



# Prevalence and associated factors of herbal medicine use among adult diabetes mellitus patients at government hospital, Ethiopia: An institutional-based cross-sectional study

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## ABSTRACT

**Background:** Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Thus, this study aimed to assess the prevalence and factors associated with HM use among DM patients

**Methods:** A hospital-based cross-sectional study was conducted on 395 diabetic patients visiting the diabetes care service of Debre Tabor General Hospital from August 1 to September 28, 2020. Interview guided self-administered questionnaire was used for data collection.

**Results:** Out of 395 diabetic patients, 231 (58.5%) participants were used herbal medicine. The most dominant herbal products used were *M.stenoptela* (53.2%), *N. sativa* (42.0%), *Z. officinale* (32.5%), *A. sativum* (20.8%), *A. vera* (13.4%), *P.gracilis* (10.4%), *T.schimperi* (7.5%), *V. amygdalina* (5.2%), *T. foenumgraecum* (3.5%), and *D. penninervum* (2.2%). The odds of HM use in female participants were 1.98 times (AOR=1.98, 95% CI=1.72, 3.25) higher compared to male participants. The odds of HM use among participants who develop DM complications were 1.77 times (AOR=1.77, 95% CI=1.03, 2.83) higher than in participants without DM complications. The odds of HM use among participants with a family history of DM were 2.89 times (AOR=2.89, 95% CI=1.42, 3.19) higher than in participants without a family history of DM.

**Conclusion:** The prevalence of herbal medicine use among diabetic patients was high. Educational level, gender, residence, educational level, duration of DM, presence of DM complication, and family history of DM were the independent predictors of HM use.

## 1. Background

Diabetes mellitus (DM) is a serious, chronic disease that occurs either when the pancreas does not produce enough insulin, or when the body can't effectively use the insulin it produces [1]. According to IDF report, approximately 463 million adults (20–79 years) were living with diabetes; by 2045 this will rise to 700 million. The proportion of people with type 2 diabetes is increasing in most countries, and about 79% of adults with diabetes were living in low- and middle-income countries [2]. Moreover, there were an estimated 374 million people with impaired

glucose tolerance and it was projected that almost 21.3 million live births to women were affected by some form of hyperglycemia in pregnancy [3]. Patient education, diet, and lifestyle modifications greatly improve the prognosis of diabetes mellitus, these strategies help to reduce weight, improve glycemic control and reduce the risk of cardiovascular complications, which account for 70%–80% of deaths among those with diabetes [4].

Alternative systems of medicine based on plant extracts have thrived through the ages and are still practiced by a large population for the management of diabetes [5]. Globally, medicinal plants have been used as a source of medicine and 80–85% of populations rely on these

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### Abbreviations

DM	diabetes mellitus
HCPs	health care professionals
HM	herbal medicines
SPSS	statistical package for the social sciences
AOR	adjusted odds ratio
WHO	world health organization

medicinal plants using the extracts or their active components as a traditional medicine to meet their primary health care needs [6]. Ethno-medicinal surveys indicate that more than 1200 plants have been used in traditional medicine systems following claims of their hypoglycemic properties [7]. Many studies confirmed the benefits of medicinal plants with hypoglycemic effects in the management of diabetes mellitus. The effects of these plants may delay the development of diabetic complications and correct metabolic abnormalities. During the past few years, some of the new bioactive drugs isolated from hypoglycemic plants showed antidiabetic activity with more efficacy than oral hypoglycemic agents used in clinical therapy [8,9].

The WHO expert committee on diabetes also recommended that medicinal herbs be further investigated as they are frequently considered to be less toxic and have side effects [1]. Recently, herbal medicines are gaining importance due to their high margin of safety. There are several medicinal plants well known for their medicinal usage for treating diabetes mellitus in the traditional system of medicine. However, some of them have been studied systematically and scientifically for their antidiabetic efficacy [7]. Different extracts from medicinal plants have also been used traditionally to manage diabetes globally, and these are considered as relatively inexpensive, less toxic, and with relatively little or no side effects [10]. Many active components were isolated from medicinal plants for direct use as drugs, or act as a lead compound or pharmacological agents. Metformin, for example, is an oral hypoglycemic agent isolated from the medicinal plant *Galega officinalis* that was used historically in medieval Europe for the treatment of diabetes [11].

The prevalence of HM use among chronic disease patients in Myanmar was (53.2%) [12], in Cambodia (44.5%) [13], in Malaysia (24.9%) [14], in Vietnam (43.6%) [15], and in Lao PDR (21.3%) [12]. Factors associated with HM use include higher socioeconomic status [16,17], women [16,17], urban residence [15], married [16], lower education [13], anxiety [18], younger or older age [15–17], hypertension [13], neither poor nor good quality of life [13], arthritis [18], gastrointestinal diseases [16], depression [18], perceived poor health status [15,16], and multiple chronic conditions [15,17].

In Ethiopia, the use of plant-based medicine is not only common rather it is also a traditionally accredited practice [19]. The use of plant-based medicine by patients with chronic diseases like hypertension and cancer was well studied in different parts of Ethiopia [19–21]. However, studies on the prevalence and associated factors of HM use among DM patients are lacking. Thus, this study aimed to assess the prevalence and factors associated with HM use among DM patients in Debre Tabor General Hospital, Debre Tabor, Ethiopia.

## 2. Methods

### 2.1. Study setting, design, and period

Institutional based cross-sectional study was conducted from August 1 to September 28, 2020, in the diabetic care service of Debre Tabor General Hospital, located in Debre Tabor town, South Gondar zone, Northwest Ethiopia, 99 km away from Bahir Dar, and 667 km far from Addis Ababa. Diabetic care service is one of the hospital's different

outpatient department clinics that gives service for many diabetic patients.

### 2.2. Study participants

The sample size of 419 was calculated using the single population proportion formula with the assumption of 50% as a proportion (p) of patients with herbal medicine use, at 95% CI, margin of error (d) = 5%, and a non-response rate of 5%. A simple random sampling technique was used to select study participants by using the diabetic clinic appointment list as a sampling frame.

### 2.3. Data collection process

Several published articles were reviewed to prepare the data collection tool [20–23]. Interview directed self-administered questionnaire was used for data collection. Initially, the questionnaire is prepared in English and translated into the local language (Amharic) then back to the English language to ensure consistency. A pre-test was done two weeks before the actual data collection of 30 participants who were not included in the final analysis. Finally, completed questionnaires were collected. The questionnaire comprised of 2 core sections. The 1<sup>st</sup> section contains questions about the socio-demographic characteristics (age, sex, religion, marital status, education, residence, monthly income, educational level, and occupation status) and clinical status of the patients such as complication, duration of the disease, and family history of diabetes mellitus. The 2<sup>nd</sup> part is intended to evaluate HM use, discuss with HCPs about HM use, and information sources. The use of HM among participants was evaluated by a sequence of questions such as the use of HM, purpose of use, type of HM, source of information, parts used, and mode of preparations. The data collectors were appropriately skilled in the data collection tool before data collection. The collected data were cleared and checked every day for completeness and consistency before processing. During data gathering, two trained health professionals were recruited and supervised by the principal investigator. Finally, the completeness and fulfillment of all questions were checked by the principal investigator and data collectors.

### 2.4. Data analysis

Statistical Package for the Social Sciences (SPSS) software version 24.0 was used for data analysis. Descriptive statistics like, frequency, percentage, mean, standard deviation, and median were used for data presentation. Univariate and multivariate logistic regression was computed to identify associated factors with a 95% confidence interval using a *p*-value <0.05 as a cutoff point.

## 3. Results

Out of 419 DM patients supposed for study participation, 395 completed the survey resulting in a 94.3% response rate. More than half of the respondents (53.2%) were female with a mean age of 48.7±12.6 years. The majority of the respondents were Orthodox Christians (58.7%) and married (62.8%). The majority of the participants were permanent residents of urban areas 62.8%. The socio-demographic and disease characteristics of study participants are summarized in Table 1.

In this study, 231 (58.5%) of the respondents claimed as they used HM while 164 (41.5%) were found to be non-users. The most commonly used plant-based preparations were Shiferaw (*Moringa stenoptela*) (53.2%), TikurAz mud (*Nigella sativa*) (42.0%), Zingible (*Zingiber officinale*) (32.5%), Nech shinkurt (*Allium sativum*) (20.8%), Eret (*Aloe vera*) (13.4%), Zigba (*Podocarpus gracilis*) (10.4%), Tosign (*Thymus schimperi*) (7.5%), Grawa (*Vernonia amygdalis*) (5.2%), Abish (*Trigonella foenum-graecum*) (3.5%), and Ameraro (*Discopodium penninervum*) (2.2%). Herbal medicines relevant to the management of DM among participants are summarized in Table 2.

**Table 1**  
Patient characteristics and factors associated with HM use among diabetic patients.

Variable	Frequency (%)	Herbal medicine use (n=231)		AOR (95% CI)
		Yes (n)	No (n)	
<b>Age</b>				
<30	68(17.2)	48	20	1
31–45	147(37.2)	82	65	1.36 (0.76–2.37)
>45	180(45.6)	101	79	0.98 (0.50–1.87)
<b>Sex</b>				
Male	185(46.8)	86	99	1
Female	210(53.2)	145	65	<b>1.98</b> (1.72–3.25)
<b>Religion</b>				
Orthodox	232(58.7)	160	72	1.61 (0.29–3.63)
Muslim	112(28.4)	53	59	0.73 (0.38–3.08)
Protestant	51(12.9)	18	33	1
<b>Marital status</b>				
Single	115(29.1)	71	44	1.48 (0.66–2.04)
Married	248(62.8)	144	104	0.90 (0.50–5.86)
Divorced	18(4.6)	10	8	1.37 (0.70–4.81)
Widowed	14(3.5)	6	8	1
<b>Residence</b>				
Urban	248(62.8)	129	119	1
Rural	147(37.2)	102	45	<b>2.34</b> (1.82–3.29)
<b>Employment status</b>				
Unemployed	219(55.4)	133	86	1
Employed	176(44.6)	98	78	0.62 (0.11–3.07)
<b>Educational level</b>				
Illiterate	101(25.6)	35	66	1
Primary and secondary school	189(47.8)	118	71	1.44 (0.72–1.96)
Above	105(26.6)	78	27	<b>1.54</b> (1.32–2.08)
<b>Monthly income</b>				
<1500 ETB	158(40.0)	89	69	1
1501-2500 ETB	134(33.9)	73	61	0.72 (0.23–2.72)
>2500 ETB	103(26.1)	69	34	1.53 (0.66–3.08)
<b>Duration of DM</b>				
<5	188(47.6)	64	124	1
>5	207(52.4)	167	40	<b>2.53</b> (1.45–4.67)
<b>Presence of DM complication</b>				
Yes	215(54.4)	157	58	<b>1.77</b> (1.03–2.83)
No	180(45.6)	74	106	1
<b>Family history of DM</b>				
Yes	189(0)	158	31	<b>2.89</b> (1.42–3.19)
No	206(52.2)	73	133	1

In this study, participants who used herbal medicines (46.8%) were the front sources of information about HM followed by families and friends (26.8%) and traditional healers (15.2%) (Fig. 1). The prevalence and characteristics of HM use are summarized in Table 3. Among HM users, 141 (61%) used HM as a complementary treatment along with modern medicine, while 26(11.3%) used HM as an alternative treatment along with modern medicine.

Dissatisfaction with the conventional therapy (43.7%) were the main reasons for HM use followed by tradition or culture, family (23.4%) and Belief in advantages of HM (13.0%), while scared of side effect of HM

(37.2%) and The Dr did not prescribe HM (32.3%) were the key reasons for not using HM among non-users. The majority of the respondents (85.5%) of HM users didn't notify their use with HCPs due to the expectation of negative response towards HM use (61.6%). The characteristics of HM use are summarized in Table 3.

According to the multivariate logistic regression analysis, gender, residence, educational level, duration of diabetes mellitus, presence of diabetes mellitus complication and family history of diabetes mellitus were the independent predictors of herbal medicine use (Table 1). The odds of HM use in female participants were 1.98 times (AOR=1.98, 95% CI=1.72,3.25) higher compared to male participants. The odds of HM use among participants with rural residence were 2.34 times (AOR=2.34, 95% CI=1.82, 3.29) higher compared to participants with an urban residence. The odds of HM use among participants with >5 years duration of diabetes mellitus were 2.53 times (AOR=2.53, 95% CI=1.45, 4.67) higher compared to patients with <5 years duration of diabetes mellitus. The odds of HM use among participants who develop diabetes mellitus complications were 1.77 times (AOR=1.77, 95% CI=1.03, 2.83) higher than in participants without diabetes mellitus complications. The odds of HM use among participants with a family history of diabetes mellitus were 2.89 times (AOR=2.89, 95% CI=1.42, 3.19) higher than in participants without a family history of diabetes mellitus (Table 1).

#### 4. Discussion

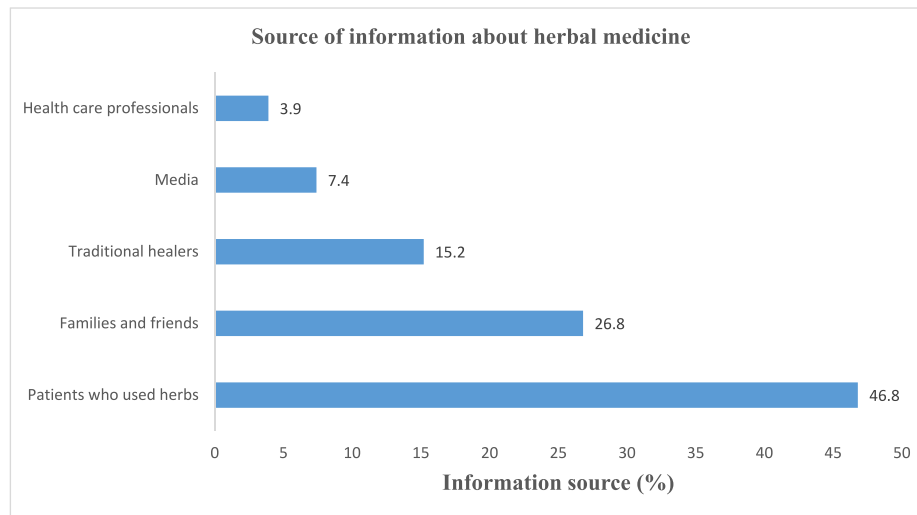
The use of herbal medicine for the management of diabetes mellitus is reported worldwide [22,24–27]. Management of diabetes with minimal side effects is still a challenge in diabetic treatment. Therapies of DM developed along the principles of western medicine are often limited in efficacy, carry the risk of adverse effects, and are often too costly, less affordable especially for the developing world [28]. This study aimed to assess the prevalence and correlates of herbal medicine use among DM patients who visited the diabetes illness follow-up care clinic of Debre Tabor General Hospital, Ethiopia.

Herbal medicine use among DM patients varies from 17.3% to 80% [29–34]. In this study, the prevalence of herbal medicine use among diabetic patients was high (58.5%). This finding is consistent with a study conducted in Ethiopia [23], Tanzania [35], and Morocco [36]. Alternative systems of medicine based on plant extracts have thrived through the ages and are still practiced by a large population for the management of diabetes [5]. Globally, medicinal plants have been used as a source of medicine and 80–85% of populations rely on these medicinal plants using the extracts or their active components as a traditional medicine to meet their primary health care needs [6]. The high prevalence of HM use in the current study can be explained by large access to herbal medicine, progressive awareness of the population over the year about herbal medicine use for DM and the study area is rich in medicinal plants that cover the primary health care.

Herbal products or plant products that are rich in secondary metabolites like terpenoids, flavonoids, coumarins, and other constituents have shown blood-glucose-lowering effect [28]. The antidiabetic activity of medicinal plants depends upon a variety of mechanisms such as pancreatic  $\beta$ -cell potassium channel blocking, Cyclic adenosine monophosphate/cAMP stimulation, Inhibition of  $\beta$ -galactosidase and  $\alpha$ -glucosidase, preventing oxidative stress that is possibly involved in pancreatic  $\beta$ -cell dysfunction [37], stimulation of glycogenesis, glycolysis and citric acid cycle and hexose monophosphate shunt, inhibition of gluconeogenesis and glycogenolysis [38], improvements in digestion along with a reduction in blood sugar and urea, protection of destruction and promotion of regeneration of the  $\beta$ -cells, initiate insulin release, and reduction in insulin resistance and/or inhibition in renal glucose reabsorption [39]. Moreover, the HMs reported by diabetic patients includes *Moringa stenoptela* (53.2%), *Nigella sativa* (42.0%), *Zingiber officinale* (32.5%), *Allium sativum* (20.8%), *Aloe vera* (13.4%), *Podocarpus gracilis* (10.4%), *Thymus schimperii* (7.5%), *Vernonia amygdalina* (5.2%),

**Table 2**  
Herbal medicines used for the management of diabetes mellitus among diabetic patients.

Scientific name	Family	Local name	Parts used	Method of preparation	Frequency (%)
<i>Moringa stenoptela</i>	Moringaceae	Shiferaw	Fresh leaves	Boil and drink the soup fresh leaves	123(53.2)
<i>Nigella sativa</i>	Ranunculaceae	TikurAzmod	Seed	A spoon of seed powder taken orally before meal	97(42.0)
<i>Zingiber officinale</i>	Zingiberaceae	Zingible	Root	Tea of the rhizome taken orally	75(32.5)
<i>Allium sativum</i>	Lilliceae	Nech shinkurt	bulb	Fresh bulb is eaten with food	48(20.8)
<i>Aloe vera</i>	Asphodelaceae	Eret	Fresh leaf	Gel extract taken orally	31(13.4)
<i>Podocarpus gracilis</i>	Podocarpaceae	Zigba	Gum and shoot	Eaten after mixed with honey	24(10.4)
<i>Thymus schimperi</i>	Lamiaceae,	Tosign	Stem, leaf, Whole plant	Dried leaf and stem powder boiled with tea taken orally	17(7.5)
<i>Vernonia amygdalina</i>	Asteraceae	Grawa	leaf, stem bark	The extract of fresh leaves in water is taken orally	12(5.2)
<i>Trigonella foenumgraecum</i>	Fabaceae	Abish	Seed	Extract of the dried and powered seed is taken orally	8(3.5)
<i>Discopodium penninervum</i>	Solanceae	Ameraro	Leaf	Eat the boiled leaf as a cabbage	5(2.2)



**Fig. 1.** Source of herbal medicine use among diabetic patients.

**Table 3**  
Prevalence and characteristics of HM use among diabetic patients.

Variable	Frequency (%)
<b>HM use since diagnosis</b>	
Yes	231(58.5)
No	164(41.5)
<b>how to use HM</b>	
complementary to modern medicine	141(61%)
Alternative to modern medicine	26(11.3%)
Both	64(27.7%)
<b>Reasons for HM use (n=231)</b>	
Tradition or culture, Family,	54(23.4)
Belief in advantages of HM	30(13.0)
HM is easily available and obtainable	22(9.5)
Treatment of DM and other health problems	16(6.9)
Dissatisfaction with modern medications	101(43.7)
Others	8(3.5)
<b>Reasons for not using HM among non-users (n=164)</b>	
Additional burden	18(11.0)
Scared of side effect of HM	61(37.2)
The Dr did not prescribe HM	53(32.3)
Lack of belief in the benefits of HM	32(19.5)
<b>Discuss with health professionals about HM use (n=231)</b>	
Yes	33(14.3)
No	198(85.7)
<b>Reason for not discussing with health professionals (n=198)</b>	
Anticipating negative response about HM use	122(61.6)
Inadequate information of HM	46(23.2)
It isn't important for Dr to know about my HM use	30(15.2)
<b>Satisfaction with HM use (n=231)</b>	
Satisfied	84(36.4)
Average	117(50.6)
Dissatisfied	30(13.0)

*Trigonella foenumgraecum*(3.5%),and*Discopodium penninervum*(2.2%).A similar finding was reported in the previous study [23].Several studies have reported the antidiabetic effect of these medicinal plants and provide a base for the authentic health claims regarding the medicinal plants [40–46].

In multivariate analysis; educational level, gender, residence, educational level, duration of diabetes mellitus, presence of diabetes mellitus complication, and family history of diabetes mellitus were the independent predictors of herbal medicine use.The odds of HM use in female participants were 1.98 times (AOR=1.98, 95% CI=1.72, 3.25) higher compared to male participants. Similar findings were reported in previous studies [47,48].This may be due to the reason that women use healthcare services more regularly, look more favorably on TM and they are more involved in treatment and self-care, which are the main reasons for the use of HM. However, previous studies revealed an insignificant correlation between gender and HM use [49,50].

In this study, there was a significant correlation between diabetes duration and HM usage, with a higher rate of HM usage among diabetic patients suffering from DM for >5 years. This result supports the previous finding which reported an association of HM use with a longer duration of DM [23,29,31,32,51,52].It is supposed that diabetic patients turn to traditional, complementary, and alternative medicine more as the DM duration rises, the DM becomes tougher to control, and the diabetic complications raises.In the present study, a higher educational level was also a predictor of HM use which is consistent with previous findings [27,30].However, a study conducted in Turkey has not revealed any significant differences in HM usage based on educational status [51].This difference could be due to factors such as ethnic and cultural values and beliefs.In the current study, patients who used herbs (46.8%) were the common sources of information about herbal medicine.

However, health care professionals (3.9%) were the least information source for HM use. This finding is in agreement with previous studies [20,21,23]. In contrast, a study conducted in Turkey revealed that health care professionals were the common sources of information about herbal medicine [51]. Similarly, several studies revealed that television and the internet were the main sources of information about HM use, indicating that most diabetic patients obtain information about this topic through the media [22,48,51,53].

In this study, only 14.3% of the diabetic patients had asked health care professionals for information. WHO reported that HCPs are usually interested in contemporary therapies, and do not ask their patients about their use of alternative products or are not informed about the alternative treatments being used [54]. Moreover, the inadequate recommendation of HM by HCPs could be due to a lack of belief in their usefulness. Likewise, most of the participants in this study (85.5%) using HM didn't tend to discuss their use of HM with their HCPs. This finding is in agreement with previous similar studies [30,36,50,51,55]. In this study, the majority of diabetic patients (61.6%) reported that anticipating negative responses about HM use was the most common reason for not discussing with health professionals. Previous studies reported that diabetic patients avoid giving information to HCPs since they anticipating negative responses about HM use [36,50]. It is believed that by not reporting their HM usage to their HCPs, participants create unwanted effects. The use of plant-based medicines with anti-hyperglycemic activity in combination with modern medicine could reduce BGL, and these HM could be interacting with food and medications; thus, HCPs must be informed about the use of HM by their patients so that they can adjust the dose of the conventional drugs accordingly.

#### 4.1. Limitation of the study

As the study is cross-sectional and depends on self-reported assessment, under-reporting is more likely to occur. This study was not included the attitude, and awareness of the participants towards HM use. Thus, the prevalence of HM use among diabetic patients might be underestimated.

## 5. Conclusions

The study found a high prevalence of HM use among diabetic patients in Debre Tabor General Hospital, along with a very low rate of disclosure to the HCPs. Frequently used HM among diabetic patients were *Moringa stenoptela*, *Nigella sativa*, *Zingiber officinale*, *Allium sativum*, *Aloe vera*, *Podocarpus gracilis*, *Thymus schimperii*, *Vernonia amygdalina*, *Trigonella foenumgraecum*, and *Discopodium penninervum*. Patients mainly depend on patients who used herbs as a source of information about HM. HCPs caring for DM patients should ask about the use of HM, while taking patients' medical and nutritional history.

### Ethics approval and consent to participate

This study was approved by the ethical committee of the health science college, Debre Tabor University with a reference number of HSC/2392/2020. Informed verbal, as well as written consent, was obtained from study participants before data collection, and the purpose of the study was explained to the respondents in advance. The information collected from respondents was kept confidential.

### Availability of data and materials

Most of the data is included in the manuscript. Additional can be found from the corresponding author based on reasonable request.

### Funding

Not applicable

## CRedit authorship contribution statement

**Zemene Demelash Kifle:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Biruk Bayleyegn:** Formal analysis, Funding acquisition, Investigation. **Tesfaye Yimer Tadesse:** Methodology, Project administration, Resources. **Alem Endeshaw Woldeyohanins:** Software, Supervision, Validation, Visualization, Roles/Writing – original draft, Writing – original draft, Writing – review & editing.

## Declaration of competing interest

The authors declare that he has no competing interests.

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