# Levels of Depression, Anxiety, and Stress Measured by DASS-21 and their Associated Factors in a Rural Village of Ranau District, Sabah, Malaysia

Khairul Anwar Zarkasi, MBBS,[1] Tracy Jessica Danker,[2] Ilya Maisarah Julani,[2] Nur Ilya Maisarah Rasid,[2] Jayaprriya Kumaran,[2] Privitha Panirselvan,[2] Nur Zuliani Ramli, MBBS[1] and Mohd. Hijaz Mohd. Sani, PhD*[1]

[1]Department of Biomedical Sciences and Therapeutics, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[2]Doctor of Medicine Program, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia

## ABSTRACT

**Background.** The prevalence of mental illness in Malaysia is rising each year, with the highest recorded in a mostly rural state of Sabah, possibly due to challenges in accessing healthcare services and the maldistribution of mental health professionals. Moreover, the data on mental illness burden among the rural Sabahans are insufficient.

**Objective.** To identify the levels of depression, anxiety, and stress and their associated factors in a rural village of Sabah, Malaysia.

**Methods.** Demographic data and the risk factors for depression, anxiety, and stress were collected from 115 respondents, followed by the administration of 21-item Depression, Anxiety, and Stress Score (DASS-21) and Short Form International Physical Activity Questionnaire (IPAQ-SF).

**Results.** The respondents' median age was 43 years. The levels of depression, anxiety, and stress were 28.7%, 42.6%, and 19.1%, respectively. Male had significantly lower odds for anxiety (OR: 0.44), while those with a history of hypertension had lower odds for depression (OR: 0.20). Individuals with a history of diagnosed stress had higher chances of having depression (OR: 11.17) and stress (OR: 7.18). Respondents with a history of other illnesses (self-reported gastritis, bloody stools, bronchial asthma, and brain carcinoma) were more likely to have depression (OR: 7.14), anxiety (OR: 9.07), and stress (OR: 34.50). Meanwhile, moderate-high physical activity was associated with higher odds for anxiety (OR: 2.39).

**Conclusion.** In this study, the rural village community had higher depression and anxiety levels than the currently available epidemiological data that may necessitate more rigorous and appropriate mental health intervention by the relevant authorities.

*Key Words: depression, anxiety, stress, mental health, rural community*

## INTRODUCTION

Mental health disorders affect 10.7% or 792 million of the world population.[1] Unlike physical or metabolic diseases, symptoms of mental health disorders often being underestimated as a normal psychological response, that together with social stigma, would lead to treatment neglect and disability, especially in under-developed nations. Approximately 80%-90% of mental illness patients from these countries did not receive appropriate treatment and follow-up.[2] As a consequence, untreated early symptoms of mental health disorders may lead to unexplained somatic symptoms, multiple visits to healthcare facilities, and the development of more severe symptoms leading to anxiety and depression.[3]

Corresponding author: Mohd. Hijaz Mohd. Sani, PhD
Department of Biomedical Sciences and Therapeutics
Faculty of Medicine and Health Sciences
Universiti Malaysia Sabah
Jalan UMS, 88400 Kota Kinabalu, Sabah, Malaysia
Email: hijazsani@ums.edu.my

Although the prevalence of common mental health disorders is similar between urban and rural regions, the latter has a comparatively higher suicide rate, which is one of the outcomes of severe mental health disorders.[4-6] These data suggest unequal distributions of healthcare facilities across the two regions, particularly mental health. Indeed, many of the Southeast Asian countries have small funding allocations towards the mental health system.[7] These countries also have limited resources in terms of the number of hospital beds, mental health personnel, and community support groups for the mentally ill patients.[7]

Sabah is one of Malaysia's constituent states, located at the Borneo Island of the South China Sea. It is one of the significant contributors to the country's economy, despite recording the smallest gross domestic product growth in 2018 compared to the other Malaysian states.[8] The state urbanization level of 54% is ranked 12th in the country; hence, a large percentage of its population resides in the rural regions.[9] Access to healthcare services among rural Sabahans is also challenging due to several socio-demographic and geographic factors, resulting in a high prevalence of undiagnosed non-communicable diseases.[10] Concerning mental health disorders, Malaysia had a steady increase in the disease's prevalence. It ranged from 10.7% in 1966 to 11.2% in 2006, and 29.2% in 2015.[11] Meanwhile, the 2016 technical report on the Malaysian Mental Healthcare Performance mentioned that Sabah has the highest prevalence of mental health disorders compared to the other Malaysian states as well as the national average,[12] which the maldistribution of mental health professionals might contribute. Indeed, the densities of clinical psychologists/counselors (0.11 per 100,000 population) and psychiatrists (0.30 per 100,000 population) in Sabah are among the lowest in the country, compared to the administrative capital of Putrajaya, which had 1.2 clinical psychologists/counselors and 2.4 psychiatrists per 100,000 population in 2015.[12] Despite having an improvement from 0.30 to 0.54 psychiatrists per 100,000 population, a recent study published in 2018 found that the psychiatrist-to-population ratio was still the lowest in Sabah.[13]

Chronic non-communicable diseases such as diabetes mellitus, hypertension, and chronic kidney disease require lifelong therapy and follow-up, serving as stressors. Elderly individuals with chronic diseases had a 2.5-fold higher risk of having mental health disorders.[14] This finding was supported by a recent meta-analysis, which mentioned that chronic disease patients were 3.1 times more likely to suffer from mental disorders.[15] On the other hand, the treatment-seeking behavior for medical illnesses among rural dwellers is poorer than the urbanites,[16] which might contribute to the development of mental illnesses in these communities.

Meanwhile, rural villagers commonly engaged in high physical activity (PA) levels due to their engagements in agricultural work.[17] High PA levels reportedly exerted beneficial effects on mental health, which might protect the rural population.[18,19] These factors might affect the presence of mental disorders among rural communities in the Ranau district of Sabah.

Recently, a study by Masuari and Karim (2020) using integrated questionnaires and the Geographic Information System (GIS) database found that rural communities in this district generally had low health literacy and insufficient access to health information.[20] In parallel to that, 96% of chronic disease patients residing in the rural district of Ranau were unaware of their conditions,[21] that further prove the widespread health illiteracy in the communities. Combined with inadequate mental health data among Sabahans in general, specifically in the rural Ranau communities, it requires urgent attention from the health researchers and authorities to ensure that they receive appropriate mental health services on time.

Therefore, this study aimed to determine the levels of depression, anxiety, and stress and their associated factors that include chronic diseases and PA levels in a rural village of Ranau district, Sabah, Malaysia.

## METHODS

### Study settings
This study was conducted during a 2-week health promotion activity in the Kilimu Village of Ranau district, Sabah, Malaysia, in August 2019. Located within the Tanah Rata/Kintukul mukim under the Paginatan State Legislative Assembly of Sabah, the district is 105 km away from the Kota Kinabalu city and accessible by road. There were 106 houses with a total of 640 residents in the village.[22] The inclusion criteria were: (1) residents of the Kilimu Village, (2) at least 18 years of age, (3) both male and female gender, and (4) able to understand English or Malay languages. Meanwhile, the exclusion criteria include (1) pregnant and (2) physically disabled.

### Study design and sampling
A cross-sectional study was conducted among the residents of Kilimu Village. Based on the Malaysian national prevalence of lifetime depression of 2.4% and absolute precision at 5% and a 95% confidence interval, the sample size calculated was 35 using the "Sample Size for Frequency in a Population" option (http://www.openepi.com). However, the invitation was sent to as many participants as possible via a simple random sampling method. Thus, our final sample size was 115. Written informed consent was obtained from all individuals who agreed to participate in this study.

### Demographic data and factors associated with depression, anxiety, and stress
Participants who understand the English language were instructed to answer a self-administered questionnaire that contained demographic data such as age, gender, ethnicity, education, employment, and income. The questionnaire also

contained various risk factors for depression, anxiety, and stress; including past histories of hypertension, diabetes mellitus, dyslipidemia, kidney disease, endocrine disease; and history of other illnesses; past histories of depression, anxiety, and stress; in addition to personal accounts of illegal drug use, smoking habit or exposure to cigarette smoke, excessive alcohol intake, and the physical activity (PA) level. Those who could only understand the Malay language were assisted and interviewed by the medical and nursing students using the same questionnaires.

## 21-Item Depression, Anxiety, and Stress Score

The standard, English version of the 21-item Depression, Anxiety, and Stress Score (DASS-21) was used to identify participants with depressive, anxiety, and stress symptoms. Respondents were instructed to score from 0 (absence of symptom) to 3 (symptom appeared most of the time) for each item. At the end of the questionnaire, scores were aggregated based on the three domains that the item represented and multiplied by two. The cut-off points were set at ≥10 for depression, ≥8 for anxiety, and ≥15 for stress.[23]

## Short Form International Physical Activity Questionnaire

Physical activity level was determined via the validated, English version of the Short Form International Physical Activity Questionnaire (IPAQ-SF).[24] The questionnaire consisted of vigorous-intensity, moderate-intensity, and walking activities, in addition to the time spent sitting to assess a sedentary lifestyle. Based on the responses, the participants were categorized into high, moderate, or low-level PA.

### Data analysis

Data analysis was performed using the IBM® SPSS® software version 23. Data normality was checked by the Kolmogorov-Smirnov test with $p>0.05$ taken as a normal distribution. Central tendency and dispersion for continuous data were presented as the median and interquartile range (IQR) since their distribution was not normal. For categorical data, the Fischer-exact and Pearson's chi-square tests were used wherever appropriate. The odds ratio and the 95% confidence interval were also calculated. The significance level was set at $p<0.05$ (2-sided).

## RESULTS

The socio-demographic characteristics are listed in Table 1. A vast majority of the respondents were aged less than 60 years (n=105, 91.3%) with a median age of 43.00 years (interquartile range: 29.00-56.00), and they mostly came from the Bumiputera ethnicity comprising of Kadazan-Dusun and Malay (n=112, 97.4%). About one-fifth of the respondents had tertiary education (n=22, 19.1%), whereas the rest had primary or secondary schools. While approximately two-thirds of them were employed (n=73,

63.5%), a higher percentage of the respondents had a total income of less than RM3,000 per month (n=100, 87.0%).

The levels of depression, anxiety, and stress among the respondents are shown in Table 2. Overall, 28.7% had depression, 42.6% had anxiety, and 19.1% had stress, according to the DASS-21 score. Females recorded higher percentages of depression (32.0% vs 22.5%, respectively), anxiety (49.3% vs 30.0%, respectively), and stress (21.3% vs 15.0%, respectively) as compared to male respondents.

With the higher levels of depression, anxiety, and stress among female participants, males consistently had lower odds for exhibiting these symptoms, with a significant result for anxiety (OR: 0.44, 95% CI: 0.20-0.99, $p=0.046$) (Table 3). Otherwise, the odds of having depressive, anxiety, and stress symptoms were similar regardless of the respondents' age groups, ethnicities, education levels, employment status, or income range.

Participants who had a history of hypertension were 0.20 times less likely to have depressive symptoms (95% CI: 0.06-0.73, $p=0.009$), while those with a history of stress were more likely to suffer from depressive (OR: 11.17, 95% CI: 1.20-104.11, $p=0.023$) and stress symptoms (OR: 7.18, 95% CI: 1.12-45.98, $p=0.048$) (Table 4). Besides, respondents engaging in moderate-to-high PA were associated with higher odds for anxiety (OR: 2.39, 95% CI: 1.04-5.49, $p=0.037$). Those who had history of other illnesses self-reported as gastritis (n=4), bloody stools (n=1), bronchial asthma (n=1), and brain carcinoma (n=1) exhibited higher odds for having depressive (OR: 7.14, 95% CI: 1.31-38.92, $p=0.020$), anxiety (OR: 9.07, 95% CI: 1.06-78.00, $p=0.041$), and stress symptoms (OR: 34.50, 95% CI: 3.89-305.98, $p<0.001$).

**Table 1.** Socio-demographic characteristics of the respondents

| | All (n = 115) | | Male (n = 40) | | Female (n = 75) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| *Age group[a]* | | | | | | |
| <60 years[b] | 105 | 91.3 | 35 | 30.4 | 70 | 60.9 |
| ≥60 years[c] | 10 | 8.7 | 5 | 4.3 | 5 | 4.3 |
| *Ethnic group* | | | | | | |
| Bumiputera | 112 | 97.4 | 37 | 32.2 | 75 | 65.2 |
| Others | 3 | 2.6 | 3 | 2.6 | 0 | 0.0 |
| *Education* | | | | | | |
| Primary/Secondary | 93 | 80.9 | 32 | 27.8 | 61 | 53.0 |
| Tertiary | 22 | 19.1 | 8 | 7.0 | 14 | 12.2 |
| *Employment* | | | | | | |
| Employed | 73 | 63.5 | 22 | 19.1 | 51 | 44.3 |
| Unemployed | 42 | 36.5 | 18 | 15.7 | 24 | 20.9 |
| *Income* | | | | | | |
| <RM3,000 | 100 | 87.0 | 35 | 30.4 | 65 | 56.5 |
| ≥RM3,000 | 15 | 13.0 | 5 | 4.3 | 10 | 8.7 |

*The median (IQR) age was [a]43.00 (29.00-56.00) years, [b]41.00 (28.50-53.00) years, and [c]68.00 (65.00-77.25) years.*

**Table 2.** Levels of depression, anxiety, and stress among the respondents

| | Male (n=40) | | Female (n=75) | | Overall (n=115) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| **Depression** | | | | | | |
| Normal | 31 | 77.5 | 51 | 68.0 | 82 | 71.3 |
| Mild | 5 | 12.5 | 10 | 13.3 | 15 | 13.0 |
| Moderate | 2 | 5.0 | 10 | 13.3 | 12 | 10.4 |
| Severe | 1 | 2.5 | 1 | 1.3 | 2 | 1.7 |
| Extremely severe | 1 | 2.5 | 3 | 4.0 | 4 | 3.5 |
| Overall depression | 9 | 22.5 | 24 | 32.0 | 33 | 28.7 |
| **Anxiety** | | | | | | |
| Normal | 28 | 70.0 | 38 | 50.7 | 66 | 57.4 |
| Mild | 4 | 10.0 | 13 | 17.3 | 17 | 14.8 |
| Moderate | 6 | 15.0 | 18 | 24.0 | 24 | 20.9 |
| Severe | 0 | 0.0 | 3 | 4.0 | 3 | 2.6 |
| Extremely severe | 2 | 5.0 | 3 | 4.0 | 5 | 4.3 |
| Overall anxiety | 12 | 30.0 | 37 | 49.3 | 49 | 42.6 |
| **Stress** | | | | | | |
| Normal | 34 | 85.0 | 59 | 78.7 | 93 | 80.9 |
| Mild | 4 | 10.0 | 11 | 14.7 | 15 | 13.0 |
| Moderate | 1 | 2.5 | 5 | 6.7 | 6 | 5.2 |
| Severe | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Extremely severe | 1 | 2.5 | 0 | 0.0 | 1 | 0.9 |
| Overall stress | 6 | 15.0 | 16 | 21.3 | 22 | 19.1 |

## DISCUSSION

The level of depression among the respondents at the Kilimu Village of Ranau district, Sabah, Malaysia, was higher (28.7%) than the findings by the WHO World Mental Health (WMH) Survey Initiative as reviewed by Kessler and Bromet (2013).[25] The WMH study used the WHO Composite International Diagnostic Interview (CIDI) version 3.0 instrument among participants across 18 countries. It reported that approximately one-fifth (20.0%) of adults from various cultural backgrounds had experienced depressive symptoms.[25] The depression level in the current study was also higher than the national prevalence mentioned in the Malaysian Mental Healthcare Performance Technical Report 2016. Only 2.4% and 1.8% of the Malaysian population suffered from lifetime and current depression, respectively.[12] The report examined and validated nine data sources related to psychiatric illnesses in Malaysia, such as the Health Informatics Center and the Clinical Performance Surveillance Unit of the Ministry of Health Malaysia; Psychiatric Survey database, the National Anti-Drugs Agency, as well as data from the Ministry of Education Malaysia, among others.[12]

Compared to other studies that used similar instruments, our results showed a higher level of depressive symptoms. For instance, the depression level among rural women in India was 15.0%, whereas the average depression level among rural Mexican young adults by the United States-Mexico border was 16.9%.[26,27] Depression level was assessed by using the DASS-21 in both studies.

**Table 3.** Association of depression, anxiety, and stress by socio-demographic characteristics

| | Depression | | OR (95% CI) | p | Anxiety | | OR (95% CI) | p | Stress | | OR (95% CI) | p |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yes | No | | | Yes | No | | | Yes | No | | |
| **Age** | | | | | | | | | | | | |
| <60 years | 31 | 74 | 1.68 (0.34-8.34) | 0.722 | 47 | 58 | 3.24 (0.66-16.00) | 0.185 | 21 | 84 | 2.25 (0.27-18.76) | 0.684 |
| ≥60 years | 2 | 8 | | | 2 | 8 | | | 1 | 9 | | |
| **Gender** | | | | | | | | | | | | |
| Male | 9 | 31 | 0.62 (0.25-1.50) | 0.283 | 12 | 28 | 0.44 (0.20-0.99) | 0.046[†] | 6 | 34 | 0.65 (0.23-1.82) | 0.411 |
| Female | 24 | 51 | | | 37 | 38 | | | 16 | 59 | | |
| **Ethnicity** | | | | | | | | | | | | |
| Bumiputera | 32 | 80 | 0.80 (0.07-9.14) | 1.000 | 49 | 63 | — | 0.260 | 22 | 90 | — | 1.000 |
| Others | 1 | 2 | | | 0 | 3 | | | 0 | 3 | | |
| **Education** | | | | | | | | | | | | |
| Primary/Secondary | 24 | 69 | 0.50 (0.19-1.32) | 0.159 | 36 | 57 | 0.44 (0.17-1.13) | 0.082 | 16 | 77 | 0.55 (0.19-1.64) | 0.365 |
| Tertiary | 9 | 13 | | | 13 | 9 | | | 6 | 16 | | |
| **Employment** | | | | | | | | | | | | |
| Employed | 18 | 55 | 0.59 (0.26-1.35) | 0.207 | 33 | 40 | 1.34 (0.62-2.91) | 0.458 | 12 | 61 | 0.63 (0.25-1.62) | 0.333 |
| Unemployed | 15 | 27 | | | 16 | 26 | | | 10 | 32 | | |
| **Income** | | | | | | | | | | | | |
| <RM3,000 | 30 | 70 | 1.71 (0.45-6.52) | 0.549 | 43 | 57 | 1.13 (0.37-3.42) | 0.827 | 20 | 80 | 1.63 (0.34-7.79) | 0.732 |
| ≥RM3,000 | 3 | 12 | | | 6 | 9 | | | 2 | 13 | | |

[†]Statistically significant with p<0.05.

**Table 4.** Association of depression, anxiety, and stress with other risk factors

| | Depression | | OR (95% CI) | p | Anxiety | | OR (95% CI) | p | Stress | | OR (95% CI) | p |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Yes | No | | | Yes | No | | | Yes | No | | |
| *h/o hypertension* | | | | | | | | | | | | |
| Yes | 3 | 27 | 0.20 (0.06-0.73) | 0.009† | 9 | 21 | 0.48 (0.20-1.17) | 0.104 | 2 | 28 | 0.23 (0.05-1.06) | 0.058 |
| No | 30 | 55 | | | 40 | 45 | | | 20 | 65 | | |
| *h/o diabetes* | | | | | | | | | | | | |
| Yes | 2 | 9 | 0.52 (0.11-2.56) | 0.508 | 4 | 7 | 0.75 (0.21-2.72) | 0.756 | 2 | 9 | 0.93 (0.19-4.66) | 1.000 |
| No | 31 | 73 | | | 45 | 59 | | | 20 | 84 | | |
| *h/o dyslipidemia* | | | | | | | | | | | | |
| Yes | 1 | 14 | 0.15 (0.02-1.21) | 0.063 | 5 | 10 | 0.64 (0.20-2.00) | 0.436 | 0 | 15 | – | 0.071 |
| No | 32 | 68 | | | 44 | 56 | | | 22 | 78 | | |
| *h/o kidney disease* | | | | | | | | | | | | |
| Yes | 0 | 1 | – | 1.000 | 0 | 1 | – | 1.000 | 0 | 1 | – | 1.000 |
| No | 33 | 81 | | | 49 | 65 | | | 22 | 92 | | |
| *h/o endocrine disease* | | | | | | | | | | | | |
| Yes | 0 | 2 | – | 1.000 | 2 | 0 | – | 0.179 | 0 | 2 | – | 1.000 |
| No | 33 | 80 | | | 47 | 66 | | | 22 | 91 | | |
| *h/o depression* | | | | | | | | | | | | |
| Yes | 3 | 1 | 8.10 (0.81-80.92) | 0.071 | 3 | 1 | 4.24 (0.43-42.05) | 0.311 | 2 | 2 | 4.55 (0.60-34.26) | 0.165 |
| No | 30 | 81 | | | 46 | 65 | | | 20 | 91 | | |
| *h/o anxiety* | | | | | | | | | | | | |
| Yes | 1 | 1 | 2.53 (0.15-41.70) | 0.493 | 1 | 1 | 1.35 (0.08-22.20) | 1.000 | 1 | 1 | 4.38 (0.26-72.92) | 0.347 |
| No | 32 | 81 | | | 48 | 65 | | | 21 | 92 | | |
| *h/o stress* | | | | | | | | | | | | |
| Yes | 4 | 1 | 11.17 (1.20-104.11) | 0.023† | 4 | 1 | 5.78 (0.63-53.41) | 0.162 | 3 | 2 | 7.18 (1.12-45.98) | 0.048† |
| No | 29 | 81 | | | 45 | 65 | | | 19 | 91 | | |
| *h/o other illnesses** | | | | | | | | | | | | |
| Yes | 5 | 2 | 7.14 (1.31-38.92) | 0.020† | 6 | 1 | 9.07 (1.06-78.00) | 0.041† | 6 | 1 | 34.50 (3.89-05.98) | <0.001† |
| No | 28 | 80 | | | 43 | 65 | | | 16 | 92 | | |
| *Illegal drug use* | | | | | | | | | | | | |
| Yes | 1 | 1 | 2.53 (0.15-41.70) | 0.493 | 1 | 1 | 1.35 (0.08-22.20) | 1.000 | 1 | 1 | 4.38 (0.26-72.92) | 0.347 |
| No | 32 | 81 | | | 48 | 65 | | | 21 | 92 | | |
| *Active smoker* | | | | | | | | | | | | |
| Yes | 3 | 8 | 0.93 (0.23-3.73) | 1.000 | 4 | 7 | 0.75 (0.21-2.72) | 0.756 | 2 | 9 | 0.93 (0.19-4.66) | 1.000 |
| No | 30 | 74 | | | 45 | 59 | | | 20 | 84 | | |
| *Passive smoker* | | | | | | | | | | | | |
| Yes | 6 | 7 | 2.38 (0.74-7.72) | 0.140 | 7 | 6 | 1.67 (0.52-5.31) | 0.384 | 3 | 10 | 1.31 (0.33-5.23) | 0.712 |
| No | 27 | 75 | | | 42 | 60 | | | 19 | 83 | | |
| *Excessive alcohol intake* | | | | | | | | | | | | |
| Yes | 1 | 7 | 0.34 (0.04-2.83) | 0.436 | 3 | 5 | 0.80 (0.18-3.50) | 1.000 | 1 | 7 | 0.59 (0.07-5.02) | 1.000 |
| No | 32 | 75 | | | 46 | 61 | | | 21 | 86 | | |
| *Physical activity level* | | | | | | | | | | | | |
| Moderate/high | 24 | 53 | 1.46 (0.60-3.55) | 0.404 | 38 | 39 | 2.39 (1.04-5.49) | 0.037† | 16 | 61 | 1.40 (0.50-3.92) | 0.522 |
| Low | 9 | 29 | | | 11 | 27 | | | 6 | 32 | | |

*History of other illnesses was self-reported as gastritis (n=4), bloody stools (n=1), bronchial asthma (n=1), and brain carcinoma (n=1).
Abbreviation: h/o (history of certain diseases). †Statistically significant with p<0.05.

The level of anxiety among the respondents was remarkably high, at 42.6%. As a comparison, only 10% of the adult population in rural Australia had anxiety symptoms according to the Kessler 10 (for psychological distress assessment) and Hospital Anxiety and Depression Scale (for anxiety and depression assessment).[28] Meanwhile, a community survey involving three districts in Selangor, Malaysia, reported an 8.2% of anxiety-related disorder prevalence by using the Generalised Anxiety Disorder 7 questionnaire.[29] A systematic review comprising four studies among the general Malaysian population found that anxiety-related disorder prevalence was only 5.6% at the highest.[30] Other studies that used the DASS-21 instrument also reported lower levels of anxiety measured at 10.6% and 33.1%, respectively, among the rural women and rural young adults.[26,27]

On the other hand, the stress level (19.1%) among the rural Kilimu Village respondents was comparable to the urbanites. Using the DASS-21, Sahoo and Khess (2010) observed that one-fifth of 500 young male adults experienced mild-to-extremely severe stress.[31] Additionally, 21.0% of male and 23.0% of female adults working in a Malaysian public university had reported stress symptoms with an overall prevalence of 21.7%, whereas 21.6% of young Malaysian adults suffered moderate-to-extremely severe stress,[32,33] which was in agreement with the current study finding. Both studies utilized the DASS-21 questionnaire to assess the stress level among their subjects.

In brief, the respondents in this study exhibited higher levels of depression and anxiety but had a similar stress level compared to the currently available epidemiological data. Many studies that looked upon mental health issues were conducted in the Malaysian Peninsular, with fewer Eastern Malaysia studies. In general, the overall mental health problem among the whole Malaysian adults was 29.2%.[34] However, the data was markedly higher in the Malaysian Bornean state of Sabah, in which 42.9% of the adults reportedly having mental illnesses.[34] These differences might be due to social stigma and reluctance to seek early consultation from healthcare professionals regarding psychological symptoms, leading to neglected treatment and the emergence of full-blown mental-related diseases. Indeed, a recently published study found that the "mental help-seeking attitude" was significantly inversely correlated with the "self-stigma on seeking help".[35]

Among respondents from the rural community of Kilimu Village, the male gender was 0.44 times less likely to have anxiety symptoms than females. Female preponderance toward anxiety could be observed from childhood to young adulthood and persistently present during older age.[36-38] Among young college-attending adults, female anxiety was closely related to body image, academic performance, as well as introverted personality.[37] However, Curran et al. (2020) also found that low education levels and lower support from spouses could remarkably contribute to females' anxiety

symptoms.[38] In many parts of the world, especially in rural regions, gender-specific roles often pre-determined by the community in a patriarchal manner.[39] Besides, it was common for rural women to carry out multiple roles. They often participated in economic activities such as performing agricultural works and trading while fulfilling their traditional roles as housekeepers (e.g., preparing food, taking care of family members, and cleaning).[40] Likewise, Malaysian women were also generally expected to fulfill these roles, contributing to higher anxiety levels than males.[41]

Several studies had linked hypertension with the occurrence of depression. For example, Rubio-Guerra and colleagues reported that depression had a relatively strong and significant positive correlation with systolic and diastolic blood pressures ($r$=0.713 and $r$=0.520, respectively).[42] Additionally, a case-control study in Karachi, Pakistan, found that the odds for having depression in uncontrolled hypertension was 2.02 (95% CI: 1.44–2.83, $p$<0.001), which remained statistically significant after covariates adjustments including age, gender, body mass index, and other co-morbidities.[43] In contrast, our data showed that respondents with a history of hypertension were less likely to have depression, which was in accord with the Netherlands Study of Depression and Anxiety cohort findings.[44] In the study, subjects with current depression and depression-in-remission had a lower mean of systolic blood pressure than controls ($\beta$=-1.74, $p$=0.04, and $\beta$=-2.35, $p$=0.004, respectively).[44] Good adherence to the antihypertensive medications reportedly had a positive impact on depression. For example, a Nepalese-based study found that antihypertensive drug' intake significantly reduced the risk for depression ($\beta$=-2.89, $p$<0.05).[45] Apart from that, prescription of certain antihypertensive classes, especially the angiotensin-converting enzyme inhibitors (ACEi) and angiotensin receptor blockers (ARBs), could even lower the risk for depression.[46] These medications are often used as first-line therapies for hypertension in Malaysia.[47] Therefore, in the current study, we deduce that the lower odds for having depressive symptoms among respondents with a history of hypertension might be contributed by the use of ACEi/ARBs, along with good adherence to the medications provided through well-organized hypertension clinic services in the government health center and district hospital.

In the current study, respondents reported higher odds of having depressive and stress symptoms when they had a history of being diagnosed with stress. Indeed, prior studies said that stress had a significant positive correlation with depression ($r$=0.406, $p$=0.002), with more than 20-fold higher risk for having depressive symptoms (OR: 20.84, $p$<0.001) among individuals with increased stress levels.[48,49] Life stress was also significantly associated with depression, even among healthy individuals ($z$=3.01, $p$=0.003).[50] It had been shown that there is a link between stress and depression. Disturbances in the metabolism of 5-hydroxytryptamine (5-HT) or serotonin, a brain monoamine neurotransmitter that modulates mood, and downregulation of its receptors,

particularly 5-HT$_{1A}$, occurred in depressive patients.[51] Combined with vulnerable personality traits, individuals with persistent 5-HT system abnormalities would have increased sensitivity to stress, which is a precursor event before the depression.[51] The presence of stress symptoms among these study participants with a previous history of diagnosed stress suggested that their psychological illness was unsuccessfully controlled. They could be due to the persistent presence of stressors, poor compliance to stress-reducing treatment, or inadequate treatment facilities. Indeed, these are essential issues that need to be addressed by the relevant authorities to provide better psychological management in this community.

Past medical history, including diabetes mellitus, dyslipidemia, and kidney and endocrine diseases, did not associate with psychological symptoms in this community. However, higher odds of having depressive, anxiety, and stress symptoms were observed in those with a history of other illnesses self-reported as gastritis, bronchial asthma, bloody stools, and brain carcinoma. Comparatively, the former two diseases often manifest with more dramatic symptoms such as epigastric pain and shortness of breath. In contrast, symptoms of the latter two conditions might be perceived to result in inevitable death. Subsequently, they could cause psychological disturbances that resulted in depression, anxiety, and stress. As a comparison, diabetes mellitus, dyslipidemia, as well as kidney and endocrine diseases have slow progression while being asymptomatic during earlier stages. Patients often underestimate their risk for these diseases. For instance, 80% of individuals with an elevated- and high-actual risk for diabetes perceived their risks as slight or absent.[52] Additionally, almost 60% of 850 hyperlipidaemic patients on hypolipidaemic agents did not believe that they had abnormal lipid profile, while another 30% of them did not recognize the requirement for long-term therapy, despite recording an 80% compliance rate.[53]

Physical activity was inversely associated with anxiety, though our results showed otherwise.[18,19] Different types of PA had contrasting effects on anxiety. For example, those involved in sports that were competitive such as gymnastics, swimming, and martial art fighting, had increased anxiety despite having high PA levels, in a phenomenon known as sports-related anxiety.[54] Farming or agricultural activities are associated with heavy-carrying and weightlifting (HCL), a tool to assess PA levels. From a total of 21,296 farmers in the Agricultural Health Study of North Carolina, the United States, 94% of them exceeded the national guidelines for muscle-strengthening and vigorous PA level due to the farming-related HCL activities.[17] Farmers were also comparatively more active during their working hours than other types of occupations with recorded occupational moderate-to-vigorous PA of 19.5 hours/week versus 6.8 hours/week ($p<0.01$).[55] Despite being physically active, the prevalence of anxiety among farmers was significantly higher than in other occupations. In the Hordaland Health Study 1997-99 in Western Norway, higher anxiety levels among farmers than non-farmers could be explained by longer working hours and lesser income.[56] Likewise, 57% of 1,132 Canadian farmers who responded to an online survey were classified as "possible cases for anxiety."[57] Certainly, economic stresses and overworking were common factors faced by farmers in any part of the world.[58] Majority of the respondents in this study were from the Kadazan-Dusun ethnicity, mostly dependent on agricultural activities.[59] This could explain the elevated anxiety level among the Kilimu Village community despite having concurrently high PA levels.

Since this is a small-scale study conducted during a health promotional activity, there are few limitations. Firstly, DASS-21 is not a diagnostic but a screening tool to detect the presence of depressive, anxiety, and stress symptoms. In the clinical setting, a high DASS-21 score will warrant further evaluation by the psychiatrist before definitive diagnosis and treatment. Hence, future follow-up study using validated diagnostic tools is recommended to determine the prevalence rates of depression, anxiety, and stress in this community. Secondly, this study was done in a rural village in Sabah. Thus, the results could not be generalized to the whole rural population in the state. A more extensive study comprising a bigger sample size that involves multiple rural villages across Sabah is recommended to get more accurate data on the psychiatric prevalence.

## CONCLUSION

The rural community in the Kilimu Village of Ranau district, Sabah, Malaysia, had high depression and anxiety levels. These findings may necessitate more rigorous mental health support and intervention by the relevant authorities in community-wide screening, establishing local mental health support groups, and improving mental healthcare personnel's availability in the district.

## Statement of Authorship

All authors participated in data collection and analysis, and approved the final version submitted.

## Author Disclosure

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