

## ORIGINAL ARTICLE

# Prevalence, risk factors and association with gallstone disease of non-alcoholic fatty liver disease among rural indigenous communities: A cross-sectional study in Sarawak, Malaysia

Ting Ting Yew, Whye Lian Cheah, Ai Jiun Koa, Han Bing Chow

Yew TT, Cheah WL, Koa AJ, Chow HB. Prevalence, risk factors and association with gallstone disease of non-alcoholic fatty liver disease among rural indigenous communities: A cross-sectional study in Sarawak, Malaysia. *Malays Fam Physician*. 2025;20:8. <https://doi.org/10.51866/oa.634>

### Keywords:

Non-alcoholic fatty liver disease, Fatty liver, Gallstone, Central obesity, Body mass index

### Authors:

#### Ting Ting Yew

(Corresponding author)  
MD, Dr.Rad, FRCR, MMed  
(Diagnostic Rad)  
Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, Kota Samarahan, Sarawak, Malaysia.  
Email: [tyew@unimas.my](mailto:tyew@unimas.my)

#### Whye Lian Cheah

Phd (Community Nutrition)  
Department of Community Medicine & Public Health, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, Kota Samarahan, Sarawak, Malaysia.

#### Ai Jiun Koa

MD, MMed Radiology  
Department of Radiology, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, Kota Samarahan, Sarawak, Malaysia.

### Abstract

**Introduction:** This study aimed to evaluate the prevalence and risk factors of non-alcoholic fatty liver disease (NAFLD) among Dayak communities in Malaysia, shedding light on an underexplored population.

**Methods:** A cross-sectional study was undertaken among Dayak villagers in Sarawak aged 18 years and above using an interview-based questionnaire, followed by an anthropometric measurement, a blood test and an abdominal ultrasound.

**Results:** A total of 324 participants met the inclusion criteria. Among them, 42.9% were men, and the mean age was 49.85±14.9 years. The prevalence of NAFLD was substantially high at 58%, with 43.1% of the participants having mild fatty liver (grade 1). NAFLD was closely associated with waist circumference and body mass index (BMI) ( $P<0.001$ ). Central obesity, as indicated by waist circumference and BMI, emerged as a potent risk factor, with higher values correlating with an increased likelihood of NAFLD. A higher prevalence of NAFLD was observed in the participants with an advancing age, an elevated triglyceride level (66.7%) and a lower high-density lipoprotein cholesterol level (81.6%). However, these associations did not remain significant in the multivariate analysis. Gallstones, which share common risk factors with NAFLD, were not significantly associated with NAFLD in this population ( $P=0.853$ ).

**Conclusion:** This study defines the prevalence and association of NAFLD with sociodemographic characteristics, health profiles and gallstone disease among indigenous villages in Dayak communities. A high BMI and central obesity are found to be independent risk factors of NAFLD.

### Introduction

Non-alcoholic fatty liver disease (NAFLD) has emerged as a worldwide health issue of alarming proportions, mirroring the rising trends of obesity and metabolic disturbances. This multifaceted liver disorder encompasses a range of pathological changes, from simple steatosis to non-alcoholic steatohepatitis, cirrhosis and hepatocellular carcinoma.<sup>1</sup>

Studies have shown that waist circumference, body mass index (BMI), age, hypertension, type 2 diabetes, triglyceride (TG) level and high-density lipoprotein cholesterol (HDL-C) level are the risk factors of NAFLD. Individuals with metabolic conditions, such as obesity, diabetes, hypertension and large waist circumference, tend to have a higher prevalence of NAFLD.<sup>2</sup>

In Malaysia, where rapid urbanisation and economic growth have precipitated substantial

lifestyle changes, NAFLD has emerged as a significant issue within the nation's healthcare landscape. With a prevalence ranging from 37.4% to 44.2%,<sup>3,4</sup> it has become a prominent health concern, notably in individuals afflicted with metabolic syndrome (82.8%),<sup>5</sup> dyslipidaemia (56.7%)<sup>6</sup> and diabetes (49.6%).<sup>7</sup>

Despite the well-documented prevalence of NAFLD among certain Malaysian populations, there remains a paucity of resources and research efforts directed towards specific communities, particularly among the indigenous Dayak population of Borneo. Dayak people who primarily reside in the Southeast Asian regions of Borneo have distinctive dietary habits and lifestyles compared to other ethnicities in Malaysia. Dayak communities have their own unique cultural practices and dietary habits such as using local ingredients based on plants, including midin and fern, and applying special

**Han Bing Chow** 

MBBCh BAO, Msc, MRCP

Department of Medicine, Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, Kota Samarahan, Sarawak, Malaysia.

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fermentation techniques in processing food, including tuak, an ethnic rice wine consumed as an alcoholic beverage during festivities or incorporated into meat dishes.<sup>8</sup> These practices may serve as potential risk factors of both NAFLD and gallstone disease (GSD). While significant research has been conducted on NAFLD and GSD worldwide, there remains a considerable gap in knowledge regarding their potential coexistence and interplay, particularly within Dayak communities, which predominantly consume ethnic food. Limited studies have investigated this specific association in this ethnically diverse population in Borneo.

The associations between NAFLD and GSD in populations in the United States, China, Taiwan and Korea have been studied.<sup>9–12</sup> NAFLD was associated with increased gallstone formation in studies on Chinese and Taiwanese populations,<sup>10,11</sup> whereas inconclusive associations were found in studies on American and Korean populations owing to the association observed between NAFLD and cholecystectomy, rather than gallstones.<sup>9,12</sup>

The prevalence of NAFLD has surged in tandem, making it a pressing public health issue worldwide. This study sought to address this knowledge gap by uncovering the prevalence of NAFLD among Dayak communities in Malaysia and its intricate association with GSD. Understanding the unique dynamics of NAFLD within this population not only expands the knowledge but also serves as a stepping stone towards improving the quality of life and developing targeted interventions. This research serves as a critical step towards understanding the specific challenges posed by NAFLD in this population and illuminating the broader global context of NAFLD as a burgeoning health crisis.

## Methods

### *Study design*

A cross-sectional study was undertaken from September 2021 to June 2022. A list of Dayak villages in the Kuching, Serian and Samarahan divisions was obtained from the district officer, and villages were randomly selected from the list. An announcement was made via *Ketua Kampung* to invite all villagers aged 18 years and above to participate in the study. Villagers who were interested in participating in the study were required to fast for at least 8 hours the night before data collection on the next morning. An interview was conducted using a structured questionnaire that included sociodemographic questions, Alcohol Use Disorder Identification

Test (AUDIT) items and medical history of chronic illnesses, followed by anthropometric measurement, blood pressure measurement, biochemical blood test and abdominal ultrasound. The AUDIT is a 10-item screening tool developed by the World Health Organization (WHO) to assess alcohol consumption, drinking behaviours and alcohol-related problems. Villagers with chronic liver disease, hepatitis B or C infection, a history of cholecystectomy, gallbladder tumour and heavy consumption of alcohol including *tuak* (AUDIT score of  $\geq 8$ ) were excluded. Hepatitis B or C status was based on self-disclosed status; no hepatitis blood screening or liver function test was carried out.

### *Anthropometric measurement*

Participants' height was measured using the SECA 213 stadiometer and body weight using the SECA 813 weighing scale (Germany). Subsequently, BMI ( $\text{kg}/\text{m}^2$ ) was calculated. Based on the BMI classification in the WHO guidelines for the Asia-Pacific region,<sup>13</sup> a BMI of  $< 23 \text{ kg}/\text{m}^2$  was classified as normal weight;  $23.0\text{--}24.9 \text{ kg}/\text{m}^2$ , overweight; and  $\geq 25 \text{ kg}/\text{m}^2$ , obesity.

Waist circumference was taken in the horizontal plane midway between the bottom edge of the last rib and the crest of the ilium using a non-elastic measuring tape. A waist circumference of  $\geq 90 \text{ cm}$  in men and  $\geq 80 \text{ cm}$  in women was considered to indicate central obesity.<sup>14</sup>

### *Blood pressure measurement*

Blood pressure was measured using a digital blood pressure monitor while participants were seated with their arms placed on the examination table and the cubital fossa supported at the heart level. Two readings were taken at a 1-minute interval, and the average of the two readings was used. Participants were categorised as hypertensive if their systolic blood pressure was  $\geq 140 \text{ mmHg}$  and/or diastolic blood pressure was  $\geq 90 \text{ mmHg}$ .<sup>15</sup>

### *Biochemical measurement*

Blood tests measured the fasting blood sugar (FBS), TG, total cholesterol (TC), HDL-C and low-density lipoprotein cholesterol (LDL-C) levels of participants. According to the 2020 Malaysian Diabetes Mellitus Guidelines and National Cholesterol Education Program-Adult Treatment Panel III, an FBS level of  $\geq 5.6 \text{ mmol}/\text{L}$  was considered to indicate hyperglycaemia,<sup>16</sup> while a TG level of  $> 1.7 \text{ mmol}/\text{L}$ , a TC level of  $> 5.2 \text{ mmol}/\text{L}$ , an LDL-C level of  $> 3.8 \text{ mmol}/\text{L}$  or an HDL-C level of  $< 1.0 \text{ mmol}/\text{L}$  in men or  $< 1.2 \text{ mmol}/\text{L}$  in women was considered to indicate dyslipidaemia.<sup>17</sup>