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Sociodemographic Factors Associated with Health Literacy Toward Complementary and Alternative Medicine: A Cross-Sectional Study Among Patients with Type 2 Diabetes Mellitus in Bali, Indonesia

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ABSTRACT

Introduction: Complementary and Alternative Medicine (CAM) is widely utilized by individuals with Type 2 Diabetes Mellitus (T2DM), particularly in culturally embedded communities. However, misconceptions related to CAM health literacy may lead to health risks and are potentially shaped by sociodemographic factors. This study aimed to examine the association between sociodemographic characteristics and misconceptions related to CAM health literacy among patients with T2DM in Denpasar, Bali.

Methods: A cross-sectional study was conducted at Osadha Klinik Pratama, Denpasar, from February to April 2025. Using purposive sampling, 104 T2DM patients were selected based on eligibility criteria. A validated 16-item questionnaire was used to assess misconceptions about CAM. Descriptive statistics were applied, and non-parametric tests, Mann-Whitney U and Kruskal-Wallis, were used to analyze associations between misconception scores and sociodemographic variables.

Results: Gender was significantly associated with CAM knowledge, with male participants scoring higher (p-value = 0.041). While age, education, occupation, income, and diabetes duration did not show statistical significance, trends revealed greater misconceptions among younger adults, individuals with low income, and recently diagnosed patients.

Conclusion: The study emphasizes the need for targeted, gender-sensitive educational strategies to address CAM-related misinformation. Strengthening health literacy through context-specific health communication is crucial to ensuring safe CAM use among diabetic populations.

Keywords: Complementary and alternative medicine (CAM); Type 2 diabetes mellitus (T2DM); Health literacy; Sociodemographic factors

Introduction

Type 2 Diabetes Mellitus (T2DM) continues to rise globally, affecting 10.5% of adults in 2021 and projected to impact 783 million people by 2045 [1,2]. This condition accounts for approximately 90% of all diabetes cases and is strongly associated with changing lifestyles, dietary patterns, obesity, and socioeconomic inequality [2,3]. The burden is especially severe in low- and middle-income countries (LMICs), where healthcare access remains limited. In these contexts, Complementary and Alternative Medicine (CAM) is often used alongside or in place of conventional treatments. This practice is shaped by cultural beliefs and perceived advantages such as affordability, accessibility, and natural origins [4,5]. However, misconceptions about CAM's safety and efficacy can result in health risks, especially when it is used without medical supervision. Some natural substances,

including ginseng and garlic, can dangerously interact with insulin or oral hypoglycemics, increasing the risk of hypoglycemia [6,7].

Health literacy plays a critical role in influencing how patients perceive and utilize CAM. Individuals with limited health literacy may struggle to understand medical information, assess risks, or recognize treatment limitations. This vulnerability increases the likelihood of misinformation and improper CAM use [8]. Moreover, cultural interpretations of illness, such as spiritual causation, may further discourage biomedical engagement [9]. In contrast, higher health literacy is linked to better self-care, adherence, and clinical outcomes [10]. This issue is particularly relevant in Indonesia, where traditional medicine is culturally entrenched and CAM use is widespread. However, the combination of widespread CAM acceptance and low health literacy increases the risk of unsafe practices [11]. Despite its significance, research exploring how sociodemographic factors shape CAM-related health literacy in Indonesia remains limited.

This study examines the association between sociodemographic characteristics and misconceptions related to CAM among patients with T2DM in Bali, Indonesia. Bali is particularly relevant as a site for this study due to its high CAM use, the blend of tourism and healthcare, and the importance of cultural preservation in the region. It aims to identify factors associated with misinformation and inform culturally appropriate strategies to improve diabetes care in resource-limited settings.

Methods

Study design

This study employed a cross-sectional design to examine the relationship between sociodemographic characteristics and health literacy-related misconceptions concerning the use of CAM among patients with T2DM.

Setting

The research was conducted at Osadha Klinik Pratama, a primary healthcare facility in Denpasar, Bali, Indonesia. Data were collected from February to April 2025. This setting was selected due to its accessibility to a diverse population of patients actively managing T2DM.

Participants

The target population comprised individuals diagnosed with T2DM and receiving care at the clinic during the study period. Inclusion criteria were: (1) aged 18 years or older, (2) diagnosed by a physician with T2DM for at least 6 months, (3) able to comprehend and complete the survey, and (4) willing to participate. Patients who declined to participate or had cognitive impairments that could compromise response quality were excluded.

Study size

The sample size was determined using Slovin's formula with a 5% margin of error and 95% confidence level. With a total population (N) of 141, the formula yielded a minimum required sample of 104 respondents. Purposive sampling was employed to target individuals who were actively involved in diabetes self-management and could provide relevant insights.

Variables

The dependent variable was CAM-related health literacy, measured via misconception scores. Independent variables included age, gender, education level, occupation, income, residence type (urban/rural), diabetes duration, and family history of diabetes.

Measurement and data sources

CAM misconceptions were assessed using a 16-item structured questionnaire. Items measured knowledge on safety, effectiveness, and potential interactions of CAM therapies. Each item had three possible responses: "incorrect" = 0, "don't know" = 0.5, and "correct" = 1, with a maximum score of 16. The instrument underwent expert validation by three professionals in public health and CAM. Pilot testing was conducted with 20 individuals sharing similar demographics as the main sample, resulting in a Cronbach's alpha of 0.785, indicating acceptable internal consistency. Data collection was executed via face-to-face interviews by trained enumerators to minimize response errors and ensure clarity.

Bias control

To control for bias, enumerators received standard training in data collection protocols. Instrument validity was enhanced through expert review, while reliability was confirmed through pilot testing.

Quantitative variables

Sociodemographic variables were categorized into discrete groups for statistical comparison: age brackets (e.g., <40, 41–60, >60), income (above/below minimum wage), residence (urban/rural), and education level. CAM misconception scores were treated as continuous variables ranging from 0 to 16, representing the respondent's CAM knowledge accuracy.

Statistical analysis

Descriptive statistics were computed to summarize respondent characteristics. Non-parametric tests were chosen due to the non-normal distribution of misconception scores. The Kruskal-Wallis test assessed differences across more than two groups (e.g., education level, income, diabetes duration), while the Mann-Whitney U test was used for dichotomous variables

(e.g., gender, residence, family history). All statistical analyses were conducted at a 5% significance level (p-value< 0.05) using SPSS version 26.

Ethical clearance

Ethical approval was obtained from the Ethics Committee of Universitas Bali Internasional, with clearance number 02.0530/UNBI/EC/III/2025 dated March 25, 2025. Participation was voluntary, and informed consent was secured prior to data collection. All procedures adhered to established ethical standards for human subject research.

Results

Sociodemographic characteristics

The demographic profile of the study respondents provides a comprehensive view of the population under investigation. Out of 104 respondents, the majority (51.0%) were aged 60 years and older, categorized as elderly. Pre-elderly individuals aged 45–59 accounted for 41.3%, while young adults (26–44 years) comprised 7.7% of the sample. This age distribution aligns with prior research indicating a high tendency for older adults to utilize Complementary and Alternative Medicine (CAM) as part of chronic disease management strategies [12,13].

Gender distribution was nearly equal, with females representing 51.0% and males 49.0%, suggesting that both genders are comparably involved in CAM-related behaviors. Supporting literature emphasizes that CAM usage among diabetic populations shows no significant gender disparity, with both men and women equally exploring alternative therapeutic options [14]. Educational attainment was as follows: 37.5% of respondents had higher education, another 37.5% had low or no formal education, and 25.0% had completed senior high school. These findings indicate a bimodal distribution that may influence health literacy and perceptions about CAM. Socioeconomic research has shown that lower educational levels often correlate with increased CAM use due to cultural beliefs and reduced access to conventional healthcare [15,16].

Occupational data revealed that almost half (49.0%) of the respondents were unemployed, followed by retirees (23.1%), self-employed individuals (11.5%), private sector employees (10.6%), and government employees (5.8%). The high rate of unemployment may reflect the elderly composition of the sample and potential financial constraints, which previous studies have identified as drivers of CAM use in resource-limited settings [17]. Income levels were similarly skewed: 49.0% reported no income, 27.9% earned below the Bali minimum wage, and only 23.1% earned equal to or above it. Economic vulnerability has been linked to higher CAM adoption, as alternative treatments are often perceived as more affordable [16]. Residential area data revealed that 69.2% of respondents lived in rural areas, with only 30.8% residing in urban settings. This rural predominance is significant, as rural dwellers have been shown to exhibit higher CAM usage due to limited access to structured diabetes education and conventional healthcare services [18–20]. The digital divide and lower health literacy in rural settings also contribute to differential CAM information access [21,22].

Regarding diabetes duration, half of the participants (50.0%) had been diagnosed for 1–5 years, 23.1% for 6–10 years, 16.3% for over 10 years, and 10.6% for less than one year. The wide range in diabetes experience may affect individuals' readiness and motivations to explore CAM. Literature indicates that more complex or long-standing cases of diabetes often drive patients toward complementary therapies in pursuit of additional symptom management [23]. Lastly, 76.9% of participants reported having a family history of diabetes, a factor that might influence awareness and attitudes toward both conventional and alternative care. However, familial exposure does not necessarily guarantee improved health literacy or reduced reliance on CAM, as beliefs and behaviors are also shaped by cultural and environmental contexts [6,24]. The complete distribution is summarized in Table 1

Table 1 Sociodemographic characteristics of respondents (n = 104)

Variable	Category	n (%)
Age	≥ 60 years (Elderly)	53 (51.0)
	45–59 years (Pre-elderly)	43 (41.3)
	26–44 years (Young adult)	8 (7.7)
Gender	Female	53 (51.0)
	Male	51 (49.0)
Education Level	Higher Education	39 (37.5)
	Senior High School	26 (25.0)
	Low/No Formal Education	39 (37.5)

Variable	Category	n (%)
Occupation	Unemployed	51 (49.0)
	Retired	24 (23.1)
	Self-employed	12 (11.5)
	Private Sector Employee	11 (10.6)
	Government Employee	6 (5.8)
Income	No Income	51 (49.0)
	< Bali Minimum Wage	29 (27.9)
	≥ Bali Minimum Wage	24 (23.1)
Residential Area	Rural	72 (69.2)
	Urban	32 (30.8)
Duration of Diabetes	< 1 year	11 (10.6)
	1–5 years	52 (50.0)
	6–10 years	24 (23.1)
	> 10 years	17 (16.3)
Family History of Diabetes	Yes	80 (76.9)
	No	24 (23.1)

Misconception indicators and prevalence

Findings from a 16-item questionnaire assessing misconceptions about CAM are presented in Table 2. Most respondents displayed incorrect knowledge across multiple items. A significant portion (68.3%) incorrectly believed that CAM does not interact with prescription drugs. Only 6.7% answered this item correctly. Similarly, 59.6% incorrectly assumed CAM could be used without supervision, and 56.7% believed it was scientifically proven safe and effective. Higher scores on the misconception scale indicate a greater level of incorrect knowledge, reflecting a lower understanding of CAM safety and effectiveness

Table 2 Distribution of respondents' health literacy toward complementary and alternative medicine (CAM) (n = 104)

Item Statement	Correct n (%)	Uncertain n (%)	Incorrect n (%)
Safe to use for treatment	55 (52.94)	17 (16.35)	32 (30.77)
Cannot cure diabetes completely	54 (51.94)	16 (15.38)	34 (32.69)
CAM should be used according to medical guidance	47 (45.19)	19 (18.27)	38 (36.54)
Safe to use with prescribed medications	23 (22.12)	34 (32.69)	47 (45.19)
Has certain side effects	15 (14.42)	36 (34.62)	53 (51.04)
May interact with prescribed drugs	7 (6.73)	26 (25.00)	71 (68.27)
Should be used according to recommended dosage	18 (17.31)	27 (26.00)	59 (56.73)
Can interfere with medical treatment if misused	20 (19.23)	24 (23.08)	60 (57.69)
Has specific dosage or usage frequency	10 (9.62)	29 (27.88)	65 (62.50)
Safe without supervision	14 (13.46)	28 (26.92)	62 (59.62)
Safer than conventional medicine	26 (25.00)	29 (27.88)	49 (47.12)
Can replace prescribed medication	16 (15.38)	31 (29.81)	57 (54.81)
Can help reduce blood glucose levels	22 (21.15)	36 (34.62)	46 (44.23)
Scientifically proven safe and effective	11 (10.58)	34 (32.69)	59 (56.73)
Recommended by some health professionals	13 (12.50)	33 (31.73)	58 (55.77)
Clinically tested and proven to be safe	10 (9.62)	33 (31.73)	61 (58.65)

Other misconceptions included the belief that CAM had no side effects (51.0%) and that it could replace prescribed medication (54.8%). Misconceptions extended to dosage understanding; 56.7% did not recognize the need for dosage regulation, and 62.5% did not believe CAM had specific usage frequencies.

Sociodemographic characteristics and misconception scores

The distribution of CAM-related misconception scores by sociodemographic characteristics is shown in Table 3. These results reveal the relationship between sociodemographic factors and misconception levels regarding Complementary and Alternative Medicine (CAM) among patients with Type 2 Diabetes Mellitus (T2DM). Respondents aged 26–44 years (young adults) had the lowest mean misconception score of 10.3 ± 1.2, suggesting a better understanding of CAM compared to older individuals. In contrast, elderly participants (≥60 years) exhibited the highest mean score of 11.2 ± 1.3, indicating a greater prevalence of misconceptions about CAM. The pre-elderly group (45–59 years) had a mean score of 11.0 ± 1.5, showing a moderate level of misconceptions. Females had a higher mean misconception score of 11.4 ± 1.5 compared to males, who had a mean score of 10.6 ± 1.4, indicating that females in this sample had more misconceptions about CAM than males.

Respondents with low or no formal education had the highest mean misconception score of 11.3 ± 1.3, while those with tertiary education exhibited the lowest mean score of 10.4 ± 1.1, suggesting that higher education is associated with fewer misconceptions about CAM. Respondents with a high school education had a mean score of 10.9 ± 1.2, indicating that educational attainment influences understanding of CAM. There was a slight variation in misconception scores across income levels. Respondents with no income had a mean score of 11.3 ± 1.5, while those earning below the minimum wage had a mean score of 11.1 ± 1.4. Individuals earning equal to or above the minimum wage had the lowest mean score of 10.8 ± 1.2, suggesting that higher income may correlate with fewer misconceptions about CAM.

Among occupational groups, the unemployed had the highest mean misconception score of 11.7 ± 1.6, followed by entrepreneurs with a score of 11.2 ± 1.4 and retirees with a score of 10.6 ± 1.5. Civil servants had the lowest mean misconception score of 10.3 ± 1.1, suggesting that certain occupations, particularly those with access to more formal health information, are associated with a better understanding of CAM. Rural residents had a higher mean misconception score of 11.4 ± 1.5 compared to urban residents, who had a mean score of 10.7 ± 1.2. This suggests that living in rural areas, which often have limited access to structured healthcare and health information, may contribute to higher misconceptions about CAM.

The newly diagnosed group (less than 1 year) had the highest mean misconception score of 11.2 ± 1.5. Respondents diagnosed for 1–5 years had a mean score of 10.8 ± 1.3, and those diagnosed for 6–10 years had a mean score of 11.1 ± 1.4. Individuals diagnosed for more than 10 years had the lowest mean score of 10.3 ± 1.2, suggesting that longer diabetes duration may be associated with better knowledge of CAM. Respondents with a family history of diabetes had a mean misconception score of 11.0 ± 1.4, while those without a family history had a mean score of 11.3 ± 1.5, indicating that family history does not significantly influence the level of misconceptions regarding CAM in this sample. These findings suggest that sociodemographic factors, particularly education, income, and occupation, are closely linked with the levels of misconceptions about CAM. Lower education levels, unemployment, and rural residency are associated with higher misconception scores, while higher income and longer diabetes duration are related to better knowledge about CAM.

Table 3 Distribution of CAM-Related Misconception Scores by Sociodemographic Characteristics Among T2DM Patients (n = 104)

Sociodemographic Characteristics	Mean Misconception Score (± SD)
Age Group	
26–44 years (Young Adults)	10.3 (1.2)
45–59 years (Pre-elderly)	11.0 (1.5)
≥60 years (Elderly)	11.2 (1.3)
Gender	
Male	10.6 (1.4)
Female	11.4 (1.5)
Education Level	
Low/No Formal Education	11.3 (1.3)

Sociodemographic Characteristics	Mean Misconception Score (± SD)
High School	10.9 (1.2)
Tertiary Education	10.4 (1.1)
Income Level	
No Income	11.3 (1.5)
Below Minimum Wage	11.1 (1.4)
Equal or Above Minimum Wage	10.8 (1.2)
Occupation	
Entrepreneur	11.2 (1.4)
Civil Servant	10.3 (1.1)
Unemployed	11.7 (1.6)
Private Sector Employee	10.9 (1.3)
Retired	10.6 (1.5)
Residential Area	
Rural	11.4 (1.5)
Urban	10.7 (1.2)
Duration of Diabetes	
< 1 year	11.2 (1.5)
1–5 years	10.8 (1.3)
6–10 years	11.1 (1.4)
> 10 years	10.3 (1.2)
Family History of Diabetes	
Yes	11.0 (1.4)
No	11.3 (1.5)

Associations between sociodemographic factors and CAM knowledge scores

Table 4 displays inferential statistics on the association between sociodemographic variables and CAM knowledge scores. Among all variables, only gender showed a statistically significant association (p-value = 0.041), with males having a higher mean score (3.52) compared to females (1.83).

Table 4 Inferential statistics of sociodemographic characteristics and CAM knowledge score

Category	n	Mean (SD)	t/F	p-value
Age group			1.975[a]	0.372
26–44 years (Young Adult)	7	3.29 (5.27)		
45–59 years (Pre-elderly)	44	2.57 (3.73)		
≥60 years (Elderly)	53	2.65 (4.31)		
Gender			1053.500[b]	0.041
Male	51	3.52 (4.52)		
Female	53	1.83 (3.50)		
Education			3.323[a]	0.505
Tertiary Education	39	3.12 (4.39)		
Primary School	16	2.22 (4.00)		

Category	n	Mean (SD)	t/F	p-value
Senior High School	26	2.69 (4.03)		
Junior High School	15	2.70 (4.38)		
No Formal Education	8	1.12 (2.80)		
Occupation			4.318[a]	0.365
Government Employee	6	4.58 (6.26)		
Private Sector Employee	11	3.27 (4.12)		
Retired	24	3.73 (4.53)		
Unemployed	51	1.88 (3.52)		
Self-employed (Entrepreneur)	12	2.29 (4.15)		
Income			2.974[a]	0.226
Below Bali Minimum Wage	29	3.36 (4.76)		
No Income	51	1.88 (3.52)		
Above Bali Minimum Wage	24	3.46 (4.26)		
Residence			1110.500[b]	0.76
Rural Area	72	2.52 (4.08)		
Urban Area	32	2.97 (4.19)		
Diabetes duration			7.639[a]	0.054
1–5 years	52	3.22 (4.22)		
6–10 years	24	1.96 (3.24)		
< 1 year	11	3.27 (5.15)		
> 10 years	17	1.53 (4.04)		
Family history			830.500[b]	0.293
Yes	80	2.43 (3.80)		
No	24	3.42 (4.99)		

Note: Significant p-value <0.05; [a] Kruskal-Wallis Test; [b] Mann-Whitney U Test

Other variables, including age group (p-value = 0.372), education level (p-value = 0.505), occupation (p-value = 0.365), income (p-value = 0.226), residence (p-value = 0.76), diabetes duration (p-value = 0.054), and family history (p-value = 0.293), did not yield statistically significant differences. However, some non-significant trends were noted. Participants with tertiary education had a higher mean knowledge score (3.12), while those without formal education scored the lowest (1.12). Government employees had the highest mean score (4.58), suggesting better access to credible health information. Participants with income above the regional minimum wage had a higher mean score (3.46) than those with no income (1.88). Duration of diabetes approached statistical significance (p-value=0.054); newly diagnosed participants had a mean score of 3.27, higher than those diagnosed for more than 10 years (1.53). Residence in rural or urban areas did not significantly affect scores.

In summary, while only gender reached statistical significance, patterns across other variables suggest sociodemographic factors may influence CAM-related knowledge. These results emphasize the need for enhanced health education and communication strategies targeting specific subpopulations with higher rates of misconceptions [25].

Discussion

This study investigated how sociodemographic variables influence health literacy-related misconceptions regarding the use of Complementary and Alternative Medicine (CAM) among patients with Type 2 Diabetes Mellitus (T2DM) in Denpasar, Bali. The findings highlight a complex interplay between cultural norms, access to information, and individual characteristics in shaping patients' understanding of CAM, with gender emerging as the most significant predictor of CAM knowledge.

Our analysis revealed that gender had a statistically significant association with CAM-related knowledge scores. Specifically, males demonstrated higher knowledge scores compared to females, suggesting lower susceptibility to CAM-related misconceptions. These findings align with previous studies indicating that although women are more proactive in seeking health-related information, they may also be more receptive to unverified CAM claims, especially through informal networks or social media

platforms [25]. Sociocultural roles may contribute to this pattern. In many traditional settings, women are caregivers and health decision-makers within families, which increases their exposure to anecdotal health narratives that often favor CAM. Therefore, educational programs targeting female populations must prioritize debunking common myths while enhancing critical appraisal skills, particularly around natural versus evidence-based treatment claims [26].

Although not statistically significant, educational attainment displayed a suggestive trend toward improved CAM literacy. Respondents with tertiary education exhibited higher knowledge scores compared to those with minimal or no formal education. This is consistent with broader health literacy literature, which suggests that higher education equips individuals with the skills to seek, interpret, and critically evaluate health information [27,28]. Nonetheless, the presence of misconceptions among some higher-educated respondents highlights the limitations of education alone in combating health misinformation. Misinformation can permeate through digital media, bypassing formal educational safeguards. Consequently, health education should incorporate media literacy training to strengthen resistance to misinformation. Occupational status also showed trends relevant to CAM knowledge. Government employees and retirees had relatively higher scores, possibly due to exposure to structured workplace or pensioner health programs. In contrast, unemployed and self-employed individuals had the lowest scores, likely reflecting limited access to formal health information channels. These findings suggest the need for community-based outreach that targets informal labor sectors and non-working populations [29].

Constraints income level was another factor that, while not statistically significant, revealed meaningful trends. Respondents earning below the Bali minimum wage or reporting no income had lower knowledge scores. This reinforces findings from previous studies that link financial vulnerability with increased CAM usage, often driven by perceptions of affordability, despite the absence of verified efficacy [30]. Furthermore, economic constraints can limit access to credible health services and force reliance on culturally familiar, low-cost alternatives. Policy interventions should consider subsidizing diabetes education and incorporating CAM risk-awareness campaigns within public health services targeted at low-income groups [31].

Rural residents scored slightly lower on CAM knowledge compared to their urban counterparts. While not statistically significant, the pattern aligns with global data indicating that rural populations face higher barriers to accessing accurate health information, partly due to digital divides and weaker health infrastructure [21,32]. Given Bali's cultural landscape, where traditional healers remain influential, rural residents may be particularly susceptible to entrenched CAM beliefs. Health literacy efforts must thus be contextually grounded, incorporating community leaders and local practices to ensure relevance and acceptance. Mobile clinics, culturally tailored health messaging, and local language materials can help bridge this gap.

Trajectories Interestingly, respondents with less than one year since diagnosis had higher CAM knowledge scores than those with longer disease durations. Although not statistically significant, this suggests that the initial stages of diagnosis may coincide with heightened engagement in health education, especially if healthcare providers offer structured orientation programs [33]. However, over time, without reinforcement, patients may revert to cultural norms or alternative therapies promoted by peers or family. This calls for longitudinal health literacy strategies that provide continual education throughout the disease trajectory, potentially integrated into routine follow-up care.

Contrary to expectations, a family history of diabetes did not correlate with improved CAM knowledge. In fact, misconception scores were slightly higher among those with diabetic family members. This finding suggests that intergenerational transmission of health knowledge may perpetuate, rather than correct, CAM-related myths, especially in cultural contexts where traditional healing is normalized [34]. Therefore, health promotion efforts must target not only individual patients but also their families, using family-centered counseling models to address entrenched beliefs and provide accurate, accessible information across generations.

These findings underscore that health literacy is not merely an individual competency but a structural determinant influenced by education, socioeconomic status, and access to credible health systems [25]. In the context of chronic disease management, especially for T2DM, misconceptions about CAM pose serious threats to patient safety, particularly when CAM is used as a substitute for conventional treatments. The study reaffirms the importance of designing demographically tailored interventions that address both individual-level and systemic barriers to accurate health information. Health professionals must be trained to engage empathetically with patients' beliefs while guiding them toward evidence-based care.

The results of this study provide actionable insights for policymakers, educators, and healthcare providers. First, health promotion strategies should integrate CAM safety education within diabetes management programs, especially in areas where traditional medicine is prevalent.

Second, gender-targeted communication should be developed, recognizing the distinct ways men and women consume and interpret health information. For example, women-focused programs could address CAM myths within maternal or family health education platforms. Third, efforts must be made to improve digital health literacy, particularly in rural areas.

Collaborations with local influencers, religious leaders, and traditional healers may enhance the credibility and reach of these interventions. Finally, integrating CAM topics into healthcare provider training can improve dialogue between patients and professionals, reducing stigma and encouraging disclosure of CAM use.

Limitations and Future Directions

While the findings offer valuable insights, several limitations must be acknowledged. The cross-sectional design limits causal inferences, and the use of purposive sampling may affect generalizability. The study was also geographically limited to a single clinic in Denpasar, although the inclusion of rural and urban participants helps mitigate this limitation.

Future research could adopt longitudinal designs to track changes in CAM knowledge over time, particularly after targeted educational interventions. Additionally, qualitative studies exploring patient narratives could enrich understanding of how cultural and emotional factors shape CAM perceptions.

Conclusion

This study examined the relationship between sociodemographic factors and misconceptions about CAM among patients T2DM. The results showed that gender was the only variable with a statistically significant association, with male participants demonstrating higher levels of CAM knowledge. Although other factors, such as age, education, occupation, income, residential status, and diabetes duration, did not show statistically significant differences, observed trends suggested that younger adults, individuals with higher education, and those recently diagnosed with diabetes tend to have a better understanding of CAM safety and efficacy.

These findings highlight the need for targeted health literacy interventions that address gender-related differences in accessing and interpreting health information. The study also emphasizes the importance of incorporating culturally appropriate education into chronic disease management programs to tackle persistent misconceptions. By considering sociodemographic factors, this research contributes to a more nuanced understanding of CAM use and supports the development of evidence-based, inclusive health promotion strategies for vulnerable populations.

Competing Interests

No Conflict of Interest

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Author contributions

NMUKD contributed to the conceptualization and design of the study, development of the research instrument, data collection, and initial drafting of the manuscript. NMDN performed statistical analysis, data interpretation, and revised the results and discussion sections. IGARW participated in the validation of the instrument, conducted a literature review, and contributed to the methodology section. LSA provided academic supervision, developed the ethics and policy implications sections, and oversaw the final editing of the manuscript.

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