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RESEARCH ARTICLE

Analysis of Cultural Factors on the Incidence of Type 2 Diabetes Mellitus in the Ammatoa Kajang Traditional Area, Bulukumba Regency

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ABSTRACT

Type 2 Diabetes Mellitus (T2DM) is a degenerative disease with a rising prevalence, significantly influenced by lifestyle and cultural factors. This study aimed to analyze the influence of cultural factors on Type 2 Diabetes Mellitus in the Ammatoa Kajang Customary Area. An observational analytical study with a case-control design was conducted, involving 129 respondents with a ratio of 1:2 (43 cases and 86 controls). Univariate analysis showed that most respondents were female (70.54%), aged 51–60 years (37.98%), had low educational levels (66.67% did not attend school), and worked as housewives (51.16%). Bivariate analysis revealed significant associations between Type 2 Diabetes Mellitus and traditional diet (P=0.0000;COR 12.12), palm wine consumption (P=0.0001; P=0.0001;COR 4.58), tobacco smoking (P=0.0059;COR 2.99), and health literacy (P=0.0000;COR 8.53). Conversely, family history did not significantly correlate with Type 2 Diabetes Mellitus incidence (P=0.375;COR 2.08). Multivariate analysis identified the traditional diet as the main risk factor (AOR 9.71;95%CI 3.457-27.265) with a 74.11% probability of contributing to Type 2 Diabetes Mellitus. Traditional dietary patterns significantly affect the incidence of Type 2 Diabetes Mellitus, thus requiring culturally based interventions to reduce the increasing prevalence of this disease in the Ammatoa Kajang community.

INTRODUCTION

Diabetes Mellitus (DM) encompasses a group of metabolic disorders characterized by hyperglycemia resulting from abnormalities in insulin secretion, insulin action, or both [1]. As one of the most serious and prevalent chronic diseases of the modern era, it can lead to complications affecting various organs, pose life-threatening risks, diminish quality of life, and impose a substantial economic burden [2,38]. The metabolic status of individuals with DM can be evaluated through several parameters, including blood glucose levels, glycated hemoglobin levels, blood lipid levels, fluctuations in body weight, and subjective health perceptions [3]. According to the "International Diabetes Federation [4], the global prevalence of diabetes in 2021 reached 537 million adults aged 20-79 years, with 90% diagnosed with Type 2 Diabetes Mellitus (T2DM). This figure is projected to rise to 643 million by 2030 and 783 million by 2045. In Indonesia, the prevalence of T2DM continues to escalate, particularly among individuals aged 55-74 years, with a notable incidence in women." This increasing prevalence is closely associated with shifts in lifestyle, dietary habits, and other environmental factors [5,37].

Type 2 Diabetes Mellitus is commonly termed "lifestyle diabetes" due to its strong association with personal habits, including the intake of high-sugar foods, insufficient physical activity, obesity, and various other factors. The complications of diabetes mellitus, both acute and chronic, such as vascular disorders, myocardial infarctions, renal impairment, and neuropathy,

significantly diminish the quality of life for those affected. These complications can be mitigated through effective diabetes management, which encompasses education, a balanced diet, regular physical activity, and adherence to treatment protocols [6].

Health literacy is a critical factor in managing Type 2 Diabetes Mellitus (DMT2). Insufficient health literacy impedes individuals' comprehension of medical information, both verbal and written, thereby hindering their capacity to independently manage the condition. Furthermore, health literacy is shaped by the cultural norms prevalent in society. In Indonesia, cultural diversity significantly influences health behaviors and perceptions, particularly among indigenous communities that adhere to traditional local wisdom.

The Ammatoa Kajang indigenous community in South Sulawesi exemplifies a society that steadfastly adheres to its customs. The life philosophy "tallase kamase-mase," which translates to simple living, underpins the daily activities of this community. Despite proximity to modern civilization, the Ammatoa community continues to uphold its traditions, particularly regarding diet and physical activity, which are indirectly linked to the management of chronic diseases such as DMT2.

The Ammatoa custom is regulated by principles known as Pasang ri Kajang, which encompass values such as simplicity, mutual respect, and adherence to divine authority. The customary rituals they engage in frequently involve the consumption of traditional foods, including sweet cakes (dumpi eja) and traditional alcoholic beverages (tuak), which can influence individuals' dietary patterns. Prior research has indicated that cultural practices, particularly the types of food consumed during customary ceremonies, may elevate the risk of DMT2 [7,36].

Local culture presents both challenges and opportunities in the management of DMT2. On one hand, certain traditional practices, such as a high-sugar, low-fiber diet, serve as significant risk factors for diabetes. Conversely, local wisdom that promotes simple living and physical activity, such as walking, can provide a foundation for a disease control strategy that is pertinent to the circumstances of indigenous communities.

This study seeks to investigate the relationship between the local culture of the Ammatoa Kajang community and the prevalence and management of DMT2, as well as to identify the potential for integrating local wisdom into disease prevention and control strategies. By employing a culture-based approach, the aim is to uncover more effective, contextually relevant solutions to alleviate the burden of DMT2 within indigenous communities.

METHOD

2.1 Design Research

The study employed an Observational Analytical design with a Case Control framework, specifically a retrospective observational analysis conducted in the Ammatoa Kajang Traditional Area of Bulukumba Regency. This design comprises two groups of subjects: those affected by conditions or diseases (cases) and those without such conditions (controls). Both groups were subsequently identified retrospectively for their exposure history [8]. Data collection occurred from September to November 2024.

2.2 Population

The population for this study comprised the research sample, specifically the community residing in the Ammatoa Traditional Area, Kajang District, Bulukumba Regency, South Sulawesi Province.

2.3 Sample

The sample in this study was categorized into two groups: the case group and the control group. The case group consisted of individuals suffering from type 2 Diabetes Mellitus residing in the Ammatoa Kajang customary area of Bulukumba Regency, South Sulawesi Province, while the control group comprised individuals without type 2 Diabetes Mellitus living in the same area. The inclusion criteria for the case group required participants to be aged 18 years or older, capable of effective communication, and able to respond to questions clearly. Similarly, the control group included respondents who had not been diagnosed with type 2 Diabetes Mellitus. The exclusion

criteria encompassed individuals with mental or cognitive disorders, as well as those suffering from chronic illnesses requiring intensive care at a healthcare facility.

2.4 Calculation of Sample Size

The quantity of samples in this study was determined using the formula (Lameshow, 1997) referenced in [9]:

$$n = \frac{Z_{1-\alpha/2}\sqrt{2P(1-P)+Z_{1-\beta}\sqrt{P^{1(1-P^{1})}+P^{2}(1-P_{2}))^{2}}}}{(P_{1}-P_{2})^{2}}$$

Information:

$Z_{1-\alpha/2}$ = Z value or 95% degree of confidence, 2-way test (1.96)

$Z_{1-\beta}$ = Z value at 1-β test strength 95% (1.65)

P = (P1 + P2) / 2 (0.629)

P_1 = Proportion exposed to cases (0.811)

P_2 = Proportion exposed to control (0.447)

OR = Odds Ratio (4.293)

$$n = \frac{1.96\sqrt{0.466718 + 1.65\sqrt{(0.153279 + 0.247191)^{2}}}}{(0.364)^{2}}$$

$$n = \frac{((1.3387) + (1.65 \text{ x } 0.6328))^{2}}{0.132496}$$

$$n = \frac{(1.3387 + 1.0428)^{2}}{0.132496}$$

$$n = \frac{5.671542}{0.132496}$$

$$n = 42{,}8$$

$$n = 43$$

The final result yields a sample size of n = 43. With a case-to-control ratio of 1:2, the case sample of 43 necessitates 86 control samples, resulting in a total sample size of 129 respondents.

2.5 Technical Sampling

The sampling technique employed in this study was Purposive Sampling, which involves selecting samples according to specific criteria (inclusion criteria) aligned with the research objectives [10,35]. Prior to initiating the study, the first step involved convening a meeting with the program management officer to gather data on potential patient respondents. Eligible patients were invited to participate in the study. Written consent was secured through the completion of an informed consent form, and participants were informed of their right to withdraw from the study at any time without penalty. The confidentiality and anonymity of the respondents were rigorously upheld.

2.6 METHODS OF DATA COLLECTION

The data collection technique employed in this study involved several methods: observation, wherein the author visited the field to directly observe the subjects for more accurate data; interviews, which entailed verbal communication and direct listening to information or statements from the community and the caretaker of the Kajang tribe; documentation, including photographic attachments and other necessary references from the research location; and questionnaires, serving as a foundation for understanding the ethics and procedures involved in conducting interviews with informants.

There are five questionnaire instruments employed for research variables, which include :

2.6.1 Conventional Dietary Habits

There are eight points on the Food Frequency Questionnaire (FFQ), which assess daily food consumption habits over the past month. The scoring system for the FFQ is as follows: 0 = Never, 1 = 1-3 times per month, 10 = 1-3 times per week, 15 = 4-6 times per week, 25 = once per day, and 50 = more than once per day [11]. The average research score regarding the frequency of local food consumption was 12.5, derived from the total consumption of local ingredients reported by 129 respondents, divided by the number of local foods in the traditional area. The observation revealed 20 local foods. Consequently, this variable encompasses two categories: healthy eating patterns, characterized by research scores of ≥ 12.5, and unhealthy eating patterns, indicated by research scores of <12.5 [11].

2.6.2 Consumption of Palm Wine

There are 15 questionnaire items regarding Palm Wine Consumption, aligned with the Standard Dietary Guidelines for Alcohol for Adults: Women: 1 glass or less per day, and Men: 2 glasses or less per day [12]. If you do not consume palm wine, you are classified as not at risk; conversely, if you consume palm wine in quantities of less than or more than 1-2 glasses, you are classified as at risk.

2.6.3 Tobacco Use Behavior

The Kajang tribe also engages in smoking (mattole) and regards tobacco cigarettes as unrelated to modern products. There are 23 items in the questionnaire addressing tobacco smoking habits, and the Brinkman Index Questionnaire has been validated by prior researchers, specifically Artiyaningrum & Azam (2016). The validity test results indicated that the r value (0.731) exceeds the r table value (0.361), confirming the instrument's validity. The reliability test yielded an r alpha value (0.729) greater than 0.6 (the threshold), thus affirming the instrument's reliability. Given the outcomes of the validity and reliability assessments, it can be concluded that the Brinkman Index questionnaire is suitable for use, as it meets the necessary criteria for research instruments [13].

According to PDPI, an individual's smoking level can be assessed using the Brinkman Index, which is multiplied by the duration of smoking in years, resulting in the following classifications:

Light smokers: 0-200 cigarettes annually

Moderate smoker: 200 to 600 cigarettes annually

Heavy smoker: over 600 cigarettes annually

In this study, the categories were classified into two groups: those at risk, comprising moderate to heavy smokers, and those not at risk, consisting of respondents who were either non-smokers or light smokers.

2.6.4 Health Literacy

Assessment of health literacy among individuals with type 2 diabetes mellitus in the Ammatoa Kajang traditional area was conducted using the HLS-EU-Q20 questionnaire, which comprises 20 items addressing self-reported challenges in accessing, comprehending, evaluating, and utilizing information pertinent to health services, including healthcare, disease prevention, and health promotion [14].

The 20-point Health Literacy Survey Questionnaire (HLS-EU-Q20) was derived from the HLS-EU-Q47, HLS-EU-Q20 Indonesian version [15]. Each item is evaluated using a four-point Likert scale (very difficult, difficult, easy, and very easy). In this study, the authors assigned a score of 0 to the categories "very difficult" and "difficult," while the categories "easy" and "very easy" received a score of 1. The scale value was computed as a score [16]. Scoring ranges from 0 to 20, establishing four levels of health literacy: inadequate (0–8), problematic (9–12), adequate (13–16), and very good (17–20). Thus, the assessment of the category "good" encompasses both 'adequate' and "very good," whereas the category "bad" includes "inadequate" and "problematic."

2.6.5 Family Background

Finally, there are nine questionnaire items concerning family history. In patients with type 2 diabetes mellitus, the disease exhibits a pronounced familial pattern. The concordance rate for type 2 diabetes among monozygotic twins approaches 100%. The likelihood of developing type 2 diabetes in siblings is approximately 40%, while the risk for their children and grandchildren is around 33%. If parents are affected by type 2 diabetes, the ratio of diabetic to nondiabetic children is 1:1, with nearly 90% likely to carry the condition [17]. This variable encompasses the category of having a family history if any descendant, whether a parent, grandparent, or sibling, is afflicted with diabetes mellitus, and no family history if there are no affected descendants in these categories.

2.7 Data Analisys

The data obtained from the research results were processed through the stages of editing, coding, data entry, cleaning, and tabulation, followed by analysis using Stata program version 14. The analysis employed univariate, bivariate, and multivariate methods. Univariate analysis involved the creation of a distribution table and frequency of respondent characteristics, as well as dependent and independent variables. Bivariate analysis was conducted by compiling a 2x2 table to calculate the odds ratio (OR) value. The significance test was performed using a 95% Confidence Interval (CI) and Chi-square (X^2). Multivariate analysis utilized logistic regression, incorporating variables that demonstrated a statistically significant 95% CI value in the bivariate analysis. Stepwise elimination was applied to remove variables with insignificant 95% CIs, thereby refining the final model to identify dominant risk factors among the independent variables. Subsequently, the probability value was calculated using the formula: $P = 1 / (1 + \exp(-y))$, allowing for the determination of the probability of the variable that serves as a risk factor for the occurrence of DMT2.

2.8 Ethical Approval

This research has received approval from the Hasanuddin University Health Research Ethics Committee, with the ethical approval recommendation number 2023/UN4.14.1/TP.01.02/2024, dated September 3, 2024.

RESULTS

A total of 129 respondents participated in this study, comprising 43 individuals with DMT2 in the case group and 86 individuals without DMT2 in the control group. The values in each group are presented in the following table:

3.1 Univariate Analysis

3.1.1 Attributes of the research population

The demographic characteristics of the respondents in this study are detailed in Table 1. The analysis reveals that the majority of respondents were female, comprising 91 individuals (70.54%), with the largest age group being 51-60 years, totaling 49 individuals (37.98%). Additionally, the most prevalent educational attainment was no formal schooling, observed in both the case and control groups, with 86 individuals (66.67%). The most frequently reported occupation was that of a housewife (IRT), accounting for 66 individuals (51.16%).

Table 1. Demographic Characteristics of Respondents

Respondent Attributes	Case		Control		Total	
	n	%	n	%	n	%
Gender						
Man	20	46,51	18	20,93	38	29,56
Woman	23	53,49	68	79,07	91	70,54
Age						
< 50 Years	10	23,26	34	39,53	44	34,11
51-60 Years	18	41,86	31	36,05	49	37,98
61-70 Years	11	25,58	14	16,28	25	19,38
> 70 Years	4	9,30	7	8,14	11	8,53

Education						
No educational institution	23	53,49	63	73,26	86	66,67
Primary school	16	37,21	20	23,26	36	27,91
Junior high school and above	4	9,3	3	3,49	7	5,43
Work						
Housewife	16	37,21	50	58,14	66	51,16
Trader	3	6,98	5	5,81	8	6,20
Farmer/Gardener	15	34,88	12	13,95	27	20,93
Does not function/.	9	20,93	19	22,09	28	21,71
Self-employed						

Source: Primary data, 2024

3.1.2 Independent Case-Control Distribution

Distribution between case and control groups based on various independent variables in the Ammatoa Kajang Customary Area, Bulukumba Regency, reveals several significant risk factors. Table 2 outlines the distribution of independent variables for case control.

Initially, it is evident that the traditional diet variable exhibits the highest proportion of unhealthy dietary habits (86.05%). This indicates that an unhealthy diet is a contributing factor to the increased risk of diabetes in this region. Furthermore, within the health literacy variable, the highest proportion is observed in the case group categorized as having poor health literacy (76.74%).

Meanwhile, the palm wine consumption variable in the case group in the risk category (58.14%), the tobacco smoking habit variable in the case group in the risk category (44.19%), and the family history variable in the case group, categorized by having a family history (6.98%), was lower than that of the control group.

Tabel 2. Distribution of case control inthe relation to the independent

Explanatory variables	**Case**		**Control**	
	n	**%**	**n**	**%**
Conventional dietary habits				
Unhealthy	37	86,05	29	33,72
Healthy	6	13,95	57	66,28
Consumption of palm wine				
At risk	25	58,14	18	41,86
Low risk	20	23,26	66	76,74
The practice of tobacco smoking				
At risk	19	44,19	18	20,93
Low risk	24	55,81	68	79,07
Health literacy				
Bad	33	76,74	24	27,91
Good	10	23,26	62	72,09
Ancestral background				
A history exists.	3	6,98	3	3,49
No history	40	93,02	83	96,51

Source: Primary data, 2024

3.2 Bivariate Analysis

At this stage, a bivariate analysis is performed between the independent and dependent variables. This analysis aims to ascertain whether the independent variables exert an influence on the dependent variables in both groups.

Table 3 presents the variables identified as risk factors for the occurrence of DMT2. The significant risk factors associated with DMT2 include traditional diet, with a value of (P = 0.000; COR 12.12), indicating that individuals with an unhealthy diet are at a 12.12 times greater risk of developing type 2 diabetes mellitus compared to those with a healthy diet. Consumption of palm wine is another risk factor, with a value of (P = 0.0001; COR 4.58), suggesting that those who consume palm wine are at a 4.58 times higher risk than those who do not. The habit of smoking tobacco also presents a risk, with a value of (P = 0.0059; COR 2.99), indicating that smokers are 2.99 times more likely to develop type 2 diabetes mellitus than non-smokers. Health literacy is another critical factor, with a value of (P = 0.000; COR 8.53), revealing that individuals with poor health literacy are 8.53 times more likely to experience type 2 diabetes mellitus compared to those with good health literacy, warranting further analysis of this variable. Conversely, the family history variable, with a value of (P = 0.375; COR 2.08), demonstrates no significant effect and will therefore be excluded from subsequent analyses.

Table 3. Risk Factors for the Occurrence of DMT2

Research Variables	**Case**		**Control**		***p***	**CI 95%**	**COR**
	n	%	n	%			
Conventional dietary habits							
Unhealthy	37	86,05	29	33,72	0,0000	4,317-38,452	12,12
Healthy	6	13,95	57	66,28			
Consumption of palm wine							
At risk	25	58,14	18	41,86	0,0001	1,954-10,849	4,58
Low risk	20	23,26	66	76,74			
Research Variables	Case		Control		*p*	CI 95%	COR
	n	%	n	%			
Tobacco smoking habit							
At risk	19	44,19	18	20,93	0,0059	1,248-7,137	2,99
Low risk	24	55,81	68	79,07			
Health literacy							
Bad	33	76,74	24	27,91	0	3,400-22,178	8,53
Good	10	23,26	62	72,09			
Ancestral background							
A history exists	3	6,98	3	3,49	0,3751	0,264-16,094	2,08
No history	40	93,02	83	96,51			

Source: Primary data, 2024 (*) = p Value < 0.05

3.3 Multivariate Analysis

Multivariate analysis employing multiple logistic regression, as illustrated in Table 4, demonstrates results of the analysis of model 1 risk factors for the incidence of DMT2.

Table 4. Model 1 Multivariate Analysis of Risk Factors for the Incidence of DMT2

Research Variables	AOR	(95% CI)
Conventional dietary habits	7,88	2,756 - 22,521
Consumption of palm wine	2,97	0,373 - 23,701
The practice of tobacco smoking	0,74	0,891 - 6,159
Health literacy	5,56	2,116 - 14,580
Constant	0,409	0,141 - 0,118

Source: Primary data, 2024 (Multiple logistic regression analysis)

Variables associated with traditional dietary patterns and health literacy serve as risk factors for the development of DMT2. Following multivariate analysis, the variables related to traditional

dietary patterns (AOR 7.88; 95% CI 2.756 - 22.521) and health literacy (AOR 5.56; 95% CI 2.116 - 14.580) were identified, demonstrating statistical significance.

Subsequently, a re-analysis will be conducted to identify the predominant variables and derive probability values for the risk factors associated with DMT2. This will be based on the primary variables contributing to the incidence of DMT2, as illustrated in Table 5, which presents the multivariate model fit for DMT2 incidence. The traditional diet and health literacy emerge as the most significant risk factors for DMT2 within the Ammatoa Kajang Traditional Area of Bulukumba Regency. The traditional diet variable exhibits the highest association, with an adjusted odds ratio (AOR) of 9.71 (95% CI, 3.457 - 27.265), indicating a 9.71-fold increased risk of developing DMT2.

Table 5. Multivariate Fit Model of Risk Factors for the Incidence of DMT2

Research Variables	AOR	Coeff	(95% CI)
Conventional dietary habits	9,71	2,273	3,457 - 27,265
Health literacy	6,68	1,889	2,619 - 17,039
Constant	0,38	-3,121	0,015 – 0,127

Primary data, 2024

Upon acquiring the coefficient and constant values, a logistic regression equation is executed based on the final model to compute the probability value utilizing the following formula:

Y = Constant+Coefficient (traditional eating patterns)*1+Coefficient (health literacy)*1

Y = -3.121+2.273*1+1.899*1

= 1.052

After obtaining the Y value inputted into the formula for calculating the probability value, the result is as follows: P = 1 / (1 + exp(-1.052)) = 74.11%.

Based on the analysis results presented above, it can be concluded that the probability of developing DMT2 as a result of traditional diet and health literacy is 74.11%.

4. DISCUSSION

4.1 characteristics of respondents

Of the 129 respondents, the majority were women (70.54%) and aged 51-60 years (37.98%). Educational characteristics show that the rate of not attending school is very high, namely 66.67%. In addition, the majority of respondents work as housewives (51.16%). This reflects the socio-economic conditions of the community in the Ammatoa Kajang traditional area, where access to formal education and employment is still limited.

4.2 Conventional Dietary Habits

The results of the bivariate analysis concerning traditional dietary patterns and the incidence of diabetes mellitus, with a p-value of 0.000 (less than 0.05), indicate a significant relationship between traditional dietary patterns and the occurrence of type 2 diabetes mellitus. The interpretation of the findings reveals that a majority of respondents fall into the category of unhealthy dietary patterns (86.05%). The traditional diet variable exhibits the highest value (AOR 9.709; 95% CI, 3.457 - 27.265), identifying it as a risk factor for the incidence of type 2 diabetes mellitus in the Ammatoa Kajang Traditional Area, Bulukumba Regency. This aligns with the study by "Suryawan [18], which found a significant correlation between dietary patterns and diabetes mellitus, noting that individuals with poor dietary patterns are 0.23 times more likely to develop diabetes compared to those with healthy dietary habits."

"Kabosu [19] The statistical analysis results utilizing the chi-square test between consumption patterns and the incidence of Type 2 DM yielded a p-value of 0.017 ($p \leq 0.05$), indicating a significant relationship between consumption patterns and the incidence of Type 2 DM." Respondents exhibiting risky consumption patterns face a 3.660 times greater risk of developing Type 2 DM compared to those with non-risky consumption patterns. This aligns with the research conducted by "Rahayu and Siti Khoiroh [20], which reported a p-value of 0.002 $<\alpha$ (0.05), demonstrating a close relationship between diet and blood sugar control in individuals with

diabetes mellitus." Due to the pancreas's inability to produce insulin, leading to elevated blood sugar levels, individuals who frequently consume foods high in carbohydrates, fats, and proteins are at risk of developing diabetes.

Food significantly influences socio-cultural behavior, thereby disrupting an individual's eating patterns. Alterations in these patterns may also arise from frequent attendance at events, where individuals often consume foods and beverages that can trigger diabetes mellitus [7]. It is crucial to underscore the necessity of a consistent diet for diabetes management, which considers eating patterns, food types, and portion sizes [21].

4.3 Health Literacy

Diabetes-related health literacy refers to the extent to which individuals with diabetes possess the skills and abilities necessary to seek, comprehend, analyze, communicate, and calculate diabetes-related information in both healthcare environments and daily life to effectively manage their condition. Research conducted in the Ammatoa Kajang traditional area revealed a p-value of 0.0000, which is less than 0.05, indicating a significant relationship between health literacy and the incidence of type 2 diabetes mellitus (DMT2). The highest proportion of individuals fell within the poor health literacy category, accounting for 76.74%, with an Adjusted Odds Ratio (AOR) of 8.53 (95% CI 3.400-22.178), underscoring a significant correlation with the incidence of DMT2. This finding aligns with the research by "Tefera [22], which asserts that low health literacy among type 2 diabetes patients is linked to difficulties in managing glucose levels. Furthermore, low diabetes literacy, with a 95% CI Adjusted Odds Ratio (AOR) of 1.85 (1.09–3.40), demonstrates a significant association with DMT2."

This low health literacy among diabetes patients stems from their inadequate understanding, which often leads to challenges in medication prescriptions, reading medicine labels, interpreting blood glucose test results, and comprehending service levels or other information provided by health centers. "Shibraumalisi [23] found that statistically ($p<0.001$), higher health literacy scores were significantly associated with improved Quality of Life (QOL) in patients with T2DM."

Several factors that can influence low health literacy levels include inadequate education. The correlation between sufficient health literacy and effective glycemic control may not be evident in patients who possess a greater comprehension of health education and directives [22]. In this conventional region, the majority of the population has limited education, with an average of 66.7% having no formal schooling. They place a higher value on cultural education than on formal education, considering it more significant, despite their general inability to read or write.

Furthermore, in addressing health issues, the Ammatoa community predominantly depends on shamans and traditional medicine. A significant number of individuals, particularly the elderly, have never utilized health facilities due to the considerable distance, which necessitates traveling barefoot.

These factors demonstrate that certain individuals lack an understanding of how to make informed decisions regarding health care and disease prevention, particularly for patients with DMT2, in relation to wound care and treatment.

4.4 Additional Relevant Factors

4.4.1 Palm Wine Consumption

Tuak is a traditional alcoholic beverage produced by tapping the newly bloomed flower bunches of the sugar palm or aren. The extraction yields a substance known as sap, which is subsequently fermented to create the alcoholic drink. Nira typically comprises water (80-90%), sucrose (12.30-17.40%), reducing sugar (0.5-1%), and other components (1.5-7%), categorizing tuak as an alcoholic beverage with a high sugar content.

The findings of the study concerning the consumption of palm wine and the incidence of diabetes mellitus, with a P-value of 0.0001, indicate a significant relationship between palm wine consumption and the occurrence of type 2 diabetes mellitus. Additionally, the research conducted by "Wu [24] revealed that only high-risk drinkers exhibited an increased risk of T2DM (1.289 (1.061, 1.566)) in comparison to individuals who have never consumed alcohol."

The case group exhibited the largest proportion within the risk category (58.14%) compared to the non-risk group (23.26%) with an adjusted odds ratio (AOR) of 2.97 (95% CI: 0.373-23.701). The findings indicated no significant association between palm wine consumption and the incidence of type 2 diabetes mellitus (DMT2) in the Ammatoa Kajang traditional area. This aligns with the research conducted by "I Gusti Ayu Mirah Adhi [25], which concluded that frequent consumption of high-sugar alcoholic beverages, such as palm wine, has not been established as a risk factor for type 2 diabetes mellitus."

In the Ammatoa Kajang traditional region, there are no limitations on the consumption of tuak. Both men and women are permitted to partake in drinking tuak, with no restrictions on the quantity consumed. Consequently, within this context, women also tend to drink tuak on average.

In the Ammatoa traditional area, tuak is not only utilized in the production of palm sugar but is also consumed daily and served at every event, whether it be a community celebration or a traditional ceremony. As noted by "Shanti Riskiyani [26] in her research on the socio-cultural aspects of alcoholic beverage consumption, tuak is regarded by the community as a customary drink, integral to the culture of the Toraja people. In Lembang Embatau, tuak has been a longstanding tradition, preserved through the ages, and is consistently offered in both daily life and various traditional celebrations."

Efforts to decrease alcohol consumption and promote abstinence are advantageous in mitigating the risk of T2DM. While not statistically significant in multivariate analysis, it remains a pertinent issue in the development of health interventions for this indigenous community.

4.4.2 Tobacco Use Behavior

Based on the analysis and data processing, the P-value result was 0.0059 <0.05, indicating a relationship between tobacco smoking and the incidence of type 2 diabetes mellitus. This finding aligns with a cohort study conducted by Kowall et al., which revealed that both active and passive smoking elevate the risk of developing type 2 diabetes mellitus. Additionally, a study by Sari [27] also indicated a correlation between smoking and GDP levels, noting that the GDP levels of diabetic patients who smoke are higher than those of non-smoking patients.

Multivariate analysis results indicate that the highest proportion within the case group falls under a risk category of 44.19%, with an adjusted odds ratio (AOR) of 0.37 (95% CI, 0.05 - 2.80). The findings suggest that there is no significant association between tobacco smoking habits and the incidence of type 2 diabetes mellitus (DMT2) in the Ammatoa Kajang Traditional Area. This aligns with the study conducted by "Wang [28], which found that active smokers exhibit a 23% reduction in the risk of prediabetes and T2DM (OR: 0.77, 95% CI: 0.63–0.93) and a 20% reduction (OR: 0.80, 95% CI: 0.66–0.98) compared to non-smokers. Furthermore, no significant relationship was identified regarding the risk of T2DM among heavy smokers and non-smokers."

"Rahim [29] demonstrated in his research that the data analysis results, utilizing the Chi-Square test, yielded a p-value of 0.195 (p > 0.05). Consequently, the alternative hypothesis (Ha) was rejected, indicating no significant relationship between smoking activity and the occurrence of uncontrolled type 2 diabetes mellitus in the jurisdiction of the Sakra Health Center, East Lombok."

Smoking can elevate blood sugar levels and induce insulin resistance, as it hampers the absorption of glucose by cells, rendering insulin less effective in the bloodstream and diminishing blood flow to the skin. Heavy smokers (20 cigarettes per day) are twice as likely to develop type 2 diabetes compared to non-smokers [30].

Although this variable was not significant in the multivariate analysis, it should still be considered in the planning of health interventions, such as the implementation of smoke-free areas, which warrant evaluation [31].

4.5 Trivial Factors

4.5.1 Ancestral Background

Based on data processing and analysis, the P-value was determined to be 0.375, which exceeds 0.05, indicating no significant relationship between family history and the incidence of DMT2. This may be attributed to the greater influence of lifestyle factors, such as diet and health literacy,

over genetic factors or family history. The substantial impact of these socio-cultural factors may diminish the significance of family history as a risk factor. Additionally, respondents who are unaware of or unable to provide a complete family history may introduce information bias, thereby diminishing the analysis's capacity to identify significant relationships.

In contrast to the research findings, "Yosmar [32] indicates that family history is a significant risk factor for diabetes mellitus (DM) within the Padang community, suggesting that individuals with a history of DM are at a heightened risk of developing the condition. The study yielded an odds ratio of 4.7, indicating that an individual with a family history of DM Is five times more likely to experience DM. " Family history is recognized as one of the risk factors for Type 2 DM; individuals with a strong hereditary background from parents, grandparents, siblings, and others are at a greater risk of developing DM compared to those without such a history. "Nasution [33] notes that approximately 1 in 4 families has a history of DM, with the assumption that around 73% of DM cases could be prevented by addressing the risk factor of family history." "Irjayanti [34] By using the Chi Square test, the statistical test shows that the value of $p = 0.029 < \alpha$ 0.05, which means Ho is rejected and Ha is accepted, that there is a relationship between family history and the incidence of Type 2 Diabetes Mellitus in the Moncongloe Health Center Working Area."

Unmodifiable risk factors, such as age and family history, can be mitigated through the adoption of a healthy lifestyle.

5. CONCLUSION

Unhealthy traditional diets and inadequate health literacy are the primary contributors to DMT2 in the Ammatoa Kajang traditional area. The traditional diet serves as a significant predictor of DMT2, with a probability of 74.11%. Culturally-based health intervention strategies are essential to address this issue and promote enhancements in the quality of life for indigenous populations.

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REFERENCES

[1] Ministry of Health of the Republic of Indonesia, “Report on the Tuberculosis Control Program 2022,” 2022.

[2] Tini, Darmawansyah, R. Amiruddin, Masni, and A. Mallongi, “Cadre Interventions on Health Outcomes of Diabetes Mellitus Patients: Systematic Review of Randomized Control Trial,” *Pharmacogn. J.*, vol. 15, no. 4, pp. 697–702, 2023, doi: 10.5530/pj.2023.15.139.

[3] Wahiduddin, A. Pranoto, and Sudjarwo, “Glycemic Control in Type 2 Diabetes Mellitus Patients with and without Pulmonary Tuberculosis,” *Media Kesehat. Masy. Indones.*, vol. 15, no. 1, pp. 99–109, 2019, doi: 10.30597/mkmi.v15i1.5292.

[4] I. D. Atlas, “DF Diabetes Atlas 10th edition. (n.d.).,” *www.diabetesatlas.org*, 2022.

[5] M. S. Ranuve and M. Mohammadnezhad, “‘They say to me “You want to be a high shot and be like a tourist” so I stopped wearing shoes at home even though I know it is to protect my feet’. The perceptions of patients on foot complications,” *PLoS One*, vol. 18, no. 11 November, pp. 1–22, 2023, doi: 10.1371/journal.pone.0294518.

[6] A. Aminuddin, Yenny Sima, Nurril Cholifatul Izza, Nur Syamsi Norma Lalla, and Darmi Arda, “Health Education on Diabetes Mellitus for the Community,” Abdimas Polsaka, pp. 7–12, 2023, doi: 10.35816/abdimaspolsaka.v2i1.25.

[7] M. J. Agustin, U. Usman, and F. Umar, “Socio-Cultural Aspects of the Risk of Diabetes Mellitus in Tolotang Traditional Chairman (UWA) in Sidrap District,” *Indones. Heal. J.*, vol. 1, no. 2, pp. 62–69, 2022, doi: 10.58344/ihj.v1i2.19.

[8] G. D. Prasasty and Legiran, “Case Control Study,” J. Kedokt. Syiah Kuala, vol. 23, no. 1, pp. 232–236, 2023, doi: 10.24815/jks.v23i1.25496.

[9] N. Fauziyah, Sampling and Sample Size in Public and Clinical Health. 2019.

[10] Sugiyono. Quantitative, Qualitative, and R&D Research Methods. Bandung: Alfabeta, 2019.
[11] A. Sirajuddin, Surmita. Food Consumption Survey. Jakarta: 2018.
[12] National Institute on Alcohol Abuse and Alcoholism (NIAAA), "Alcohol Use in the United States: Age Groups and Demographic Characteristics | Retrieved from data for individuals aged 18 and older on Alcohol Use in the United States: Age Groups and Demographic Characteristics," p. https://www.niaaa.nih.gov/alcohols-effects-health/.
[13] B. Artiyaningrum and M. Azam, "Factors Associated with the Incidence of Uncontrolled Hypertension in Patients Undergoing Routine Examination," Public Health Perspectives Journal, vol. 1, no. 1, pp. 12–20, 2016.
[14] T. V. Duong *et al.*, "Measuring health literacy in Asia: Validation of the HLS-EU-Q47 survey tool in six Asian countries," *J. Epidemiol.*, vol. 27, no. 2, pp. 80–86, 2017, doi: 10.1016/j.je.2016.09.005.
[15] J. Pelikan, F. Röthlin, and K. Canahl, "Introduction to HL measurement procedures of the HLS-EU study," *2nd Eur. HL Conf. Aarhus, 10.4.2014*, 2014.
[16] P. Bas-Sarmiento, M. Poza-Méndez, M. Fernández-Gutiérrez, J. L. González-Caballero, and M. F. Romero, "Psychometric assessment of the european health literacy survey questionnaire (HLS-EU-Q16) for arabic/french-speaking migrants in southern Europe," *Int. J. Environ. Res. Public Health*, vol. 17, no. 21, pp. 1–15, 2020, doi: 10.3390/ijerph17218181.
[17] S. Surya, M. Khalid Fredy Saputra, and R. Pannyiwi, "Counseling on Diabetes Mellitus in the Manisa Health Center Work Area," Al-Amanah J. Pengabdi. Masy., vol. 1, no. 2, pp. 33–35, 2023, [Online]. Available: http://kesmas-unsoed.info/2010/12/makalah-diabetes-melitus-epidemiologi.
[18] N. W. Suryawan et al., "JPKM Journal of Public Health Profession," vol. 4, no. 1, pp. 1–7, 2023.
[19] R. A. S. Kabosu, A. A. Adu, and I. A. T. Hinga, "Risk Factors for the Incidence of Type Two Diabetes Mellitus in Kupang City Bhayangkara Hospital," Timorese Journal of Public Health, vol. 1, no. 1, pp. 11–20, 2019, doi: 10.35508/tjph.v1i1.2122.
[20] F. Rahayu and M. Siti Khoiroh, "The Correlation between Dietary Patterns and Regulated Blood Glucose Levels in Patients with Type II Diabetes Mellitus at Abdul Wahab Sjahranie Hospital, Samarinda," Borneo Student Research, vol. 1, no. 3, pp. 1659–1665, 2020.
[21] E. N. N. Arifin and A. S. Rachmawati, "Implementation of Foot Exercises Utilizing Newspapers to Lower Random Blood Sugar Levels in Mrs. E with Type 2 Diabetes Mellitus in RT.04 RW.15 Perum Cisalak, Tasikmalaya City," Healthc. Nurs. J., vol. 4, no. 2b, pp. 53–58, 2022.
[22] Y. G. Tefera *et al.*, "Diabetic health literacy and its association with glycemic control among adult patients with type 2 diabetes mellitus attending the outpatient clinic of a university hospital in Ethiopia," *PLoS One*, vol. 15, no. 4, pp. 1–15, 2020, doi: 10.1371/journal.pone.0231291.
[23] N. A. Shibraumalisi, N. Mat Nasir, M. Md Yasin, and M. R. Isa, "The Association Between Health Literacy and Quality of Life and Its Associated Factors Among Adults with Type 2 Diabetes Mellitus in Public Primary Care Clinic," *J. Clin. Heal. Sci.*, vol. 5, no. 1, p. 60, 2020, doi: 10.24191/jchs.v5i1.9822.
[24] X. Wu *et al.*, "Prevalence and characteristics of alcohol consumption and risk of type 2 diabetes mellitus in rural China," *BMC Public Health*, vol. 21, no. 1, pp. 1–10, 2021, doi: 10.1186/s12889-021-11681-0.
[25] I Gusti Ayu Mirah Adhi, "Analysis of Alcohol Consumption Patterns in Male Patients with Type 2 Diabetes Mellitus in the Working Area of Manggis I and II Community Health Center, Manggis District, Karangasem Regency, Bali," Prima, vol. 3, no. 2, pp. 126–134, 2017.
[26] S. Riskiyani, M. Jannah, and A. Rahman, "Socio-Cultural Aspects of Alcoholic Beverage Consumption (Tuak) in North Toraja Regency: The Social Cultural Aspect of Alcohol (Tuak) Utilized in North Toraja," J. MKMI, pp. 76–85, 2015.
[27] Y. Sari *et al.*, "The cultural beliefs and practices of diabetes self-management in Javanese diabetic patients: An ethnographic study," *Heliyon*, vol. 8, no. 2, 2022, doi: 10.1016/j.heliyon.2022.e08873.

[28] S. Wang *et al.*, "Cigarette Smoking Is Negatively Associated with the Prevalence of Type 2 Diabetes in Middle-Aged Men with Normal Weight but Positively Associated with Stroke in Men," *J. Diabetes Res.*, vol. 2019, 2019, doi: 10.1155/2019/1853018.

[29] A. R. Rahim, J. Anggoro, and S. Priyambodo, "Correlation Between Smoking Activity and Incidence of Uncontrolled Type 2 Diabetes Mellitus in Puskesmas Sakra, East Lombok," *Unram Med. J.*, vol. 12, no. 2, pp. 133–139, 2023, doi: 10.29303/jk.v12i2.4353.

[30] R. W. Gayatri, A. N. Kistianita, et al., Diabetes Mellitus in the 4.0 Era, vol. 6, no. 1, 2022.

[31] S. Martini, K. D. Artanti, A. Hargono, S. Widati, A. Ahsan, and Y. S. Prabandari, "Association between percentage of smokers and prevalence of smoking attributable morbidity in Indonesia: one decade after implementation of smoke-free area regulation," *BMC Public Health*, vol. 22, no. 1, pp. 1–8, 2022, doi: 10.1186/s12889-022-14435-8.

[32] R. Yosmar, "Risk Survey of Diabetes Mellitus in the Community of Padang City," J. Farm. Sci. Clin., vol. 5(2), pp. 134–141, 2018, doi: //doi.orghttps://doi.org/10.25077/jsfk.5.2.134-141.2018.

[33] F. Nasution, Andilala, and Ambali Azwar Siregar, "Risk Factors for the Occurrence of Diabetes Mellitus," vol. 9, no. 2, pp. 94–102.

[34] K. Irjayanti P, S. Zaenal, and Suhartatik, "Faktor-Faktor yang Mempengaruhi Terjadinya Peningkatan Diabetes Melitus Tipe 2," J. Ilm. Mhs. Penelit. Keperawatan, vol. 1, no. 6, pp. 805–813, 2022, [Online]. Available: https://123dok.com/document/yj7xmxdk-faktor-faktor-mempengaruhi-terjadinya-peningkatan-diabetes-melitus-tipe.html

[35] Waheed, M., & Jam, F. A. (2010). Teacher's intention to accept online education: Extended TAM model. *Interdisciplinary Journal of Contemporary Research in Business*, *2*(5), 330-344.

[36] Jam, F. A., Sheikh, R. A., Iqbal, H., Zaidi, B. H., Anis, Y., & Muzaffar, M. (2011). Combined effects of perception of politics and political skill on employee job outcomes. *African Journal of Business Management*, *5*(23), 9896-9904

[37] Mansor, A. B. A., Yassin, K. M., & Ahmad, S. (2024). Islamic psychospiritual approach in drug rehabilitation therapy based on inabah philosophy. *Pakistan Journal of Life and Social Sciences (PJLSS)*, *22*(1), 166-182.

[38] Ali, M. A., Ahmad-ur-Rehman, M., & Chauhan, M. A. H. (2024). A Revisit on the Servicescape (Physical and Social): Re-Conceptualization and Validation. *Journal of Management Practices, Humanities and Social Sciences*, *8*(2), 38-52.