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Cultural factors and risks: Incidence analysis of acute coronary syndrome in young adults in Bali

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Original Article

ABSTRACT

Background: The prevalence of acute coronary syndrome (ACS), which is the most critical ischemic heart disease and is the main source of morbidity and mortality worldwide, increases significantly every year in Indonesia, including Balinese young adults. Identification of modifiable risk factors, such as smoking habits, consuming alcohol, and processed food, is culturally important for making primary prevention strategies, the occurrence of attacks, and secondary prevention to reduce readmissions.
Objectives: This study aims to identify modifiable factors using a cultural approach associated with the incidence of ACS in Balinese young adults.
Methods: This is a quantitative cross-sectional study. A total of 150 eligible respondents were recruited consecutively at the Integrated Heart Service Centre of Prof. Dr. I.G.N.G Ngoerah General Hospital, Bali. Data were collected using validated questionnaires on socio-demographics, diet (SQ-FFQ), physical activity (GPAQ), alcohol use (AUDIT), psychological status (DASS-42), and sleep quality (PSQI). Independent variables included hypertension, diabetes, dyslipidemia, hyperuricemia, lifestyle, and psychosocial factors, with ACS incidence as the outcome. Data were analysed with descriptive statistics, chi-square, and logistic regression ($p < 0.05$).
Results: Results showed a significant relationship between hypertension, high salt intake, and sleep quality. Hypertension demonstrated the strongest statistical association with ACS among the variables included in the model (OR = 6.785, 95% CI: 2.429 - 18.956). The Nagelkerke R^2 value was 0.449, indicating a moderately strong predictive model. This shows that hypertension, risky diet, and poor sleep quality contribute to 44.9% of the explained variance in the incidence of ACS among young adults.
Conclusion: Risk factors contribute to the high prevalence of hypertension in Bali, including a high salt and fat diet in Balinese cuisine, poor sleep habits, and traditional activities in Bali. Recommendations for future research include exploring cardio-social factors and culturally based prevention and control strategies for ACS in young adults in Bali.

INTRODUCTION

Acute Coronary Syndrome (ACS) is the most critical ischemic heart disease and remains a leading cause of morbidity and mortality worldwide.[1] Ischemic heart disease is the leading cause of death globally, with a prevalence of 16% of total deaths.[2] The global mortality rate from heart disease has risen substantially, increasing from just over 2 million deaths in 2000 to 8.9 million in 2019. Projections suggest this number could reach 23.3 million by 2030. In Southeast Asia alone, coronary heart disease caused around 3.9 million deaths, with nearly half (48%) occurring even before patients arrived at a hospital.[2] Cardiovascular disease is the leading cause of death in Indonesia.[3] The incidence of ACS in Indonesia, according to the Ministry of Health (2019) was 17.7 million out of 39.5 million of deceases. The death rate from ACS reached 680 per 100,000 people.[3] The prevalence of coronary heart disease (CHD) in Bali Province diagnosed by physicians

was 0.4%, while the prevalence based on other diagnostic methods reached 1.3%.[4] The highest mortality rate in 2020 is still in low-income countries. The prevalence of ACS among adolescents and young adults is rising, exhibiting a shifting epidemiological trend from a condition predominantly affecting the elderly to one that is now more frequently observed in early adulthood, often characterised by normal coronary arteries, non-obstructive disease, and high blood vessel disease. However, in recent years, more young adults have been reported to suffer from ACS.[5]

Risk factors for ACS, such as gender, age, and family history, are non-modifiable factors. On the other hand, sedentary lifestyle, smoking, alcohol consumption, hypertension, diabetes mellitus, obesity, hyperuricemia, and hypercholesterolemia are factors that are considered modifiable and can be targeted for lowering the risk of ACS.[6] Tourism in Bali not only has an impact on tourist destinations but also has an impact on the globalisation of local communities, especially the younger generation.[7] Lifestyles such as smoking, consuming excessive high-fat foods, and drinking alcohol are risk factors for ACS. This lifestyle also occurs in Balinese society, where these habits are inseparable in a series of traditional ceremonies in Bali. Based on data from the 2023 Indonesian Health Survey[8], the prevalence of heart disease in Bali Province diagnosed by physicians was 1.00%, indicating that approximately 1 in 100 residents in Bali were diagnosed with heart disease by a medical professional during the survey period, placing Bali slightly above the national average.

Fatty foods accompanied by alcoholic beverages and smoking habits, especially during traditional ceremonies, are often consumed by young adults in Bali. This habit is a high-risk factor for ACS in young adults, as there is a relationship between diet, alcohol consumption, and smoking to increases the incidence of coronary heart disease.[9] Research on the patterns of dietary habits and lifestyle in Bali needs to be explored more deeply so that the prevention of disease risk factors that affect community resources in Bali can be achieved. The importance of health education without ignoring the meaning of the ritual itself is expected to increase awareness of the Balinese young adults regarding the risk factors for ACS before the first attack occurs.

In addition to diet, psychosocial factors also affect the incidence of ACS in Balinese young adults. Psychological disorders such as stress and anxiety are also experienced by village officers in Bali. In a case study, it was found that stress experienced by village officers in Bali caused hypertension, which is one of the factors of ACS. There is an activity in Bali with a heavy workload and volunteering, namely *"Ngayah",* is also a source of stress for this village officer. The psychological dynamics experienced by traditional figures in Bali can affect health conditions, which can lead to increased blood pressure.[9] This research offers an in-depth analysis of ACS risk factors in young adults, which were inconsistent in numerous prior studies.

In the last decade, the global incidence of ACS has continued to increase every year. When viewed from the age group, the proportion of ACS tends to increase in young adults compared to other groups. Various efforts have been made to prevent coronary heart disease and ACS incidence through modification of the risk factors involved and socialisation, but the incidence has not shown a significant decrease. Additionally, a cross-sectional study analysis of ACS recurrence in Bali's Buleleng villages showed that persistent high smoking and hypertension rates were significantly tied to ACS recurrence within 30 days.[10] Although Bali authorities have invested in risk factor modification and community health education, epidemiological data indicate a persistently high prevalence of key risk factors and challenges in translating awareness of CHD into behaviour change.[11] The pattern of dietary customs in Bali that has existed for generations should be re-evaluated to determine whether it should be maintained, modified, or changed to be more beneficial in terms of health. This study was conducted to identify modifiable factors of cultural approach related to the incidence of Acute Coronary Syndrome (ACS) in young adults in Bali.

METHODS

Study design

This study uses a quantitative cross-sectional research type with analytical descriptive

studies. The cross-sectional design is collected at a certain point in time. Independent and dependent variables by taking measurements simultaneously at one time and there is no follow-up procedure.

Population and sample

The study was conducted at the Integrated Heart Service Centre (*Pelayanan Jantung Terpadu*) of Prof. Dr. I.G.N.G Ngoerah General Hospital, Bali from February 5th, 2024 to March 30th, 2024. The subjects of this study were all patients with cardiovascular system disorders who were outpatients at Prof. Dr. I.G.N.G Ngoerah General Hospital in February - March 2024 and who met the inclusion criteria with a total sample of 150 patients obtained using the Lemeshow formula and 10% of drop out. The inclusion criteria in this study were: patients with Acute Coronary Syndrome (ACS) undergoing outpatient treatment at Prof. DR I.G.N.G. Ngoerah General Hospital, aged 18-40 years, Hindu religion, practising Balinese culture means actively engaging in the traditions, customs, and daily practices that are part of the cultural identity of the Balinese people (e.g., *Ngayah*, *Megibung*, and *Megenjekan*), and living in Bali for at least 5 years. The exclusion criteria in this study were: patients with unstable hemodynamics also patients with stable angina, stroke, chronic kidney disease, chronic liver disease, and pregnancy.

Data collection

The instrument in this study used a questionnaire consisting of 6 parts: Sociodemographic Data Questionnaire (Patient Identity, Gender, Age, Education Level, Occupation, Family History of CHD, Hypertension, Diabetes Mellitus, Dyslipidemia, Hyperuricemia, Obesity, Smoking and the incidence of ACS in young adults), SQ-FFQ Questionnaire, Global Physical Activity Questionnaire (GPAQ), Alcohol Use Disorder Identification Test (AUDIT) Questionnaire, Depression Anxiety Stress Scales Questionnaire (DASS 42) (Stress, Anxiety and Depression) and Pittsburgh Sleep Quality Index Questionnaire (PSQI).

Variable of study

The independent variables in this study are hypertension, diabetes mellitus, dyslipidemia, hyperuricemia, diet assessed with SQ-FFQ, physical activity, obesity, smoking, alcohol consumption, stress, anxiety, depression, and sleep quality. The dependent variable is the incidence of ACS in young adults. Missing data were managed by ensuring completeness, clarity, relevance, and consistency of the questionnaires during data collection. Each questionnaire was reviewed prior data processing to minimise missing or invalid entries.

Explanation cut off in each variable is hypertension (with cut off: BP >130/80 mmHg and use medication), diabetes mellitus (random glucose >200 mg/dL, fasting glucose >126 mg/dL, or HbA1c >6.5%), dyslipidemia (total cholesterol >200 mg/dL), hyperuricemia with uric acid >7.0 mg/dL (men) or >6.0 mg/dL (women), diet assessed with SQ-FFQ based on *Angka Kecukupan Gizi* (Indonesian RDA), physical activity measured using GPAQ; categorized by MET-min/week (low <600, moderate 600–3000, high >3000), obesity if BMI ≥25 kg/m^2 (Asia-Pacific cut-off), smoking (current or past smoker vs. non-smoker), alcohol consumption using AUDIT score (≥8 indicates risky use), stress, anxiety, depression measured using DASS-42 cut-off varies by domain, and sleep quality measured using PSQI score >5 indicates poor sleep quality.

Data analysis

Data analysis in this study is univariate, bivariate, and multivariate analysis using statistical application programs. Univariate analysis is used to provide an explanation or description of the characteristics of each research variable. Bivariate analysis is used to describe the relationship between each independent variable and the incidence of ACS in young adults as the dependent variable. This bivariate analysis was carried out using the Chi-Square test with α: 0.05. Multivariate analysis in this study aims to see the relationship between independent variables and dependent variables at one time.[12] Logistic regression was employed for multivariate

analysis, suitable for the categorical dependent variable, to identify independent predictors and construct the optimal model for ACS risk.

Ethical statement

This research has fulfilled the research permits and ethical feasibility test. Research permit number: DP. 04.03/D.XVII.2.2.2/3976/2024 and research ethical clearance number: 0102/UN14.2.2VII.14/LT/2024.

RESULTS

Table 1 presents the characteristics of the respondents, showing a mean age of 31 years, most were male (89 patients, 59.3%), most had high school education (87 patients, 58%), with the majority worked as private employees (40.7%), In addition, most respondents reported no family history of CHD (107 patients, 71.3%).

Table 1. Socio-demographics characteristic (n=150)

No	Variable	n (%)
1	Age (Years)	30.6 ± 7.4; 31 (18-40)
2	Gender	
	Female	61 (40.7)
	Male	89 (59.3)
3	Education Level	
	Not in school	1 (0,7)
	Elementary	3 (2)
	Junior High School	4 (2.7)
	Senior High School	87 (58)
	College	55 (36.7)
4	Occupation	
	Civil servant/Police	14 (9.3)
	Non-government	61 (40.7)
	Farmer	2 (1.3)
	Entrepreneur	44 (29.3)
	Housewives	29 (19.3)
5	Family history of CHD	
	No	107 (71.3)
	Yes	43 (28.7)

Table 2. Bivariate Analysis of the relationship between variables

No	Variable Independent and Categories	Incident of ACS In Bali Young Adults		Total n (%)	*Odds Ratio (95% CI)*	*p-value*
		No n (%)	Yes n (%)			
1	Hypertension					
	No	21 (55.3)	19 (17)	40 (26.7)	1	0.001*
	Yes	17 (44.7)	93 (83)	110 (73.3)	6.046 (2.696 - 13.561)	
2	Diabetes Mellitus					
	No	32 (84.2)	71 (63.4)	103 (68.7)	1	0.029*
	Yes	6 (15.8)	41 (36.6)	47 (31.3)	3.080 (1.188 -7.987)	
3	Dyslipidemia					
	No	29 (76.3)	62 (55.4)	91 (60.7)	1	0.036*
	Yes	9 (23.7)	50 (44.6)	59 (39.3)	2.599 (1.127 -5.992)	

No	Variable Independent and Categories	Incident of ACS In Bali Young Adults		Total n (%)	*Odds Ratio (95% CI)*	*p-value*
		No n (%)	Yes n (%)			
4	Hyperuricemia					
	No	32 (84.2)	73(65.2)	105 (70)	1	0.045*
	Yes	6 (15.8)	39 (34.8)	45 (30)	2.849 (1.097 - 7.402)	
5	Diet					
	Diet No Risk/Normal	28 (73.7)	40 (35.7)	68 (45.3)	1	0.001*
	Diet with risk	10 (26.3)	72 (64.3)	82 (54.7)	5.040 (2.222 -11.432)	
6	Physical Activity					
	Severe	13 (34.2)	16 (14.3)	29 (19.3)	1	0.028*
	Moderate	20 (52.6)	71 (63.4)	91 (60.7)	2.884 (1.191 - 6.983)**	
	Mild	5 (13.2)	25 (22.3)	30 (20)	4.062 (1.215-13.587)**	
7	Obesity					
	No	19 (50)	26 (23.2)	45 (30)	1	0.004*
	Yes	19 (50)	86 (76.8)	105 (70)	3.308 (1.528 – 7.162)	
8	Smoking					
	No	32 (84.2)	66 (58.9)	98 (65.3)	1	0.008*
	Yes	6 (15.8)	46 (41.1)	52 (34.7)	3.717 (1.438 – 9.609)	
9	Alcohol Intake					
	Mild Risk	23 (60.5)	38 (33.9)	61 (40.7)	1	0.016*
	Moderate Risk	14 (36.8)	63 (56.3)	77 (51.3)	2.724 (1.253-5.923)**	
	Severe Risk	1 (2.6)	11 (9.8)	12 (8)	6.658 (0.806-55.003)**	
10	Stress					
	Normal	16 (42.1)	74 (66.1)	90 (60)	1	0.027*
	Mild	15 (39.5)	22 (19.6)	37 (24.7)	0.317 (0.136 - 0.742)	
	Moderate	7 (18.4)	16 (14.3)	23 (15.3)	0.494 (0.175 - 1.398)	
11	Anxiety					
	Normal	18 (47.4)	35 (31.3)	53 (35.3)	1	0.124
	Mild	10 (26.3)	28 (25.0)	38 (25.3)	1.440 (0.574 – 3.610)**	
	Moderate	10 (26.3)	49 (43.8)	59 (39.3)	2.520 (1.039-6.115)**	
12	Depression					
	Normal	5 (13.2)	28 (25)	33 (22)	1	0.195
	Mild	33 (86.8)	84 (75)	117 (78)	0.455 (0.162 – 1.277)	
13	Sleep Quality					
	Good	21 (55.3)	35 (31.3)	56 (37.3)	1	0.014*
	Poor	17 (44.7)	77 (68.8)	94 (62.7)	2.718 (1.279 – 5.776)	

* Significance level at $\alpha < 0.05$

**OR and 95%CI values were obtained from the results of simple logistic regression analysis

Table 2 explained that of 112 respondents who experienced ACS, 93 respondents (83%) had hypertension. This indicates that the proportion of ACS in young adults with hypertension is higher. The results of statistical tests showed a significant relationship between hypertension and ACS in young adults in Bali (p: 0.001; $\alpha = 0.05$). Seeing from the OR value, it can be concluded that respondents with hypertension tend to have ACS 6 times greater than respondents without hypertension (OR 6,046; CI 95% 2,696 - 13,561).

Furthermore, of 112 respondents who experienced ACS, 72 respondents (64.3%) had a risky diet. This indicates that the proportion of ACS in young adults who have a risky diet is higher. The statistical tests showed a significant relationship between diet and ACS incidence in young adults in Bali (p = 0.001; α = 0.05). From the OR value, it can be concluded that respondents with a risky diet tend to experience ACS 5 times greater than respondents with a non-risky diet (OR 5,040; CI 95% 2,222 - 11,432).

In addition, of the 112 respondents who experienced ACS, 77 respondents (68.8%) had poor sleep quality. This indicates that the proportion of ACS in young adults who have poor sleep quality is higher. The statistical tests showed a significant relationship between sleep quality and ACS in young adults in Bali (p = 0.014; α = 0.05). From the OR value, it can be concluded that respondents who have poor sleep quality tend to experience ACS 3 times greater than respondents with good sleep quality (OR 2.718; CI 95% 1.279 - 5.776).

The next stage after bivariate selection is multivariate analysis, conducted using multiple logistic regression tests with the "Enter" method. This method considers the substantive aspect.[13] The process is carried out in stages by retaining variables that have a p-value <0.05 and sequentially removing variables with a p-value > 0.05, starting from the largest p-value. If the removal of a variable causes a change in the Odds Ratio (OR) value of more than 10%, the variable must be re-entered, and the process is stopped. The variable most related to the dependent variable is determined by a p-value <0.05 and the highest B exp value. The results of the multivariate analysis are used to create a probability prediction equation, for example, for the incidence of ACS in young adults in Bali. The calibration model was tested using the *Hosmer* and *Lameshow* Test, with a significant value > 0.05 indicating a good calibration.

Table 3. Final Model Multivariate Analysis

Variabel	B	p-value	OR	95% CI		R^2
				Lower	Upper	
Hypertension	1.915	0.000*	6.785	2.429	18.956	0.449
Diet	1.907	0.000*	6.734	2.449	18.516	
Sleep Quality	1.142	0.023*	3.134	1.174	8.364	
Depression	0.646	0.343	1.908	0.501	7.257	
Hyperuricemia	0.697	0.227	2.007	0.648	6.217	
Diabetes Mellitus	0.999	0.091	2.715	0.852	8.652	
Anxiety	1.043	0.053	2.839	0.985	8.184	
Stress	-0.962	0.063	0.382	0.139	1.055	
Constant	-2.137	0.001				

* Significant level at α < 0.05

Based on the final model of the multivariate analysis in Table 3 above, it turns out that the variables that are significantly related to the incidence of ACS in young adults in Bali are hypertension, diet, and sleep quality. Meanwhile, depression, hyperuricemia, diabetes mellitus, anxiety, and stress were included as control variables. The results of the analysis obtained the Odds ratio (OR) of the hypertension variable is 6.785 (95% CI: 2.429-18.956), means that young adults with hypertension are at risk of experiencing ACS 7 times higher than those without hypertension after controlling for the variables diet, sleep quality, depression, hyperuricemia, diabetes mellitus, anxiety, and stress. The same can be interpreted for other variables. The variable that is most related to the incidence of ACS in young adults in Bali is hypertension. The Nagelkerke coefficient (R^2) is 44.9%, which means that the three independent variables consisting of hypertension, risky diet, and poor sleep quality contribute to the incidence of ACS in young adults by 44.9%, while the remainder, about 55.1% is explained by other factors that are not included in this logistic regression model.

DISCUSSION

There is a significant correlation between hypertension and the incidence of ACS in young adults in Bali. This finding is consistent with a prior coronary artery study in young adults aged ≤35 years, which showed that ACS is more commonly found in males.[14] Based on global studies, risk factors for coronary heart disease can develop at a young age and can differ in each region depending on the lifestyle of the local population. Identifying high-risk occupational groups can help design targeted interventions. It is necessary to strengthen education and health promotion efforts, especially in groups with lower levels of education for health knowledge and awareness. Another study indicated that acute coronary syndrome predominantly occurs in individuals aged 18 to 44 years, particularly among those with multiple risk factors.[15]

Hypertension is a major risk factor for ACS.[16,17,18] There is also a relationship between age factors and lack of physical activity with the occurrence of hypertension in adulthood.[19] A study on the incidence of ACS patients for a decade in Germany (2005 - 2015) found that most patients were diagnosed with hypertension, dyslipidemia, and diabetes. The study also showed an increase in coronary management procedures and a decrease in mortality in the past decade.[20]

Hypertension was found to be the second largest risk factor for ACS in young adults (≤40 years) after smoking. As many as 29.7% of patients experienced hypertension in young adulthood. The delay in the onset of acute coronary syndrome, especially among young patients, is still common, so the mortality rate also increases in this population group.[17] A cross-sectional study from 2017 to 2019 that observed the diversity of dietary patterns on risk factors for atherosclerosis found that consuming sweet drinks, eating midnight snacks, smoking, consuming alcohol, and having a history of hypertension were the main risk factors for carotid atherosclerosis, which causes narrowing and occlusion of the arteries, forming the basis for cardiovascular disease.[18]

Hypertension is defined as BP greater than 140/90 mmHg or the use of antihypertensive medication. High-normal blood pressure, classified as BP ranging from 130–139/85–89 mmHg, also poses potential cardiovascular risk. In the regression analysis, individuals with high-normal hypertension demonstrated an elevated association with acute coronary syndrome (ACS), although the result was not statistically significant (hazard ratio [HR]: 1.20; 95% confidence interval [CI]: 0.81–1.77). In this study, the majority of patients were classified as having hypertension. Both elevated and high-normal BP levels were observed as contributing risk factors for the incidence of ACS.[16] A well-controlled long-term blood pressure, ideally starting before the patient is discharged, is needed to reduce subsequent events. Systolic blood pressure on hospital admission of more than 110 mm Hg and diastolic blood pressure not <70 mm Hg before discharge was associated with a better long-term prognosis in ACS patients.[21]

The results showed that the age of respondents was around 31 years old, the majority were male, most respondents had a senior high school education level, the majority worked as private employees, and most had no family history of CHD in the family. Based on global studies, risk factors for coronary heart disease can develop at a young age and can differ in each region depending on the lifestyle of the local population. Identifying high-risk occupational groups can help design targeted interventions. It is necessary to strengthen education and health promotion efforts, especially in groups with lower levels of education for health knowledge and awareness. Another study indicated that acute coronary syndrome predominantly occurs in individuals aged 18 to 44 years, particularly among those with multiple risk factors.[15]

Some activities that have the potential to increase the risk of hypertension are *"Megibung"* activities. "*Megibung*" is an activity of communal meal often including fatty and salty dishes such as *komoh* and *lawar*, which is part of cultural practices that significantly correlate with hypertension incidence.[22] The study found that diets rich in saturated fats and high salt content, commonly consumed during "*Megibung*" gatherings, could increase the risk of hypertension incidence if consumed excessively.[23]

The findings of several studies above are in line with the results of this study. It is important to increase public knowledge and awareness of hypertension, which can later increase the risk factors for premature coronary artery blockage by recognising symptoms, risk factors, and

prevention.

In this study, there was a significant relationship between diet and the incidence of ACS in young adults in Bali. This is in line with a study of 1,242 ACS patients aged ≤ 45 years, which found that one-third of patients experienced dyslipidemia caused by poor eating habits and lack of activity, which led to a high prevalence of overweight and obesity in ACS patients.[26] Consumption of red meat and processed meat was associated with increased mortality from cardiovascular disease associated with red meat. Combined intake of red meat and processed meat was associated with all-cause mortality, while low intake of red meat and processed meat was significantly associated with cardiovascular disease compared with no meat consumption.[27] Poor dietary habits and physical inactivity are associated with an increased risk of ACS in young adults.[28]

Balinese culture has a rich culinary tradition, but some traditional dietary patterns may increase the risk of ACS. The traditional Balinese diet is rich in vegetables, fruits, fish, and spices, which is beneficial for health, but modernisation and Western cultural influences have encouraged the consumption of unhealthy processed and fast foods.[29] White rice, the staple food of the Balinese people, is low in fibre and has a high glycemic index.[30] Popular dishes such as suckling pig, a meat roasted with spices, high in animal fat; "lawar" is a mix of coconut, meat (often pork), and sometimes blood, rich in fat; satay is made from minced pork, fish, or chicken mixed with grated coconut and coconut milk; and coconut milk dishes, often served at traditional events, are high in saturated fat and cholesterol.[31] Involving community and religious leaders in culture-based health campaigns can effectively promote healthy eating while respecting Balinese culinary traditions.

International guidelines recommend a diet that emphasises the intake of fruits and vegetables, whole grains, fish, and legumes, and minimises the intake of processed meat and fats to reduce CHD risk factors. Consumption of a high-protein diet has shown potential for CHD risk prevention with increased fish intake and decreased red/processed meat intake. Meanwhile, data on legume intake are still inconsistent with CHD risk.[28] A systematic review and meta-analysis found that a high-carbohydrate diet may increase the risk of CHD, especially in Asian populations. This is due to the high consumption of carbohydrates and genetic variations found in Asia. The meta-analysis found that patients with the highest carbohydrate intake had a 1.15-fold increased risk of CHD compared to those with the lowest intake. The relationship between carbohydrate intake and cardiovascular disease was found to be more than 60% of total energy derived from carbohydrates.[32] Unhealthy dietary habits, such as excessive saturated fat intake, are the main factors causing obesity and metabolic syndrome. Saturated fat intake combined with excessive carbohydrate consumption increases the risk of cardiometabolic disease by 1.28 times.[33]

Bali's diverse culinary traditions, especially foods containing saturated fat and cholesterol. Dishes such as suckling pig, *"lawar"*, coconut milk-based foods, and traditional cakes rich in sugar and oil are often an integral part of traditional and religious events. In terms of beverages, Bali also has traditional alcohol, namely "Arak Bali". The use of alcohol as an offering and sometimes consumed by Balinese people is found in several religious events and traditional ceremonies in Bali. "Arak Bali", which is a traditional alcoholic drink, can increase the risk of hypertension and ACS if consumed excessively. At certain moments, Balinese people, especially men from adolescence to adulthood, gather and chat while drinking palm wine and Balinese arak, while *"metuakan"* or *"mearakan"* people will chat and play music namely *"megenjekan".* Among young adults in Bali, the ease of access and the social pressure to participate in the celebration of certain events have increased alcohol consumption.[22]

Another activity is "*Ngayah*", in addition to providing a positive social impact, it is also a source of stress that contributes to hypertension if the burden of "*Ngayah*" is excessive. "*Ngayah"* refers to a culturally rich tradition of voluntary community service and is part of religious ceremony activities at the temple or traditional ceremonies at local residents' homes, such as wedding ceremonies, funerals, tooth filing, welcoming birthdays, and so on.[24] When these duties are excessive or emotionally taxing, they can impose considerable psychosocial stress. Excessive psychosocial stress associated with communal obligations and societal burdens is significantly

correlated with elevated blood pressure and hypertension in several Indonesian populations.[25]

Balinese people are required to be able to balance customary activities and economic livelihoods to meet household needs and social life in the community, so it is common for young adults in Bali to experience a lack of time for heavy physical activities such as regular exercise.[34,35]

This study shows a significant relationship between sleep quality and the incidence of ACS in young adults. Lack of sleep with poor quality (less than 6 hours) increases the risk of heart disease by 63%. Sleep patterns that are too long can also increase the risk of heart disease.[36] This is in line with a study stating that sleep patterns that are too short or too long can increase the risk of ACS. Late bedtime (≥24:00), short sleep duration (<6 hours), and early waking (>07:00) are associated with increased acute myocardial infarction risk, while nighttime exposure to bright light further elevates this risk. Regular daytime naps may offer a protective effect, particularly in young and middle-aged adults.[37] Patients with sleep durations of less than 5 hours were found to have a higher prevalence of acute coronary syndrome (ACS) compared to those who slept more than 9 hours. Sleep disturbances, especially lack of or reduced sleep time, can be a risk factor for CHD.[38]

Balinese culture, which is rich in rituals and social activities, can affect people's sleep patterns, especially the younger generation. Some religious activities and traditional ceremonies are often carried out at night or early morning, which can affect sleep quality and have an impact on general health. One example of the "*Megebagan*" activity is carried out at night until early morning at the deceased's house to show a sense of togetherness and support for the bereaved family. This is also a form of respect and honour for the deceased. Risk factors that cause high cases of ACS in Bali include a diet high in salt and fat in Balinese cuisine, lack of activity in urban areas and tourist destinations,[39] stress due to life pressures and rapid tourism development, hypertension factors are inherited from families, excessive alcohol consumption in celebrating traditional activities[40] in Bali, such as wedding ceremonies, increasing smoking habits, lack of awareness of the importance of routine health checks and because access to services in some places in Bali is limited to do health checks.[41]

This study is limited by its single-centre design and the focus on a specific population, which may restrict the generalisability of findings to Indonesia's diverse regions. Cultural and sociodemographic factors, including marital status, were not comprehensively assessed. Additionally, the exclusion of multicentre and comparative data, as well as the absence of both hospital and community-based samples, limits the applicability of the results to broader ACS prevention strategies.

CONCLUSION

The factors most associated with the incidence of young adult ACS in Bali were hypertension, diet, and sleep quality. There was a significant correlation between hypertension, diabetes mellitus, dyslipidemia, hyperuricemia, diet, physical activity, obesity, smoking, alcohol consumption, stress, and sleep quality. Future research should adopt multicentre, comparative designs across diverse Indonesian regions, integrating cultural and sociodemographic factors such as marital status, and encompassing both hospital and community-based populations to strengthen culturally tailored national ACS prevention strategies.

CONFLICT OF INTEREST

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DATA AVAILABILITY

Data derived from the medical records of Integrated Heart Service Centre *(Pelayanan Jantung Terpadu)* of Prof. Dr. I.G.N.G Ngoerah General Hospital, Bali. Data collection was conducted after obtaining ethical clearance approval, and the data were then submitted to the Director of Prof. Dr. I.G.N.G Ngoerah General Hospital, Bali. The raw data are not presented in this journal due to restrictions by ethical clearance.

SUPPLEMENTAL DATA

No supplemental data obtained.

AUTHOR CONTRIBUTIONS

NR: Conceptualised the study, designed the experiments, performed data analysis, and wrote the first draft of the manuscript; EN: Developed the novel algorithm, conducted computational simulations, and contributed to manuscript revision; TH: Assisted in data interpretation, supervised the research process; MA: Provided critical insights on theoretical framework, supervised the research process. SK: Contributed to the final editing of the manuscript.

DECLARATION OF USING AI IN THE WRITING PROCESS

Authors utilise AI tools (Google Translate) to enhance word choice and phrasing.

LIST OF ABBREVIATIONS

ACS: Acute Coronary Syndrome; BP: Blood Pressure; CHD: Coronary Heart Disease.

REFERENCES

1. Sidhu NS, Kaur S, Rangaiah SKK, Ramesh D. Differences in clinical characteristics, management and in-hospital outcomes among diabetic versus non diabetic patients with acute coronary syndrome. International Journal of Research & Review. 2019;6:337-345.
2. World Health Organization: WHO. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
3. Kemenkes. KEPMENKES NOMOR HK.01.07/MENKES/675/2019. pedoman nasional pelayanan kedokteran tata laksana sindroma koroner akut.; 2019. https://yankes.kemkes.go.id/unduhan/fileunduhan_1610419977_266892.pdf
4. Kemenkes. KESEHATAN BPDP, RI KK. riset kesehatan dasar riskesdas 2013.; 2013. https://repository.badankebijakan.kemkes.go.id/id/eprint/4467/1/Laporan_riskesdas_2013_final.pdf
5. Ahmed M, Abbas K, Ali A, Ansari HUH, Naveed MA, Ellahi A, et al. Risk factors, angiographic findings, and clinical outcomes in young vs. older patients with acute coronary syndrome: a meta-analysis of South Asian and non-South Asian studies. SSRN: https://ssrn.com/abstract=4549711. Published online 2023. DOI:10.2139/ssrn.4549711
6. Sharifi-Rad J, Rodrigues CF, Sharopov F, Docea AO, Can Karaca A, Sharifi-Rad M, et al. Diet, lifestyle and cardiovascular diseases: linking pathophysiology to cardioprotective effects of natural bioactive compounds. Int J Environ Res Public Health. 2020;17(7):2326. DOI:10.3390/ijerph17072326
7. Prabawati NPD. Peran pemuda dalam kegiatan pengembangan pariwisata di desa tibubeneng, kabupaten badung, bali. Jurnal Kepariwisataan Indonesia Jurnal Penelitian dan Pengembangan Kepariwisataan Indonesia. 2019;13(1):73-84. DOI: 10.47608/jki.v13i12019.73-84
8. Kementerian kesehatan RI. Survey kesehatan idonesia. Vol 01. Indonesia dalam angka; 2023. https://drive.google.com/file/d/1RGiLjySxNy4gvJLWG1gPTXs7QQRnkS--/view

9. Melandari KI, Yunanto TAR. Studi kasus: dinamika gangguan psikologis dan fisik yang dialami pria pengurus desa adat bali. Psychocentrum Review. 2022;4(2):238-249. DOI:10.26539/pcr.42875
10. Wahyuni NLS, Nasution TH, Widjajanto E. Risk factors related to recurrence rates of acute coronary syndrome in Pakraman and non-pakraman villages in bali province. Research Journal of Life Science. 2020;7(2):92–100. DOI:10.21776/ub.rjls.2020.007.02.3
11. Suarningsih NKA, Suindrayasa IM. Awareness and level of knowledge in preventing coronary heart disease among community sample. Journal of a Sustainable Global South. 2020;4(1):10. DOI:10.24843/jsgs.2020.v04.i01.p03
12. Dahlan MS. Statistik untuk kedokteran dan kesehatan deskriptif, bivariat dan multivariat. In: Salemba Medika.Dantes N, ed. Dilengkapi Alikasi Menggunakan SPSS. 6th ed. Alqaprint.
13. Hastono SP. Analisis data pada bidang kesehatan. (ed., ed.). PT. Rajagrafindo Persada
14. Aggarwal A, Srivastava S, Velmurugan M. Newer perspectives of coronary artery disease in young. World J Cardiol. 2016;8(12):728. DOI: 10.4330/wjc.v8.i12.728
15. Foussas, S. (2020). Acute Coronary Syndromes. *CRC Press eBooks*. DOI: 10.1201/9780429025396
16. Kringeland EA, Tell GS, Midtbø H, Haugsgjerd TR, Igland J, Gerdts E. high-normal blood pressure is particularly associated with increased risk for acute coronary syndromes in women: the Hordaland Health Study. J Hypertens. 2021;39:e198. DOI: 10.1097/01.hjh.0000746668.30179.61
17. Revaiah PC, Vemuri KS, Vijayvergiya R, Bahl A, Gupta A, Bootla D, et al. Epidemiological and clinical profile, management and outcomes of young patients (≤40 years) with acute coronary syndrome: A single tertiary care center study. Indian Heart J. 2021;73(3):295-300. DOI:10.1016/j.ihj.2021.01.015
18. Wang N, Wei Y, Zhou G, Zhang Y, Song J. Acute coronary syndrome in an 8-year-old child with familial hypercholesterolemia: A case report. J Med Case Rep. 2022;16(1). DOI:10.1186/s13256-022-03488-3
19. Ekarini NLP, Wahyuni JD, Sulistyowati D. Faktor - faktor yang berhubungan dengan hipertensi pada usia dewasa. JKEP. 2020;5(1):61-73. DOI:10.32668/jkep.v5i1.357
20. Neumann JT, Goßling A, Sörensen NA, Blankenberg S, Magnussen C, Westermann D. Temporal trends in incidence and outcome of acute coronary syndrome. Clin Res Cardiol. 2020;109(9):1186-1192. DOI:10.1007/s00392-020-01612-1
21. Konstantinou K, Tsioufis C, Koumelli A, Mantzouranis M, Kasiakogias A, Doumas M, et al. Hypertension and patients with acute coronary syndrome: Putting blood pressure levels into perspective. J Clin Hypertens. 2019;21(8):1135-1143. DOI:10.1111/jch.13622
22. Padmi LS a J, Achjar K a H, Gama IK, Mustika IW, Lestari AS, Sudiantara K, et al. The relationship between cultural food of metuakan and megibung with the incidence of hypertension at karangasem i health center, karangasem district, Bali, Indonesia. Health Dynamics Journal. 2025;2(2):78–84. DOI:10.33846/hd20205
23. Ferdinand KC, Nasser SA, Ferdinand DP, Bond RM. Dietary Approaches to hypertension: Dietary sodium and the DASH diet for cardiovascular health. In: Contemporary Cardiology. ; 2021:61–72. DOI:10.1007/978-3-030-78177-4_4
24. Sandria A. Pancasila values in tradition on the bali hindu community reviewed from bali adat law and hindu's law. Vidyottama Sanatana: International Journal of Hindu Science and Religious Studies. 2018;2(2):226. DOI:10.25078/ijhsrs.v2i2.622
25. Upik P, Triswanti N, Prawira WF, Pramesti W. Relationship between stress level and the event of hypertension at productive age at kedaton public health center, bandar lampung. Medical Profession Journal of Lampung. 2022;12(2):261–267. DOI:10.53089/medula.v12i2.339
26. Bugami, S. A., Alhosyni, F., Alamry, B., Alyami, A., Abadi, M., Ahmed, A., et al. Acute coronary syndrome among young patients in Saudi Arabia (Single center study). J Cardiol Curr Res. 2019;12(3):60-63. DOI:10.15406/jccr.2019.12.00440
27. lshahrani, SM, Fraser GE, Sabaté, J, Knutsen, R, Shavlik, D, Mashchak, A, et al. Red and

processed meat and mortality in a low meat intake population. Nutrients. 2019;11(3):622. DOI:10.3390/nu11030622
28. Greco A, Brugnera A, Adorni R, D'Addario M, Fattirolli F, Franzelli C, et al. Protein intake and physical activity in newly diagnosed patients with acute coronary syndrome: a 5-year longitudinal study. Nutrients. 2021;13(2):634. DOI:10.3390/nu13020634
29. Sukerti NW, Marsiti CIR. Developing culinary tourism: the role of traditional food as cultural heritage in bali. advances in social science, education and humanities research. 2020;406. DOI:10.2991/assehr.k.200218.029
30. Vîrlan A, Coşciug L, Ţurcanu D, Siminiuc R. The influence of rice types and boiling time on glycemic index: An in vivo evaluation using the ISO 2010 method. Foods. 2024;14(1):12. DOI:10.3390/foods14010012
31. Harmayani E, Anal, AK, Wichienchot, S, Bhat R., Gardjito M, Santoso U, et al. Healthy food traditions of Asia: exploratory case studies from Indonesia, Thailand, Malaysia, and Nepal. Journal of Ethnic Foods. 2019;6(1). DOI:10.1186/s42779-019-0002-x
32. Jo U, Park K. Carbohydrate intake and risk of cardiovascular disease: a systematic review and meta-analysis of prospective studies. Nutrients. 2023;15(7):1740. DOI: 10.3390/nu15071740
33. Wali JA, Jarzebska N, Raubenheimer D, Simpson SJ, Rodionov RN, O'Sullivan JF. Cardio-metabolic effects of high-fat diets and their underlying mechanisms—A narrative review. Nutrients. 2020;12(5):1505. DOI:10.3390/nu12051505
34. Dewi NPPY, Budiasih IG a N, Gayatri G, Wirajaya IGA. Career development models. International Journal of Social Sciences. 2023;6(3):151–158. doi:10.21744/ijss.v6n3.2172
35. Anindya K, Marthias T, Biruni MZ, Hage S, Ng N, Laverty AA, et al. Low physical activity is associated with adverse health outcome and higher costs in Indonesia: A national panel study. Front Cardiovasc Med. 2022;9. DOI:10.3389/fcvm.2022.972461
36. Kuehn BM. Sleep duration linked to cardiovascular disease. Circulation. 2019;139(21):2483-2484. DOI:10.1161/circulationaha.119.041278
37. Lian X, Gu J, Wang S, Yan J, Chen X, Wang M, et al. Effects of sleep habits on acute myocardial infarction risk and severity of coronary artery disease in Chinese population. BMC Cardiovasc Disord. 2021;21(1). DOI:10.1186/s12872-021-02251-8
38. Sadabadi F, Darroudi S, Esmaily H, Asadi Z, Ferns GA, Mohammadpour AH, et al. The importance of sleep patterns in the incidence of coronary heart disease: a 6-year prospective study in Mashhad, Iran. Sci Rep. 2023;13(1). DOI:10.1038/s41598-023-29451-w
39. Gotera W, Wulandari DC. Metabolic disorders among tourism hotel workers in Nusa Dua, Bali. Biomedical & Pharmacology Journal. 2017;10(4):1805–1808. DOI:10.13005/bpj/1296
40. Hariyadi D, Hendriyani H, Dahliansyah, Nindrea RD. A path model of factors associated with cardiovascular disease in West Borneo: Analysis of Indonesian Basic Health Survey 2018. Systematic Reviews in Pharmacy. 2021; 12(12): 3803-3809.
41. Artha IMJR, Dwipayana IMP, Saputra BMI, Juzar DA, Soerianata S. Clinical characteristics, medical management and outcomes of patients with st-elevation myocardial infarction in sanglah general hospital. Biomedical & Pharmacology Journal. 2017;10(3):1197–1206. DOI:10.13005/bpj/1221