the criteria.

2.3 | Variables and procedure

We explained the study's objectives, procedure and related information before asking respondents' consent in face-to-face sessions. Respondents then completed a set of self-administrated questionnaires. It consisted of primary sociodemographic data,

a Self-Reporting Questionnaire 20 (SRQ-20) to assess the emotional mental disorders of nurses (Santoso, 2010) and an Expanded Nursing Stress Scale (ENSS) questionnaire to assess nurses' work stress (Hasto, 2017). All the questionnaires had been validated in Bahasa Indonesia.

The SRQ-20 consists of 20 questions with "yes" and "no" answer choices. SRQ is effective as a screening tool in assessing emotional mental disorders by having a good sensitivity and specificity (Barreto do Carmo et al., 2018; Netsereab et al., 2018). Measuring stress at work is complicated since the symptoms or signs of stress may not manifest explicitly (Seňová & Antořová, 2014). In this study, we used ENSS that helped measure stressors in general without looking at the characteristics of the nurse's position and the conditions of the hospital work environment specifically for research (Alkrisat & Alatrash, 2017).

The ENSS consists of 57 questions grouped into nine components, that is subscale questions related to death and dying, conflicts with doctors, inadequate preparation, problems with peers, problems with supervisors, workload, uncertainty concerning treatment, problems with patients/their families and discrimination. We summed the total score to calculate their work stress scores and grouped the scores into several levels: no/mild (scores 0–57), moderate (58–114), severe (115–171) and very severe (172–228).

In addition, respondents completed a semi-quantitative food frequency questionnaire (FFQ) to assess their B-vitamin intake (Noroyono et al., 2017). This questionnaire helped respondents record their food intake in the last month. Next, we use the recommended daily allowances (RDA) value in Indonesia to assess the adequacy of their B-vitamin intake (Ministry of Health Republic Indonesia, 2019). This research obtained ethical research approval from the Ethics Committee, the Faculty of Medicine, University of Indonesia with number: KET-146/UN2.F1/ETIK/PPM.00.02/2021 before its implementation. All patients received the study explanation and signed the informed consent before joining the study.

2.4 | Statistical analysis

We displayed the characteristics of nurses, their stress scores and levels and their B-vitamin intakes in numbers (*n*) and percentages (%) for categorical variables and mean, median, standard deviation and range values for continuous variables. We applied chi-squared tests, or Fisher exact tests as the alternative, to assess the relationship between B-vitamin intake and emotional mental disorders. In multivariate analyses, we applied binary logistic regression and adjusted with several presumed confounders, that is the categories of length of work, age, gender and work stress as covariates to assess the relationship between intake of B vitamins and mental-emotional disorders. We displayed the results in adjusted odds ratios (aORs), their 95% confidence intervals (95% CIs) and significance values (*p*-values). The statistical significance was set at .05. All the statistical analyses in this study we conducted using SPSS version 20.

3 | RESULTS

Of 98 invited nurses, 80 (81.6%) nurses participated in this study. Most of them were female (72.5%), had night shift rotation (76.3%), had worked for 1–5 years at the hospital (58.8%) and worked at inpatient ward (47.5%), with an average age of 28.7 ± 4.25 years (Table 1). Most nurses in this study were female (72.5%), had night shift rotation (76.3%), had worked for 1–5 years at the hospital (58.8%) and worked at inpatient ward (47.5%), with an average age of 28.7 ± 4.25 years (Table 1).

Seven of the respondents (8.8%) experienced severe work-related stress, and 27 (33.8%) experienced moderate work-related stress (Table 2). We combined these two groups as having moderate-to-severe work-related stress—to a total of 42.6% of work-related stress among nurses. Of 80 nurses in this study, eighteen respondents (22.5%) had emotional mental disorders.

Most respondents did not consume B-vitamin supplements (78.8%), and most of them lacked intake of vitamin B1 (87.3%), vitamin B9 (87.3%) and vitamin B12 (52.4%; Table 3). Vitamin B6, however, was consumed adequately by 65.1% of participants. On another side, of respondents who consumed Vitamin B supplements, most had covered the needs of vitamin B1 (88.2%), vitamin

TABLE 1 Characteristics of respondents

Variable	N	%
Gender		
Female	58	72.5
Male	22	27.5
Age		
<25 years	16	20.0
>25 years	64	80.0
Education		
Diploma	64	80.0
Bachelor	16	20.0
Marital status		
Married	63	78.8
Single	17	21.3
Work unit		
Emergency	10	12.5
Outpatient	15	18.8
HCU/ICU	9	11.2
Operation room	8	10.0
Ward	38	47.5
Night shift work		
Yes	61	76.3
No	19	23.8
Length of work		
<1 year	10	12.5
1–5 years	47	58.8
>5 years	23	28.8

TABLE 2 Prevalence of work stress levels and emotional mental disorders

Variable	N	%
Work stress		
No stress/mild stress	46	57.5
Moderate stress	27	33.8
Severe stress	7	8.8
Emotional mental disorders		
Yes	18	22.5
No	62	77.5

B6 (100.0%) and vitamin B12 (88.2%). However, the proportion of those consuming vitamin B9 adequately was still 22.2%. The majority of respondents had adequate intake/consumption of B6 and B12; 72.5% and 56.3%, respectively. However, only 8.8% and 15.0% of respondents had consumed adequate levels of vitamin B1 and vitamin B9.

In univariate analyses, the emotional mental disorder was statistically significantly correlated with the intake of vitamin B6 ($p < .001$) and vitamin B12 ($p = .006$) but not statistically significantly correlated with vitamin B1 and vitamin B9. After adjustment with presumptive confounding factors (i.e. length of work, age, gender and work-related stress level), the consumption of vitamin B6 and vitamin B12 was statistically significantly correlated with the incidence of emotional mental disorders (Table 4). The disorders were more probably to occur in nurses with less vitamin B6 intake than those with adequate vitamin B6 intake (aOR 20.06, 95% CI 4.14–97.09, $p < .001$). The disorders were also more probably to occur in nurses with less vitamin B12 intake than those with adequate vitamin B12 intake (aOR 4.49, 95% CI 1.19–16.83, $p = .026$).

4 | DISCUSSION

The proportion of work-related stress experienced by nurses in Indonesia was high, with a statistically significant number of emotional mental disorders. Most nurses in this study had consumed vitamins B6 and B12 adequately, and these were statistically significantly correlated with the lower odds of experiencing emotional mental disorders.

This study showed a high proportion of nurses having work-related stress. The result was similar to a previous study in Indonesia, which indicated that nurses experienced work-related stress in moderate (35%) and severe levels (7.5%; Dewanto, 2018). The figures may vary since they depend on what tools or instruments were used in the study. However, with 42.6% of nurses experiencing moderate/severe stress, intervention is necessary to prevent further adverse effects on nurses' health.

A high proportion of nurses experiencing emotional mental disorders should also be concerned. Despite the lack of data on the prevalence of emotional mental disorders among Indonesian nurses, our finding is much higher than the prevalence of the disorders in

TABLE 3 Respondents' B-vitamin intake

Vitamins	Without Vit B supplementation, n = 63		With Vit B supplementation, n = 17		Total, n = 80		p
	Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)	
Vitamin B intake, in mg							
B1	0.71 ± 0.50	0.5 (0.2-2.7)	26.69 ± 22.0	21.7 (0.3-52.2)	6.23 ± 14.58	0.70 (0.2-52.2)	<.001
B6	1.75 ± 1.19	1.4 (0.4-6.3)	9.08 ± 5.06	11.3 (1.5-16.6)	3.31 ± 3.92	1.55 (0.40-16.60)	<.001
B9	228.63 ± 154.98 ^a	177.3 (51.8-704.1) ^a	304.99 ± 194.3 ^a	232.4 (75.7-813.6) ^a	244.86 ± 165.79 ^a	189.60 (51.8-813.6) ^a	.114
B12	6.92 ± 9.03	3.70 (0.7-51.8)	9.34 ± 5.31	7.9 (1.1-18.4)	7.44 ± 8.41	5.30 (0.70-51.80)	.011
Category of Vit B intake, n (%)	Adequate	Inadequate	Adequate	Inadequate	Adequate	Inadequate	p
B1	8 (12.7%)	55 (87.3%)	15 (88.2%)	2 (11.8%)	23 (28.8%)	57 (71.3%)	<.001
B6	41 (65.1%)	22 (34.9%)	17 (100.0%)	0 (0.0%)	58 (72.5%)	22 (27.5%)	.004
B9	8 (12.7%)	55 (87.3%)	4 (22.2%)	13 (72.2%)	12 (15.0%)	68 (85.0%)	.271
B12	30 (47.6%)	33 (52.4%)	15 (88.2%)	2 (11.8%)	45 (56.3%)	35 (43.8%)	.003

Note: p-Values show the statistical differences of vitamin intake between respondents with and without Vit B supplement.

^a Unit in mcg.

the general Indonesian population, which is 9.8% (National Institute of Health Research Development Ministry of Health Republic of Indonesia, 2018) but similar to another previous study in national referral hospital (Fitriani et al., 2020). The proportion of emotional mental disorders found in this study is similar to other previous findings: 18% of nurses in the United States experienced emotional mental disorders (Letvak et al., 2012), and 26.8% of nurses in Iran had depression (Fereidouni et al., 2018). The disorders found in this study were similar to those found in study conducted during the COVID-19 pandemic (Iskandarsyah et al., 2021; Marthoenis et al., 2021; Sunjaya et al., 2021). However, the prevalences were skewed—much higher in hospitals providing care for patients with COVID-19 and lower in non-COVID-19 healthcare facilities (Rochmawati et al., 2022; Sofiani et al., 2021).

The disorders among nurses should be avoided to ensure a good quality of service and patient safety (World Health Organization, 2009) in both during and beyond the COVID-19 pandemic. Given the pressure at the healthcare workplace, the disorders developed among the healthcare workers group are more complex and can be influenced by various internal and external factors. One of the factors that this study highlighted is B-vitamin intake.

This study found that consumptions of Vitamins B1 and B9 among nurses were still low according to RDA values in Indonesia. This low-Vitamin B9 intake was also shown among Japanese workers (295.6 ± 127.3 mcg per day; Miyaki et al., 2012) and Malaysian women (227.2 ± 142.6 mcg per day; Geok et al., 2006). However, vitamin B9 intake was still inadequate even among nurses who took vitamins supplementations. It may be affected by the composition of the vitamin supplementation. The supplementation containing vitamin B9 is often more expensive than those without vitamin B9.

On the contrary, the consumption of vitamins B6 and B12 among Indonesian nurses was high. Consumption of these two vitamins is generally adequate, as revealed by other studies in Poland (Malara et al., 2013) and South-Asian women populations (Mearns & Rush, 2017). It may be affected by the food they consume. They commonly consumed foods containing vitamins B6 and B12, such as meats, fish and eggs, but lacked vitamin B9-related foods, such as beans, peanuts and whole grains. This low intake after vitamins supplementation may also be affected by the ingredients that mainly contain vitamins B6 and B12 but not vitamins B1 and B9 (folate). In addition, there is some variation in the recommended value for daily B9 intake that could make a difference in the analysis of its relationship with other factors (European Food Safety, 2014).

This study showed that emotional mental disorders were more probably to occur in nurses with less vitamin B6 intake than those with adequate vitamin B6 intake. This finding is similar to Pan's study (Pan et al., 2012) and meta-analysis findings which indicated the effect of vitamin B6 deficiency on depression (Wyatt et al., 1999). On a theoretical basis, vitamin B6 deficiency can reduce S-Adenosyl methionine (SAM) production, which results in an increase in homocysteine in the body. This process is suspected of triggering the occurrence of mental disorders. In addition, vitamin B6 also contributes to activating enzymes that play a role in synthesizing

TABLE 4 B vitamins and emotional mental disorders

Variable	N	Emotional mental disorders, n (%)	p	OR (CI 95%)	p	aOR (CI 95%) ^a
Vitamin B1						
Inadequate	57	16 (28.1%)	.060	4.09 (0.86–19.52)	.094	4.26 (0.78–23.18)
Adequate	23	2 (8.7%)		Reference		
Vitamin B6						
Inadequate	22	13 (59.1%)	<.001	15.31 (4.39–53.45)	<.001	20.06 (4.14–97.09)
Adequate	58	5 (8.6%)		Reference		
Vitamin B9						
Inadequate	68	17 (25.0%)	.280	3.67 (0.44–30.53)	.208	4.19 (0.45–39.05)
Adequate	12	1 (8.3%)		Reference		
Vitamin B12						
Inadequate	35	13 (37.1%)	.006	4.73 (1.49–15.01)	.026	4.49 (1.19–16.83)
Adequate	45	5 (11.1%)		Reference		

^aAdjusted with length of work, age, gender and stress as covariates.

neurotransmitters such as serotonin which will affect a person's mood and mental condition (Kennedy, 2016; Pan et al., 2012; Parletta et al., 2013).

In this study, vitamin B12 intake showed a statistically significant relationship with the incidence of emotional mental disorders. Various studies show mixed results about the relationship between B9 and B12 intake with emotional mental disorders. Some research suggests that depression was not associated with folate intake and B12 (Şengül et al., 2014). However, others conclude that there is a statistically significant association between B9 and B12 intake with the incidence of mental disorders (Herbison et al., 2012; Tolmunen et al., 2004). Another study suggested that supplementation of folate, B12 and other B vitamins can reduce symptoms of emotional mental disorders (Young et al., 2019).

The multivariate analyses showed that the odds of experiencing emotional mental disorders would be higher after adjusting with the length of work, age, sex and work-related stress. It indicates that the relationship between vitamins B6 and B12 may be confounded by one or more of these four variables. However, the regression may overestimate the odds ratio because of the small-to-moderate sample size (Nemes et al., 2009), particularly vitamins B6 and B9. We did not correct the bias in this study, and, therefore, the high odds ratio is not reliable despite the significance. Further study with adequate, larger sample size is required to confirm this study's finding.

To the best of our knowledge, this is the first study in Indonesia to evaluate the relationship between dietary intake, especially B vitamins, with mental health in healthcare workers. The findings can be applied to other healthcare workers with similar job characteristics.

However, this study has several limitations. First, the data were collected during the COVID-19 pandemic. This situation may influence the nurse's mental condition and overestimate the incidence of mental health disorders. Second, a semi-quantitative FFQ questionnaire may not reflect the actual consumption because of recall and tool biases. The tool uses the average portion, which was not

the actual portion. To limit the tool bias, we determined the portion levels into several options to help respondents choose their food portions. Third, the findings cannot be necessarily generalized to the Indonesian nurse population due to working conditions variations. Fourth, the small-to-moderate sample size may overestimate the association between vitamins intake and mental disorders among nurses. Further study with a higher number of samples is required.

5 | CONCLUSIONS

Almost half of the nurses in Indonesia experienced work-related stress, and almost a quarter of the nurses had emotional mental disorders. The emotional mental disorders have a statistically significant relationship with the vitamins B6 and B12 intake. Therefore, the intake of vitamins B6 and B12 needs to be considered to reduce the opportunity of experiencing emotional mental disorders, either with food intake or additional supplements. Further research can be conducted on other workers by measuring B vitamins in the blood or surveys of consumption patterns with more accurate measurement of meal portions and requires a more accurate mental condition assessment during the pandemic period.

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CONFLICT OF INTEREST

We declare no competing interest.

AUTHOR'S CONTRIBUTION

MS, DYF and AF: Conceptualization and formal analysis. MS: Data curation, writing—original draft. MS, DYF, AF, DF and RWB: Methodology and Writing—review & editing.

ETHICAL APPROVAL

This study was approved by the Ethics Committee, the Faculty of Medicine, University of Indonesia with number: KET-146/UN2.F1/ETIK/PPM.00.02/2021. All patients received the study explanation and signed the informed consent before joining the study. Data confidentiality were safely kept and anonymously stored and analysed.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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