

Traditional Medicine and Its Impact on Patient Outcomes in Type 2 Diabetes Mellitus Therapy

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ABSTRACT

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The number of antidiabetic medicine used and the use of traditional medicine as a complementary medicine are increasing along with the growing number of people with diabetes mellitus (DM). The choice of treatment depends on patients' perception and will have an effect on compliance and clinical outcome. This study aimed to determine the relationship between patients' perception of consuming a combination of Traditional Medicine (TM) and Synthetic Medicine (SM) and their compliance with medication, as well as to examine its impact on the outcomes of type 2 DM treatment at three community health centers in Yogyakarta. This study is a cross-sectional study. Participants that met the inclusion criteria were 110 patients with type 2 DM who had been taking TM-SM combination at least one month at three community health centers in the City of Yogyakarta. The main outcome is the relationship between perception and compliance, as well as the outcome of therapy. The results showed that from 110 patients, only 40 (36.4%) had a good perception of the use of TM-SM combination, and 32 patients (29.1%) adhered to the recommended administration of synthetic drugs. A total of 49 patients (44.5%) reported controlled blood sugar levels as the outcome of DM management. Patients' perception of drug combination was proven unrelated to patient compliance and treatment outcome ($p > 0.05$). In conclusion, there is no relationship between patients' perception and adherence as well as treatment outcomes. Moreover, the duration of TM use showed a significant relationship with the treatment outcome and the patients' perception of TM-SM combination.

Keywords: Compliance, Perception, Type 2 Diabetes Mellitus, Therapy Outcome

INTRODUCTION

Type 2 is the most common type of diabetes mellitus (DM) as it contributes to 90% of DM occurrences worldwide (Arisman, 2010). Data from IDF shows that the Western Pacific region, including Indonesia, has the highest number of people with DM, which is up to 159 million in 2017 and is expected to increase by 15% in 2045. In 2017, Indonesia ranked sixth among ten countries with the most significant number of DM sufferers, i.e., 10.3 million people, and this figure is projected to reach 16.7 million in 2045 (International Diabetes Federation, 2017). The Indonesia Basic Health Research in 2018 (RISKESDAS) affirms that, in the case of DM sufferers, the Special Region of Yogyakarta ranks third after Jakarta and East Kalimantan and that the number persistently

multiplies from the year 2013 to 2018 (Indonesian Ministry of Health, 2018).

The growing number of people with diabetes mellitus means more patients are taking both oral antidiabetic and insulin and, potentially, traditional medicines (TM). One of the factors related to poor compliance with treatment among patients in Indonesia is because they prefer to consume traditional medicine (Indonesian Ministry of Health, 2018). Similarly, many DM patients rely on traditional medicine as an alternative treatment. Makabuhay (*Tinospora rumphii* Boerl.), cinnamon (*Cinnamom burmannii*), bitter melon (*Momordica charantia* L.), and Indian or Indonesian bay leaf (*Syzygium polyanthum* Weight.) are some plant species whose efficacy in preclinical and clinical trials and safety as traditional remedies for

diabetes have been proven (Indonesian Ministry of Health, 2016). Another plant, creat or green chireta (*Andrographis paniculata*), can also lower blood glucose levels (Paramitha & Rahamanisa, 2016).

Since DM patients are required to take drugs continuously, this can lead to a sense of boredom with the treatment. If prolonged, it eventually reduces patient compliance with antidiabetic oral consumption, and patients start to seek an alternative that is believed to provide psychological and mental comfort. Feeling less satisfied with the outcome of therapy or experiencing unstable blood sugar levels, some tend to pursue other efforts to maximize the perceived therapeutic result. For some patients, economic limitations reduce their access to modern medicine, encouraging them to switch to consuming traditional remedies (Mosihuzzaman & Choudhary, 2008). Analyzing attitudes toward complementary alternative medicine (CAM), Jasamai claim that 71% of Malaysian adults prefer CAM, and 54.44% of them mostly take herbal products (Jasamai *et al.*, 2017).

Based on the National Center for Complementary and Alternative Medicine, CAMs are divided into five, which are biological, spiritual/mind-body, alternative, physical (body-based), and energy therapies (Farrukh *et al.*, 2018; Wieland *et al.*, 2011). Some plants have been known for their benefits for diabetic patients, such as green cumin essential oil (Jafari *et al.*, 2017), leaf of *Morus indica* or Indian mulberry (Mathew, F; Varghese, Bimi; Joseph, 2019), *Cocos nucifera* (coconut palm) (Joseph, Dhanish; George,Junia; Mathew, 2019), leaf extract from three types of Mangrove (Usman *et al.*, 2019), and garlic that can reduce the fasting blood sugar when combined with metformin rather than using metformin alone (Fadheel, 2019).

Based on the information above, research on the relationship between patients' perception of Traditional Medicine (TM) and Synthetic Medicine (SM) and adherence of SM, as well as the outcome of the therapy among type 2 diabetes mellitus patients at three community health centers in Yogyakarta becomes necessary.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study collected data directly from patients using a perception questionnaire and the medical records of patients diagnosed with type 2 DM at three community health centers in the City of Yogyakarta. These three community health centers are Kotagede 1,

Danurejan 1, and Gondomanan. This research was carried out between March and April 2019. This research had been approved by the Research Ethics Committee of University of Ahmad Dahlan number 011811139.

Participants

The research subjects were patients who had been taking TM-SM combination at least one month and were registered at one of the three selected community health centers in Yogyakarta. A total of 110 patients met the selection criteria. The inclusion criteria were diabetic patients aged ≥ 18 years old who were diagnosed with type 2 DM at the community health center and had been consuming TM-SM combination at least one month. Also, they were willing to participate as a respondent, had a complete medical record, and could communicate well. Meanwhile, the exclusion criteria were pregnancy and partially filling questionnaires.

Instrument

This study used two sets of questionnaires, namely a perception questionnaire (8 questions) and a compliance questionnaire (5 questions). The perception questionnaire was deemed valid and reliable after being tested (Faridah *et al.*, 2017). The whole questionnaire consisted of three sections of questions, namely (1) demographic patients, (2) the history of disease and its treatment, and (3) perceptions of traditional medicine among patients who took TM-SM combination. The adherence was measured using the Medication Adherence Report Scale (MARS) questionnaire.

Data Analysis

Measurement of perception

Perception in this study refers to the patients' perception regarding the use of TM-SM combination. Data on patients' perception of the use of TM-SM combination were processed by scoring each of the respondents' answers using a non-analytic descriptive method, namely a 4-point Likert scale. The respondents were encouraged to answer each question and respond to each statement written in the questionnaire by selecting one of the four provided options, which are "strongly disagree", "disagree", "agree", and "strongly agree". From these answers, the respondents' perceptions of taking TM-SM combination were measured using the following rules: Strongly disagree = 1; Disagree = 2; Agree = 3;

and Strongly agree= 4. Afterward, these scores were analyzed statistically in SPSS and interpreted with a particular principle. A respondent is categorized as having a good perception if the total score of his/her questionnaire survey is equal to or higher than the mean value. A respondent is considered as having a poor perception if the total score of his/her questionnaire survey is lower than the mean value (Sugiyono, 2013).

Measurement of adherence

Adherence in this study is based on the compliance of the patients to use a synthetic medicine as recommended by practitioners. Data on adherence to medication were acquired from the self-administered MARS questionnaire, then scored and presented in percentage (%). The Medication Adherence Report Scale (MARS) is an instrument that measures the level of adherence among diabetic patients. It consists of five questions, and the levels of adherence range between 1 and 5, with 1= always, 2= frequently, 3= sometimes, 4= rarely, and 5=never. Patients are categorized as compliant if they obtain a score of 25. Any scores <25 indicate poor compliance (Rahmadani, 2018).

Data collection and Statistical Analysis

The demographic characteristics of the respondents include age, sex, education, income, marital status, employment, and treatment outcomes, which were obtained from their medical records. The treatment outcome is blood sugar levels, as measured from fasting blood sugar (FBS), random blood sugar, and HbA1C. Based on the Diabetes Guideline 2016 issued by the American Diabetes Association (ADA) (American Diabetes Association, 2016), blood sugar levels are divided into controlled and uncontrolled blood sugar levels. These data were analyzed descriptively in percentages (%).

This study used statistical analysis, i.e., the chi-square test, in SPSS v.16 to process two variables, namely the relationship between perception and compliance and the relationship between perception and treatment outcomes among type 2 DM patients. Significance is marked by p -value \leq 0.05.

RESULTS AND DISCUSSION

The majority of the 110 patients who met the inclusion criteria were geriatric or averagely 60 years old (57.3%), female (70.9%), married (78.2%), and unemployed (66.4%) (Table I). Most

of them attended less than nine years of education (58.2%) and had low incomes or lower than IDR 1,000,000 (64.5%). These sociodemographic characteristics are in line with previous research which shows that most of the 294 diabetic patients taking complementary medicines in Iran were over 55 years old (31.1%), female (55.8%), married (70.41%), employed (45.2%), and working as homemakers (43.2%). Furthermore, Sheikhrabari *et al.* (2017) stated that there is a significant correlation between employment, the existence of other chronic diseases, prescribed diabetic medications, and the consumption of complementary and alternative medicines (χ^2 13.22, P .004; χ^2 10.69, P .001; and χ^2 26.38, P .000, respectively) (Sheikhrabari *et al.*, 2017).

The respondents of this study mostly have suffered from diabetes for less than 5 years (53.6%) with average (\pm SD) 5.9 years (\pm 5.7). Around 61.8% of the patients took combination of diabetes medication, in which 54.5% patients used metformin and glimepiride. Regarding the use of traditional medicine (TM), 43.6% patients used TM only if they needed it while 28.2% patients used TM every day. traditional medicine is divided into three types based on National Policy on Traditional Medicine of Indonesia (KOTRANAS), which are *Jamu*, standardized herbal, and phytopharmaca (Departemen Kesehatan Republik Indonesia, 2007). However, in this study, the researcher used open-ended questions for the type of TM use. Therefore, it cannot be categorized based on KOTRANAS classification.

Adherence to treatment is the extent to which patients agree to what the healthcare provider has recommended and is apparent in their behavior in taking the medicines or changing their lifestyle (Sabate, 2003). Although many aspects are believed to contribute to non-adherence, three factors are strongly associated with it, which are perceived medication inefficacy, resources of herbal medicine, and access to spiritual/divine healing (Atinga *et al.*, 2018). Indonesia is one of many countries that has abundant resources of herbal medicines, and their high accessibility affects the everyday life and belief systems of patients (Falkenberg, 2015). In this study, perception is categorized into either good or poor, while compliance is grouped into adherent or not adherent (Table II). The treatment outcome is represented by blood sugar level and classified into controlled and uncontrolled (Table III).

Table I. Characteristic of respondents that using TM-SM combination for DM

Characteristic		Total	%
Age	<60 years	47	42.7
	≥60 years	63	57.3
	Average ± SD	60.2 ± 10.2	
Gender	Female	78	70.9
	Male	32	29.1
Education	≥9 years education	64	58.2
	> 9 years education	46	41.8
Income	<1.000.000 IDR	71	64.5
	≥1.000.000 IDR	39	35.5
Status	Married	86	78.2
	Single	24	21.8
Job	Employed	37	33.6
	Unemployed	73	66.4
Diabetes Duration	<5 years	59	53.6
	≥5 years	51	46.4
	Average ± SD	5.9 ± 5.7	
Medication	Single	42	38.2
	Combination	68	61.8
Drug	Metformin	38	34.5
	Glimepiride	3	2.7
	Glicazid	1	0.9
	Metformin - Glimepiride	60	54.5
	Metformin - Glibenclamide	7	6.4
	Glibenclamide - Glimepiride	1	0.9
Duration of use of TM	Every day	31	28.2
	Twice a week	19	17.3
	Once a week	12	10.9
	If needed	48	43.6

Table II. The Correlation between Patients' Perceptions of TM-CM combination and Treatment Adherence

Perceptions	Adherences		Total	P
	Adherent	Not adherent		
Good	13	27	40	0.552
Poor	19	51	70	
Total	32	78	110	

The correlation between perceptions of traditional remedies and treatment adherence among type 2 DM patient was measured using the chi-square test. This test yielded $p=0.552$ (Table II), meaning that H_0 is accepted, whereas H_a is rejected. In other words, there is no relationship between the perception of traditional anti-diabetic remedies and compliance with therapy ($p>0.05$).

Several previous studies have confirmed that CAM use likely affects patients' compliance with therapy. Research on hypertensive patients

suggests that female patients who take CAM have lower adherence than those who do not (Gohar *et al.*, 2008). Studying patients with cardiovascular disease in Singapore, Teo *et al.* (2016) demonstrate another strong effect of taking CAM, i.e., patients who take CAM (114 patients, 35.6%) are less compliant (forget to take their medicine) than those who do not (84, 20.5%), with $p<0.001$. Also, CAM users (130 patients, 41.4%) are reported as non-compliant to their routine visits to the doctor compared with non-CAM users (112, 28.1%), with $p<0.001$ (Teo *et al.*, 2016).

Table III. The Correlation between Patients' Adherence, Perceptions of TM-SM combination and Duration of TM use with the Outcome of Therapy (Blood Sugar)

Variables	The Outcomes of Therapy (Blood Sugar)		Total	P
	Controlled (%)	Uncontrolled (%)		
Adherence				
Adherent	14 (43.7)	18 (56.3)	32 (29.09)	0.914
Not Adherent	35 (44.9)	43 (55.1)	78 (70.91)	
Perception				
Good	20 (50.0)	20 (50.0)	40 (36.36)	0.384
Poor	29 (41.4)	41 (58.6)	70 (63.64)	
Duration of TM use				
Every day	9 (29.0)	22 (71.0)	31 (28.18)	0.015*
Twice a week	9 (47.4)	10 (52.6)	19 (17.27)	
Once a week	10 (83.3)	2 (16.7)	12 (10.91)	
If needed	21 (43.7)	27 (56.3)	48 (43.64)	
Total	49 (44.55)	61 (55.45)	110 (100)	

*statistically significant at P value ≤ 0.05

CAM use is based largely on patients' perception rather than paying attention to clinical reality. Patients with a strong opinion are likely to continue to take CAM or combine it with conventional medicine. This situation is feared to induce complications or other health problems that patients potentially experience (Bahall & Edwards, 2015), as evident in this research. A total of 61 patients who combined herbal products (55.45%) with modern medicine reported uncontrolled blood sugar levels. However, the statistical analysis yielded $p=0.384$ (Table III), signifying the absence of the relationship ($p>0.05$) between the perception of traditional anti-diabetic remedies and the outcome of therapy. The duration of TM use showed significant relationship with the outcome of therapy. Patients who use TM every day showed uncontrolled blood sugar (71%); moreover, patients who use TM once a week showed controlled blood sugar (83.3%).

In addition to perception, adherence also plays a role in the effort to improve patients' outcomes, particularly for chronic drug regimens. Greater adherence to medical regimens would be associated with better metabolic control. Previous research shows that there is a strong relationship between adherence and metabolic outcome (HbA1c). Increasing 30% of adherence, on average, is associated with a roughly 0.5% absolute improvement of HbA1c. Those study also found that race has an association with adherence, which will give an impact to the metabolic outcome (Schectman *et al.*, 2002). In contrast with that, this

study shows that there is no relationship ($p>0.05$) between patients' adherence and outcome of therapy (blood sugar). Many factors contribute to this result, such as the number of samples. Further research with larger sample is needed to strengthen study on the association between adherence and clinical outcome.

Some problems will be faced by the patients if their blood sugar is still uncontrolled during the treatment. It is known that around 45.60% patients with diabetes have a high probability of experiencing dyslipidemia, which is a risk factor for cardiovascular disease (Ranadheer Chowdary *et al.*, 2017). Microvascular complication such as diabetic foot ulcer also would be faced by diabetes mellitus patients, and it has a correlation with psychological distress rather than patients who has diabetes only (Maheshwari *et al.*, 2017). Poor glycemic control is also related with anemia in diabetes mellitus patients who have normal renal function, and the further impact is other diabetes complication (Mounika *et al.*, 2017). Therefore, it is important to control the blood sugar for preventing patients from other complications.

The complexity of the regimen is also known to influence the adherence. Research on chronic ill patients in Kuala Lumpur, Malaysia showed that from 259 patients, 86.9% was not adherent to their medication. The non-adherent-patients used a lot of medicines with mean 9.6 ± 2.1 (Islahudin & Hasan, 2019). However, other study showed that non-adherence can be minimized by educating the patients.

Table IV. The Correlation between Patients' Perception, Adherence and Characteristic of Patients, n=110

Characteristic	Perception		P-value	Adherence		P-value
	Poor (%) (n=70)	Good (%) (n=40)		Not Adherent (%) (n=78)	Adherent (%) (n=32)	
Age						
<60 years	29 (41.4)	18 (42.7)	0.716	32 (41.0)	15 (46.9)	0.573
≥60 years	41 (58.6)	22 (57.3)		46 (59.0)	17 (53.1)	
Gender						
Female	46 (65.7)	32 (80.0)	0.113	57 (73.1)	21 (65.6)	0.434
Male	24 (34.3)	8 (20.0)		21 (22.7)	11 (34.4)	
Education						
≥9 years	35 (50.0)	29 (72.5)	0.021*	49 (62.8)	15 (46.9)	0.124
> 9 years	35 (50.0)	11 (27.5)		29 (37.2)	17 (53.1)	
Income						
<1.000.000 IDR	42 (60.0)	29 (72.5)	0.187	47 (60.3)	24 (75.0)	0.142
≥1.000.000 IDR	28 (40.0)	11 (27.5)		31 (39.7)	8 (25.0)	
Status						
Married	55 (78.6)	31 (77.5)	0.896	59 (75.6)	27 (84.4)	0.314
Single	15 (21.4)	9 (22.5)		19 (24.4)	5 (15.6)	
Job						
Employed	22 (31.4)	15 (37.5)	0.517	26 (33.3)	11 (34.4)	0.916
Unemployed	48 (68.6)	25 (62.5)		52 (66.7)	21 (65.6)	
Diabetes Duration						
<5 years	37 (52.9)	22 (55.0)	0.828	42 (53.8)	17 (53.1)	0.945
≥5 years	33 (47.1)	18 (45.0)		36 (46.2)	15 (46.9)	
Medication						
Single	27 (38.6)	15 (37.5)	0.911	29 (37.2)	13 (40.6)	0.735
Combinaton	43 (61.4)	25 (62.5)		49 (62.8)	19 (59.4)	
Duration of TM use						
Every day	16 (22.8)	15 (37.5)		22 (28.2)	9 (28.1)	
Twice a week	9 (12.9)	10 (25.0)	0.048*	14 (17.9)	5 (15.6)	0.781
Once a week	8 (11.4)	4 (10.0)		7 (8.9)	5 (15.6)	
If needed	37 (52.9)	11 (27.5)		35 (44.9)	13 (40.6)	

Abbreviations: IDR, Indonesian Rupiah *statistically significant at P value ≤ 0.05

A study on diabetes mellitus patients in India examined the effect of counseling or patient education (and also Patient Information Leaflet) given by Pharmacists with patients' adherence. The result showed that before counseling, only 52 patients obtained compliance and 148 patients obtained noncompliance; however, after counseling the compliance status was obtained by 194 patients and only 6 patients were found to get non-compliance status (Abinaya & Aanandhi, 2018).

This study showed that although 110 patients used TM-SM combination, but only 40 patients (36.4%) have a good perception about those combinations. Some of the patients disagreed with the statement that "The use of TM-SM combination is better than only using one of them".

It is also in line with the data indicating that 43.6% patients in this study used TM only if they needed it. Data from Table 4 indicated that education and duration of TM use were associated with perception of patients in using TM-SM combination (p≤0.05). Previous research also showed that TM users for malaria symptoms in Indonesia were more likely to have less than 9 years of education (p<0.0001) (Suswardany *et al.*, 2017). Table 4 also highlights that patients with good perception of TM-SM combination have a higher percentage of everyday TM use (37.5%), while more than 50% patients with poor perception of TM-SM combination only use TM if needed.

TM in Indonesia has been consumed since centuries. People in Indonesia, especially housewives and traditional healers, prepared TM

especially *Jamu*. About 70-80% of Indonesian population still rely on the effectiveness of *Jamu*, and the knowledge of *Jamu* has been proved empirically through generations (World Health Organization, 2010). Although they prefer to use TM, the patients' perception about TM-SM combination is still unclear. Previous research which interviewed the clients of *Jamu* in Yogyakarta Indonesia showed that there are no problems related to taking *Jamu* product with chemical medicines. Although few people commented that they are concerned about the use of those combination (Torri, 2013).

There are five factors that can contribute to adherence including social economic factors, therapy-related factors, patient-related factors, condition-related factors, and health system factors. Some factors from social economic factors which are reported to have an association with adherence are poor economic status, low level of education, and unemployment. The complexity of regimen also implies the patients' adherence as a therapy-related factor (World Health Organization, 2013). This study shows that those factors also give an impact on the number of not adherent patients; otherwise, the relationship is not statistically significant ($p > 0.05$).

Study limitations

This study uses a small sample size. Therefore, further research is expected to involve a more significant number of samples. Also, in Indonesia, the measures of treatment outcomes, which are blood sugar and fasting blood sugar, still vary. This situation affects the expected results of diabetes-related studies. Furthermore, patients' compliance in this study is measured solely from questionnaire surveys. Other measures that are more objective, such as pill count, are recommended.

CONCLUSION

There is no relationship between patients' perceptions of the use of combined medications and adherence to treatment as well as the outcomes of the therapy ($p > 0.05$). Moreover, the duration of TM use showed a significant relationship with the outcome of therapy and the patients' perception of TM-SM combination.

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REFERENCES

- American Diabetes Association. (2016). Standards of medical care in diabetes - 2016. *Diabetes Care*, 39(SUPPL. 1).
- Arisman. (2010). *Obesitas, diabetes mellitus & dislipidemia*. Buku Kedokteran EGC.
- Atinga, R. A., Yarney, L., & Gavu, N. M. (2018). Factors influencing long-term medication non-adherence among diabetes and hypertensive patients in Ghana: A qualitative investigation. *PLoS ONE*. <https://doi.org/10.1371/journal.pone.0193995>
- Bahall, M., & Edwards, M. (2015). Perceptions of complementary and alternative medicine among cardiac patients in South Trinidad: A qualitative study. *BMC Complementary and Alternative Medicine*, 15(1), 1-10. <https://doi.org/10.1186/s12906-015-0577-8>
- Departemen Kesehatan Republik Indonesia. (2007). *KEBIJAKAN OBAT TRADISIONAL NASIONAL TAHUN 2007*. Departemen Kesehatan Republik Indonesia.
- Fadheel, Q. J. (2019). A comparative study of the effect of metformin and metformin plus garlic on blood glucose level in patients with type 2 diabetes mellitus in Iraq. *Research Journal of Pharmacy and Technology*. <https://doi.org/10.5958/0974-360X.2019.00301.9>
- Falkenberg. (2015). Traditional and Complementary Medicine. In *Procedia - Social and Behavioral Sciences* (Vol. 170, pp. 262-271). <https://doi.org/10.1016/j.sbspro.2015.01.036>
- Faridah, I. N., Putri, M. N. C., & Perwitasari, D. A. (2017). Validation of A New Questionnaire Assessing Knowledge and Perceptions about Combination between Herbal and Conventional Medicine (Validasi Kuesioner Baru Menilai Pengetahuan dan Persepsi tentang Kombinasi antara Pengobatan Herbal dan Konvensional). *Jurnal Ilmu Kefarmasian Indonesia*, 15(1), 109-113.
- Farrukh, M. J., Makmor-Bakry, M., Hatah, E., & Tan, H. J. (2018). Use of complementary and alternative medicine and adherence to antiepileptic drug therapy among epilepsy patients: A systematic review. *Patient*

- Preference and Adherence*, 12, 2111–2121. <https://doi.org/10.2147/PPA.S179031>
- Gohar, F., Greenfield, S. M., Gareth Beevers, D., Lip, G. Y. H., & Jolly, K. (2008). Self-care and adherence to medication: A survey in the hypertension outpatient clinic. *BMC Complementary and Alternative Medicine*, 8(1), 1–9. <https://doi.org/10.1186/1472-6882-8-4>
- Indonesian Ministry of Health. (2016). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 6 tahun 2016 tentang Formularium Obat Herbal Asli Indonesia*. Kementerian Kesehatan Republik Indonesia.
- Indonesian Ministry of Health. (2018). *Hasil Utama Riskesdas 2018*. Kementerian Kesehatan Republik Indonesia.
- International Diabetes Federation. (2017). Eight edition 2017. In *IDF Diabetes Atlas, 8th edition*. [https://doi.org/http://dx.doi.org/10.1016/S0140-6736\(16\)31679-8](https://doi.org/http://dx.doi.org/10.1016/S0140-6736(16)31679-8).
- Islahudin, F., & Hasan, S. Z. (2019). Medication adherence and satisfaction among patients in Malaysia. *Research Journal of Pharmacy and Technology*. <https://doi.org/10.5958/0974-360X.2019.00173.2>
- Jafari, S., Sattari, R., & Ghavamzadeh, S. (2017). Evaluation the effect of 50 and 100 mg doses of Cuminum cyminum essential oil on glycemic indices, insulin resistance and serum inflammatory factors on patients with diabetes type II: A double-blind randomized placebo-controlled clinical trial. *Journal of Traditional and Complementary Medicine*, 7(3), 332–338. <https://doi.org/10.1016/j.jtcme.2016.08.004>
- Jasamai, M., Islahudin, F., & Samsuddin, N. F. (2017). Attitudes towards complementary alternative medicine among Malaysian adults. *Journal of Applied Pharmaceutical Science*, 7(6), 190–193. <https://doi.org/10.7324/JAPS.2017.70627>
- Joseph, Dhanish; George,Junia; Mathew, M. M. et al. (2019). A Compilation on Anti-Diabetic Profile of Cocos nucifera. *Research J. Pharm. and Tech*, 12(8), 3791–3796.
- Maheshwari, P., Pavithra, D., Neethu, T. T., Shanmugarajan, T. S., & Shanmugasundaram, P. (2017). Study on health outcomes in diabetic patients - association between diabetic foot ulcer and psychological distress. *Research Journal of Pharmacy and Technology*. <https://doi.org/10.5958/0974-360X.2017.00011.7>
- Mathew,F;Varghese,Bimi;Joseph, D. et al. (2019). An Appraisal of Pharmacological actions of Morus indica: The Indian mulberry with a detailed investigation on its Anti-diabetic potential. *Research J. Pharm. and Tech*, 12(8), 3654–3658.
- Mosihuzzaman, M., & Choudhary, M. I. (2008). Protocols on safety, efficacy, standardization, and documentation of herbal medicine (IUPAC technical report). *Pure and Applied Chemistry*, 80(10), 2195–2230. <https://doi.org/10.1351/pac200880102195>
- Mounika, V., Sarumathy, S., Anisha Ebens, J., & Shanmugarajan, T. S. (2017). A prospective study on incidence of anaemia in type 2 diabetes mellitus patients. *Research Journal of Pharmacy and Technology*. <https://doi.org/10.5958/0974-360X.2017.00003.8>
- Paramitha, M. D., & Rahamanisa, S. (2016). Ekstrak etanol herba sambiloto (*Andrographis paniculata*) sebagai antidiabetik terhadap mencit wistar terinduksi aloksan. *Majority*, 5(5), 75–79.
- Rahmadani, M. A. (2018). *Hubungan Kepatuhan Terapi Obat Terhadap Kualitas Hidup Pada Pasien Hipertensi Dengan Komplikasi Diabetes Melitus di Puskesmas Wilayah Kota Yogyakarta*. Universitas Ahmad Dahlan.
- Ranadheer Chowdary, P., Praveen, D., & Vijey Aanandhi, M. (2017). A prospective study on incidence of dyslipidemia in diabetes mellitus. *Research Journal of Pharmacy and Technology*. <https://doi.org/10.5958/0974-360x.2017.00086.5>
- Abinaya S.K., & Vijey Aanandhi, M. (2018). An improvement in patient compliance in diabetes mellitus. *Research Journal of Pharmacy and Technology*. <https://doi.org/10.5958/0974-360X.2018.00108.7>
- Sabate, E. (2003). *Adherence to Long-Term Therapies, Evidence for Action*. World Health Organization.
- Schectman, J. M., Nadkarni, M. M., & Voss, J. D. (2002). The Association Between Diabetes Metabolic Control and Drug Adherence in an Indigent Population. *Diabetes Care*, 25(6), 1015–1021.

- Sheikhrabori, A., Dehghan, M., Ghaedi, F., & Khademi, G. R. (2017). Complementary and Alternative Medicine Usage and Its Determinant Factors Among Diabetic Patients: An Iranian Case. *Journal of Evidence-Based Complementary and Alternative Medicine*, 22(3), 449–454. <https://doi.org/10.1177/2156587216675079>
- Sugiyono. (2013). *Metode Penelitian Administrasi*. Alfabeta.
- Suswardany, D. L., Sibbritt, D. W., Supardi, S., Pardosi, J. F., Chang, S., & Adams, J. (2017). A cross-sectional analysis of traditional medicine use for malaria alongside free antimalarial drugs treatment amongst adults in high-risk malaria endemic provinces of Indonesia. 1–15.
- Teo, T. Y., Yap, J., Shen, T., & Yeo, K. K. (2016). Complementary and alternative medicine use amongst patients with cardiovascular disease in Singapore. *BMC Complementary and Alternative Medicine*, 16(1), 1–7. <https://doi.org/10.1186/s12906-016-1430-4>
- Torri, M. (2013). Knowledge and Risk Perceptions of Traditional Jamu Medicine among Urban Consumers. *European Journal of Medicinal Plants*, 3(1), 25–39. <https://doi.org/10.9734/ejmp/2013/1813>
- Usman, Muh Amir, M., Erika, F., Nurdin, M., & Kuncoro, H. (2019). Antidiabetic activity of leaf extract from three types of mangrove originating from sambera coastal region Indonesia. *Research Journal of Pharmacy and Technology*. <https://doi.org/10.5958/0974-360X.2019.00284.1>
- Wieland, L. Susan; Manheimer, E; Berman, B. (2011). Development and classification of an operational definition of complementary and alternative medicine for the Cochrane Collaboration. *Altern Ther Health Med*, 17(2), 50–59. <https://doi.org/10.1038/jid.2014.371>
- World Health Organization. (2010). *Traditional Medicine in Republic of Indonesia*. 23–36.
- World Health Organization. (2013). Adherence to Long-Term Therapies, Evidence for Action. In *World Health Organization*. <https://doi.org/10.4028/www.scientific.net/AMM.321-324.1779>