



Pattern of complementary and alternative medicine (CAM) use among patients with chronic kidney disease

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1. Introduction

Chronic kidney disease (CKD) is defined as abnormalities of kidney structure or function present for more than 3 months, with adverse health implications [1]. The prevalence of CKD is estimated to be 8–16% worldwide [2]. In the United States, the prevalence of CKD increased from 12% in 1994 to 14% in 2004 [3], whereas the prevalence in China and India was reported to be around 13% in studies conducted between 2000 and 2012 [4]. In Malaysia, there is an alarming rate of increase in the number of CKD. In 2011, the prevalence of CKD in West Malaysia was reported as 9.07% [5]. Based on this, the estimated numbers of new dialysis patients have been projected to be 51,269 in 2020 and double to 106,249 by 2040 [6]. The increase in the CKD prevalence in Malaysia may be attributable to the rising number of hypertension, diabetes and obesity cases, and the impact of the aging population [6].

CKD is a progressive and irreversible condition. It can range from Stage 1 (mild) to end-stage renal disease (ESRD) in Stage 5 [1]. In ESRD, renal replacement therapy (RRT) which refers to dialysis or renal transplant, is required to improve the quality of life and sustaining the life of CKD patients [7]. As CKD is an irreversible condition, the mainstay of treatment focuses on slowing down the disease progression to ESRD. In this regard, it is vital to maintain optimal blood pressure and glycaemic control, apart from restricting protein and salt intake to preserve renal functions [1]. Most importantly, CKD patients are advised to avoid the use of over-the-counter products and herbal remedies based on the Kidney Disease Improving Global Outcome (KDIGO) guidelines [1].

Several studies revealed that many patients with CKD have turned to complementary and alternative medicine (CAM) in their desperate pursuit for cure [8,9]. CAM refers to the group of diverse medical and health care practices and products that are not part of conventional medicine [10]. Natural products such as herbs, vitamins, and minerals,

as well as mind and body practices such as yoga, meditation, and music therapy, are some of the examples of CAM [10]. In Malaysia, CAM is regulated under the Traditional and Complementary Medicine Act of 2016. Under this act, all traditional medicine practitioners must register with the authorities to be licensed to practice [11]. Although CAM products in Malaysia are required to comply with the safety requirements of the Drug Control Authority under the Ministry of Health, these requirements are less stringent compared to pharmaceutical products. For instance, manufacturers of herbal supplements are required to submit the data on the quality of the products prior to the registration of the products. However, only the results of a few tests are needed, namely the presence of heavy metals, microbial contamination, disintegration, uniformity of weight, and stability [12]. Furthermore, raw herbs in the form of powder or dried are exempted from registration and testing [12]. In other words, the registration regulation is not comprehensive enough to confirm the safety profile of these products.

There have been mixed findings in the literature about the pros and cons of CAM. In some clinical trials, certain CAM has been found to benefit patients with CKD [13,14]. This is especially true for mind and body practices such as qigong, yoga, and acupuncture as they may improve the mental, social, and physical health of patients with CKD [15]. On the other hand, increasing reports on the harmful effects of CAM has also attracted the attention of healthcare professionals and public alike [16–18]. The consumption of unregistered herbal products is more prevalent nowadays as these products can be easily purchased from online media, street markets, or shops. It is a worrying trend as it can be linked to the increasing number of patients with liver and kidney failures in public hospitals in Malaysia [19]. Some herbs and dietary supplements are known to cause an unfavourable effect on the kidney and should not be consumed by people with compromised kidney function [17,20,21]. Reviews by Bagnis et al. [20] and Jha [22] highlighted that certain herbs, such as *Ginkgo biloba* and alfalfa, could lead to hyperkalaemia, hypertension, and rhabdomyolysis. All these

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Table 1
Classification of CAM used in this study.^a

Classification of CAM used in the study	Type of CAM
Natural products	Herbs, vitamins and minerals, dietary supplements
Mind and body practices	Qigong, yoga, acupuncture, chiropractic, meditation, tai chi
Other complementary health approaches	Ayurvedic medicine, traditional Chinese medicine, homeopathy, naturopathy

^a According to the National Center for Complementary and Integrative Health (<http://www.nccih.nih.gov/health>) [10]. Abbreviation: CAM, complementary and alternative medicine.

conditions are known to be the precipitating factors of CKD development and progression. Furthermore, patients with CKD have a higher risk of developing cardiovascular disease. Many of them are prescribed with anti-platelets and anti-coagulants. The anti-platelets and anti-coagulants may interact in a synergistic or additive manner with CAM products, resulting in blood-thinning effects which could subsequently lead to excessive bleeding [23]. Some herbs have also been reported to interact with immunosuppressive drugs such as cyclosporin and tacrolimus. Such interactions may alter the level of the immunosuppressant in renal transplant patients, putting them at risk of graft rejection or drug-related toxicity [24,25].

Based on the available literature, the prevalence of CAM usage among patients with CKD ranged from 9.5% to 64.4%, with a higher usage found among ESRD patients [8,9,26–31]. Inconsistent definition of CAM in the literature could have led to the variations in the prevalence rates reported in these studies. Herbs are reported to be the most common form of CAM used by patients with CKD [26,31]. A study from Thailand also found that patients with CKD started using CAM due to its perceived benefits especially after being influenced by family and friends [32]. A few of these studies also revealed low rates of patient's disclosure to physicians regarding CAM usage [9,29,31].

Despite the increasing use of CAM products among the general population, very little is known about the usage of CAM among patients with CKD in Malaysia. With the increasing number of patients with CKD in Malaysia, it is important to understand the use of CAM in greater depth. This study aims to examine the use of CAM at different stages of CKD, the modalities of CAM used, the predictors of CAM usage, and the rate of patients' disclosure to physicians regarding CAM usage.

2. Materials and methods

2.1. Study design and population

This cross-sectional study was conducted at the University of Malaya Medical Center (UMMC), a tertiary teaching hospital in Kuala Lumpur, Malaysia from February to April 2017. Convenience sampling was adopted to select CKD patients in this study. Patients older than 18 years, diagnosed as having CKD at any stage, receiving haemodialysis or peritoneal dialysis and recipients of a kidney transplant were included in the study. Patients were excluded from the study if they refused to sign the consent form and were not fit to be interviewed. Face-to-face interviews using a questionnaire were conducted with selected CKD patients at the nephrology, dialysis, and kidney transplant units after informed consent was obtained.

The sample size was calculated using Epi Info software package version 7.2 (Centers for Disease Control and Prevention, Atlanta, GA, USA) based on an estimation of 3,000 CKD patients who attended the renal outpatient, dialysis, and transplant clinics annually. The estimated prevalence of CAM use in CKD patients was taken as 45% based on a published study [31]. Using a 95% confidence level and a 5% confidence limit, the minimum sample size required was 338. The study was approved by the UMMC Ethics Committee (MRECID no: 20161025-4423).

2.2. Questionnaire

The questionnaire used in the study was adapted from available literature [9,31]. It consists of 22 items covering topics, including 8 items on sociodemographic information of the patients and 6 items related to CKD. The remaining 8 questions revolve around the details of CAM, such as the types, frequency, reasons, and sources of information about CAM use, as well as the disclosure of use and reasons for non-disclosure to the physicians. The face validity of the questionnaire was established by a nephrologist and 3 clinical pharmacists, all of whom are academicians with research backgrounds in the area of CAM. A cognitive debriefing was conducted with 20 patients. Changes were made to the questions that were found to be ambiguous to the respondents. A Cronbach's alpha value of 0.922 was obtained from the final version of the questionnaire, indicating high reliability.

2.3. Definition and classification of CAM

For the purpose of this study, the use of CAM was defined as “any type of CAM used more than once during the six months after a diagnosis of CKD.” CAM was classified according to the National Center for Complementary and Integrative Health [10], as shown in Table 1. Vitamins and minerals used by patients in this study were considered as CAM if they were not prescribed by their respective physicians. The herbal medicine used in the study was defined as an herbal extract, either prepared as a decoction or tea by the patients, taken as a product produced by a manufacturer, or consumed as an herbal preparation given by a traditional practitioner. Patients were specifically asked if they used CAM for general health, for the treatment of CKD, or for the treatment of other chronic conditions.

2.4. Study procedure

Patients were approached by the researchers while they were waiting for their appointments at the clinics or during the dialysis procedure at the nephrology, dialysis, and kidney transplant units. Participants were briefed on the objectives of the study and the definition of CAM prior to the commencement of the interview. They were shown lists and pictures of different types of CAM prior to the interview in order to assist them to provide accurate information on the type(s) of CAM used. Each interview lasted between 8 and 10 min.

2.5. Safety information on the herbs used by patients

A list of herbs or plants that are commonly used by the CKD patients was generated. The safety information of all the products was searched in the database of the National Center for Complementary and Integrative Health (<http://www.nccih.nih.gov/health>) [10], the Natural Medicine Comprehensive Database (<http://naturaldatabase.therapeuticresearch.com/home.aspx?s=ND&cs=home>) [33], and a guidebook on herbs and natural supplements [21].

2.6. Data analysis

All data were analyzed using the Statistical Package for the Social

Table 2
Sociodemographic characteristics of CAM and non-CAM users with CKD.

Characteristic	Total (%) n = 442	CAM user (%) n = 281	Non-CAM user (%) n = 161	p-value
Gender				
Male	227 (51.4)	153 (54.4)	74 (46.0)	0.093 ^b
Female	215 (48.6)	128 (45.6)	87 (54.0)	
Age (years)				
< 20	3 (0.7)	2 (0.7)	1 (0.6)	0.594 ^c
20–39	46 (10.4)	33 (11.7)	13 (8.1)	
40–59	132 (29.9)	82 (29.2)	50 (31.1)	
60–79	221 (50.0)	142 (50.5)	79 (49.1)	
> 80	40 (9.0)	22 (7.8)	18 (11.2)	
Ethnicity				
Malays	178 (40.3)	113 (40.2)	65 (40.4)	0.280 ^c
Chinese	177 (40.0)	106 (37.7)	71 (44.1)	
Indians	81 (18.3)	57 (20.3)	24 (14.9)	
Other	6 (1.4)	5 (1.8)	1 (0.6)	
Marital status				
Single	52 (11.8)	32 (11.4)	20 (12.4)	0.934 ^c
Married	385 (87.1)	246 (87.5)	139 (86.3)	
Divorced/ widowed	5 (1.1)	3 (1.1)	2 (1.2)	
Employment status				
Student	13 (2.9)	10 (3.6)	3 (1.9)	0.368 ^d
Civil servant	34 (7.7)	23 (8.2)	11 (6.8)	
Private employee	44 (10.0)	32 (11.4)	12 (7.5)	
Self-employed	35 (7.9)	24 (8.5)	11 (6.8)	
Unemployed/ pensioner	316 (71.5)	192 (68.3)	124 (77.0)	
Level of education				
Primary	111 (25.1)	58 (20.6)	53 (32.9)	0.002 ^{d*}
Secondary	204 (46.2)	129 (45.9)	75 (46.6)	
Tertiary	127 (28.7)	94 (33.5)	33 (20.5)	

*p < 0.05. Abbreviations: CAM, complementary and alternative medicine; CKD, chronic kidney disease.

^b Fisher's exact test.

^c Likelihood ratio.

^d Pearson's Chi-square test.

Sciences version 23 (IBM Corp., Armonk, NY, USA). Data were expressed as frequencies and percentages. For the purpose of analysis, patients in the peritoneal and the haemodialysis groups were grouped together as dialysis patients. Pearson's Chi-square test with likelihood ratio or Fisher's exact test were used to assess the association between CAM use and sociodemographic variables. Binomial logistic regression analysis was then performed to determine the predictors of CAM use among CKD patients. The level of statistical significance was set at p < 0.05 for all analyses.

3. Results

Out of the 480 CKD patients initially approached for the study, 442 consented to participate in the study, giving a response rate of 92.1%. Majority of the patients were males, aged between 60 and 79 years, Malays, and married. The sociodemographic details of the study participants are presented in Table 2.

Among all the sociodemographic variables, only the level of education was significantly associated with the use of CAM ($\chi^2 = 12.134$, $df = 2$, $p = 0.002$). This finding was further confirmed by the binomial logistic regression analysis which showed that the level of education was a significant predictor of CAM use ($p < 0.001$). Most of the patients were in the Stage 4 of CKD (n = 130, 29.4%), followed by Stage 3 (n = 87, 19.7%), and patients undergoing peritoneal dialysis (n = 85, 19.2%). However, when the peritoneal and haemodialysis patients were grouped together, patients on dialysis made up the largest percentage of CKD patients (n = 165, 37.3%). Fig. 1 shows the patient distribution by the severity level of CKD.

Among the 442 respondents, more than half of the patients (63.6%) reported using at least one type of CAM for more than once during the

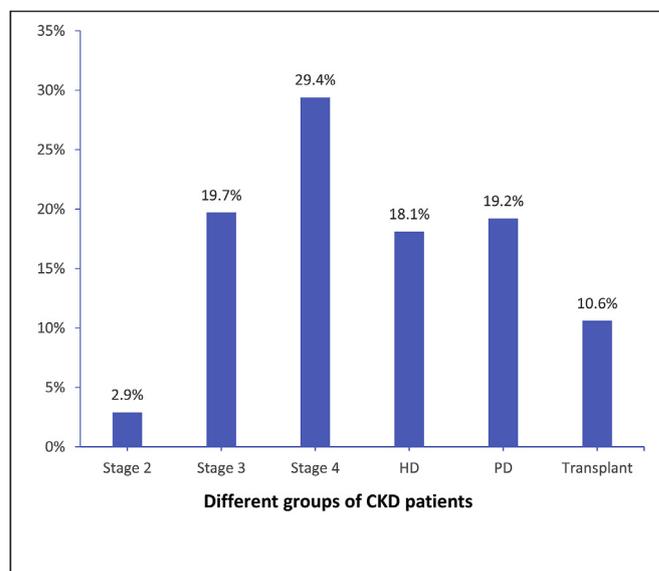


Fig. 1. Distribution of different groups of CKD patients in the present study. Abbreviations: CKD, chronic kidney disease; HD, haemodialysis; PD, peritoneal dialysis.

first six months after their CKD diagnosis. The subgroup analysis revealed that CAM use was the highest among renal transplant patients (76.6%), followed by dialysis patients (76.4%), and patients with CKD Stage 2, 3, and 4 (51.7%). There was a significant association between the different groups of patients by CKD severity levels and CAM use ($p < 0.001$) (Table 3).

As for the types of CAM used by the respondents, this study found that natural products (n = 220, 78.3%) were the most common types of CAM used, followed by mind and body practices (n = 58, 20.6%). Only very few of them practised other complementary health approaches (n = 24, 8.5%). In the subgroup analysis, it was found that mind and body practices were more commonly used by dialysis (31.0%) and transplant (33.3%) patients compared to the pre-dialysis group (5.9%) of CKD patients (Table 4).

Table 5 lists the top 10 CAM modalities used by the various groups of CKD patients. Among the different types of natural products, herbs were the most commonly consumed type of product. Interestingly, a higher percentage of herb consumption among CAM users were observed in the dialysis (62.7%) and transplant (72.2%) patient groups compared to patients in Stage 2 (55.6%), Stage 3 (35.6%) and Stage 4 (47.7%) of CKD. However, in comparison with the dialysis and renal transplant patients, pre-dialysis patients were noted to be consuming other types of ingested CAM, such as vitamins and minerals, fish oil, coenzyme Q10, and glucosamine.

Dialysis patients also reported the highest use of mind and body practices, such as meditation (14.3%), and prayer (4.0%) than other

Table 3
CAM use among different groups of patients with CKD.

Groups of CKD patients	Total (%) ^e n = 442	CAM user (%) ^f n = 281	Non-CAM user (%) ^f n = 161	p-value
Stage 2	13 (2.9)	9 (69.2)	4 (30.8)	< 0.001**
Stage 3	87 (19.7)	45 (51.7)	42 (48.3)	
Stage 4	130 (29.4)	65 (50.0)	65 (50.0)	
Dialysis	165 (37.3)	126 (76.4)	39 (23.6)	
Transplant	47 (10.6)	36 (76.6)	11 (23.4)	

**p-value < 0.001. Abbreviations: CAM, complementary and alternative medicine; CKD, chronic kidney disease.

^e Value calculated over column total.

^f Value calculated over row total.

Table 4
Types of CAM used by different groups of CKD patients (n = 281).

Types of CAM	Total (%) ^g	Groups of CKD patients, n (%) ^g				
		Stage 2 n = 9	Stage 3 n = 45	Stage 4 n = 65	Dialysis n = 126	Transplant n = 36
Natural products	220 (78.3)	8 (88.9)	37 (82.2)	56 (84.8)	91(72.2)	28 (77.8)
Mind and body practices	58 (20.6)	0 (0.0)	3 (6.7)	4 (1.5)	39 (31.0)	12 (33.3)
Other approaches	24 (8.5)	1 (11.1)	5 (11.1)	5 (7.7)	10 (7.9)	3 (8.3)

Abbreviations: CAM, complementary and alternative medicine; CKD, chronic kidney disease.

^g The total value may be more than the number of patients, as some could have had used more than one type of CAM.

remaining groups of CKD patients. In addition, Table 6 outlines the list of plants or herbs consumed by the CKD patients in this study with the associated safety concerns as identified from evidence-based references and the published literature.

When asked about the purpose of using CAM, majority of the patients claimed that it was for the improvement of general health (n = 152, 54.1%), followed by treatment of other chronic diseases (n = 74, 26.3%). Only 54 patients (19.2%) used CAM specifically for the treatment of their kidney conditions. Every four out of five of the respondents (80.4%) obtained information about CAM from their family and friends. Some of them depended on information from the internet (12.5%) and other sources such as social media and mobile applications (3.9%). Health care professionals were the least common source of information, only 3.2% of the respondents ever enquired healthcare professionals about CAM (Fig. 2).

As high as 80.1% (n = 225) of the 281 CAM users amongst the CKD patients did not disclose their use of CAM to their physicians. Upon further investigation, the most common reason stated for the non-disclosure was that the physicians did not enquire about such details from them (68.0%). Another 27.6% of the patients thought that their physicians did not need to know about such details, while 4.4% of the patients were in fear that the physicians would disapprove their use of CAM (Fig. 3).

4. Discussion

Studies on the use of CAM in CKD populations are growing in number due to the increasing reports on the detrimental effects of certain herbal products on kidneys. Nevertheless, most of the existing studies focused on specific groups of CKD patients, especially ESRD patients. Thus, the present study was conducted to examine the prevalence, pattern of use, and predictors of CAM use in different groups of patients with CKD.

In this study, the overall prevalence of CAM use among CKD patients was 63.6%. However, the prevalence was higher among the

dialysis and renal transplant patients than in the pre-dialysis group of patients. This is in contrast to a study conducted in Egypt by Osman et al. [9], who reported a higher prevalence of CAM use in pre-dialysis patients versus the dialysis and renal transplant groups. The higher prevalence of CAM use in our study could be due to the different definitions of CAM used as Osman et al. [9] excluded all vitamins and minerals consumed by the patients, whereas only vitamins and minerals that were not prescribed by a physician were considered as CAM in this study. Health-related quality of life (HRQOL) was shown to be reduced in CKD patients as the severity level of CKD increased, especially at the initiation of dialysis [39,40]. This may be the main reason why CKD patients who need to start on dialysis were more inclined to seek alternative treatment to cope with their condition. Apart from that, CAM use was also more prevalent among patients with diabetes and cardiovascular diseases who reported a lower quality of life [41]. The reasons as to why patients resorted to CAM have been explored in many studies. Distrust of and frustration with conventional medicine due to the lack of efficacy, escalating costs, and adverse effects were among the most commonly reported factors [42,43].

In this study, the level of education was the only associating factor of CAM use. A positive correlation between the education level and the use of CAM has been well-established by several studies in the area of CAM [44,45]. The use of CAM was reported to be higher among individuals with a college education in comparison with those without a college education [45]. Barnes et al. [44] also found that the rate of CAM use increased with the level of education. A higher rate of CAM use in those with a higher level of education may be confounded by the financial status of the individual, as well-educated people tend to have higher incomes and thus would be able to afford CAM [46]. Nevertheless, we could not assess the association between CAM use and patients' income in this study as most patients were reluctant to disclose their income status.

Natural products were the most commonly used CAM modality by CKD patients in this study. The use of herbs was the most commonly reported type of natural products. Our findings were echoed by many

Table 5
Top 10 common CAM modalities used by different groups of CKD patients (n = 281)^h.

Types of CAM	Total ⁱ (%)	Groups of CKD patients, n (%) ⁱ				
		Stage 2 n = 9	Stage 3 n = 45	Stage 4 n = 65	Dialysis n = 126	Transplant n = 36
Herbs	157 (55.9)	5 (55.6)	16 (35.6)	31 (47.7)	79 (62.7)	26 (72.2)
Vitamin & minerals	50 (17.8)	4 (44.4)	14 (31.1)	23 (35.4)	7 (5.6)	2 (5.6)
Fish oil	36 (12.8)	3 (33.3)	12 (26.7)	13 (20.0)	7 (5.6)	1 (2.8)
Meditation	22 (7.8)	0 (0.0)	0 (0.0)	0 (0.0)	18 (14.3)	4 (11.1)
Acupuncture	15 (5.3)	0 (0.0)	4 (8.9)	2 (3.1)	7 (5.6)	2 (5.6)
Coenzyme Q10	15 (5.3)	2 (22.2)	3 (6.7)	8 (12.3)	1 (0.8)	1 (2.8)
Massage	14 (5.0)	0 (0.0)	3 (6.7)	3 (4.6)	6 (4.8)	2 (5.6)
Physical therapy	8 (2.8)	0 (0.0)	0 (0.0)	0 (0.0)	8 (6.3)	0 (0.0)
Glucosamine	8 (2.8)	1 (11.1)	2 (4.4)	4 (6.2)	1 (0.8)	0 (0.0)
Prayers	5 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	5 (4.0)	0 (0.0)
Music therapy	5 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	3 (2.4)	2 (5.6)

^h 11 CAMs are listed, as the last two CAMs share a similar percentage.

ⁱ The total value may be more than the number of patients, as some could have had used more than one type of CAM. Abbreviations: CAM, complementary and alternative medicine; CKD, chronic kidney disease.

Table 6
List of herbs used by CKD patients in the study, with the safety concerns of each herb.

Herbs/plants commonly used by CKD patients	Dosage form/doses associated with safety concerns	Safety concerns
<i>Panax ginseng</i>	Crude and standardized ginseng root extract, high doses, combined preparation [21]	Hypoglycaemia [21], hypertension [34], may interact with anti-coagulants [35]
<i>Ginkgo biloba</i>	Standardized ginkgo extract (EGb 761, 80 mg/day), crude ginkgo plant parts (5 ppm of toxic ginkgolic acid) [21]	May interact with anti-coagulants [34], severe allergic reaction [21]
Cinnamon	Cinnamon extract [21]	Hypoglycaemia [21], may cause or worsen liver conditions [34]
Ginger	Dried root, liquid extract, doses > 10 g/day [21]	May interact with anti-coagulants [34]
Garlic	Fresh garlic, dried powder (> 7 g/day), higher doses than usual dietary intake [21]	May interact with anti-coagulants [34], anti-hypertensive, anti-hyperlipidaemic, and hydrochlorothiazide [21]
<i>Andrographis paniculata</i>	<i>Andrographis paniculata</i> extract (50 and 100 mg/kg/day) for 14 days [36], standardised <i>Andrographis</i> extract [21]	May interact with hepatic metabolizing enzymes [36], may interact with anti-coagulant, anti-platelet, anti-hyperglycaemic, barbiturates [21]
Bitter melon (<i>Momordica charantia</i>)	Bitter melon tea, bitter melon extract administered intravenously and intraperitoneally, high-dose bitter melon seed [21]	Hypoglycaemia [21], may interact with hypoglycaemic agents [37], death in children [21]
Pomegranate (<i>Punica granatum</i>)	Pomegranate juice, pomegranate extract [34]	Possible interactions with anti-coagulants [34]
Dong quai	Dong quai extract (tablet), dose: 565 mg (1–2 tab/day) for 4 weeks [38]	Increased risk of bleeding, increased cancer risk, may interact with anti-coagulants, anti-platelet, oestrogen (augments the effect of oestrogen) [33]
Alfalfa	Alfalfa seed products [33]	May cause autoimmune diseases (SLE, multiple sclerosis, rheumatoid arthritis), photosensitivity, oestrogen-like effects, hypoglycaemia, interaction with immunosuppressant, warfarin, oral contraceptives, oestrogen conjugates, oral hypoglycaemic agents, iron, vitamin E [33]
Fenugreek	Fenugreek seeds, fenugreek seed powder (> 5 g) [21]	Hypoglycaemia [21], oestrogen-like effect [34]
Green tea	Tea (high dose > 600 mg/day or 2.25–4.5 L/day) [21]	May cause liver problems [34], may interact with nadolol (beta-blocker) [34], diuretics [21]
Noni (<i>Morinda citrifolia</i>)	Noni juice, dose > 400 mL [21]	Liver toxicity [21,34], contains high potassium [21,34]
Spirulina (blue-green algae)	A product containing blue-green algae [33]	Increased risk of bleeding, may interact with immunosuppressant, anti-platelet, anti-coagulants, NSAIDs, other herbs that reduce blood clotting (e.g., ginseng, garlic, ginkgo) [33]

Abbreviations: CKD, chronic kidney disease; NSAIDs, non-steroidal anti-inflammatory drugs; SLE, systemic lupus erythematosus.

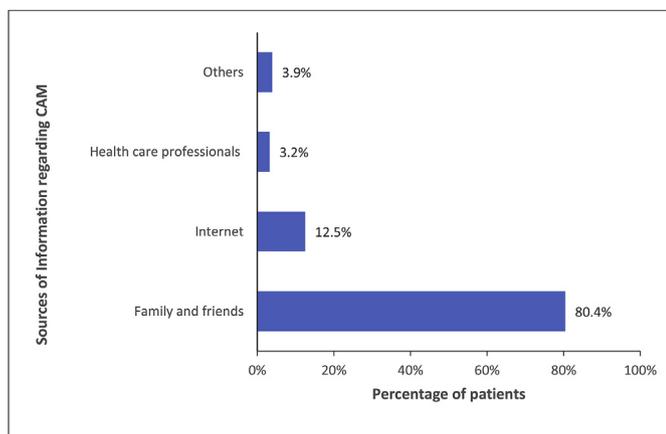


Fig. 2. Sources of information regarding CAM. Abbreviation: CAM, complementary and alternative medicine.

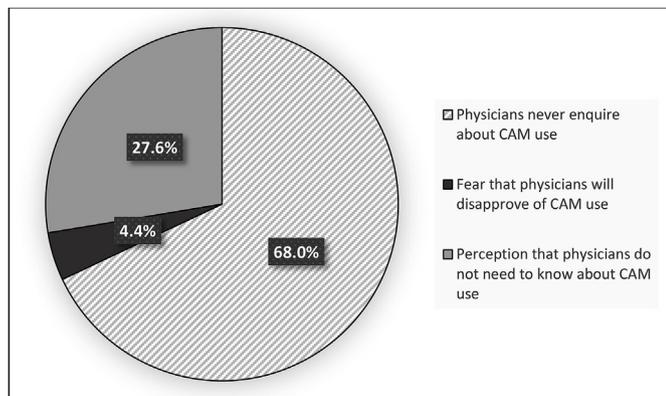


Fig. 3. Reasons for non-disclosure to physicians regarding CAM use. Abbreviation: CAM, complementary and alternative medicine.

studies, including those conducted in Palestine, Egypt, and Germany [9,30,47]. In our study, *Panax ginseng* and *Ginkgo biloba* were the top two commonly used herbs. Other herbs that were also used by patients in our study included garlic, ginger, dong quai, and spirulina. Notably, all the aforementioned herbs are known to have anti-coagulant properties or have been linked with an increased risk of bleeding [48,49]. Patients on haemodialysis are already predisposed to bleeding due to the continuous platelet activation induced by the interaction between blood and artificial surfaces [50]. Furthermore, CKD patients are known to be at a higher risk of developing cardiovascular disorders and need to be put on prophylactic anti-platelet and anti-coagulant medications. Therefore, the use of certain herbal products may potentiate the bleeding tendency in this group of patients. While these herbs may be generally safe if taken as food in moderate amounts [34], very often their safety information is inconclusive as the doses of the herbs in the products are often unknown and the herbal products may contain multiple ingredients. Furthermore, most of these herbal products are not standardized in terms of the preparations or dosages, thus posing further barriers to study their safety profiles. In view of the underlying inefficiency of the kidneys to remove waste and metabolites in CKD patients, there is a possible risk of accumulative adverse effects following long-term consumption of these products. Therefore, it is important to raise awareness about the potential harm of these products among patients with CKD.

Another interesting finding from our study was that the use of mind and body practices were more prominent among dialysis and transplant patients compared to pre-dialysis patients. Meditation, prayer, and music therapy were included in this CAM modality. ESRD patients often suffer from emotional and psychosocial burdens as they cope with disease symptoms, financial problems, and struggles to adhere to the strict dialysis schedules. A review by Bennett et al. [51] concluded that meditation was highly beneficial for dialysis and transplant patients as meditation have been found to reduce stress, anxiety, sleep disturbances, and depression and ultimately improved the wellbeing of these individuals. In addition, patients with chronic diseases often perceive CAM as a positive component of health maintenance as CAM

has been associated with symptomatic relief, improved general health, increased knowledge, and a better understanding of their disease management [52].

We found a rather high rate of herb consumption among dialysis and renal transplant patients. This may signify a lack of communication between patients and physicians regarding the safe use of CAM, as ESRD patients should have been informed to refrain from herbal medicine due to the failure of their kidneys to excrete the metabolic waste. Approximately 80% of the respondents did not disclose the use of CAM because they claimed that their physicians did not ask them about it. According to a study by Shelley et al. [53], most patients expected their physicians to initiate a discussion about CAM. If prompted by the physicians, patients will feel more comfortable and open to talk about CAM and this would also help patients to overcome negative reactions [53]. As an important entity of the health care system, pharmacists play a major role in encouraging the discussion about CAM use with patients. However, training and education regarding CAM among healthcare professionals are lacking, hence impeding effective communication with patients regarding CAM [54].

There are a few limitations to this study. First, the findings of our study are confined to the patients from a single institution and hence may not be representative of all CKD patients. Secondly, most of the study participants could not identify the exact herbs they used and the dosage of the herbs. Such missing information may have led to an underreporting of the use of certain herbs and thus, the level of risk causing significant harm to the patients could not be concluded.

5. Conclusion

In conclusion, the consumption of ingested forms of CAM was high in patients with CKD, especially among ESRD and renal transplantation patients. Some of the herbs used by patients can potentially lead to adverse side effects or produce unintended interactions with conventional medications. Majority of the patients did not disclose their use of CAM to their physicians because they were not asked about it. Thus, it is critical for healthcare professionals to be more vigilant regarding the use of CAM among CKD patients and they must continuously monitor patients for any adverse effects of CAM. More studies concerning the safety and efficacy of CAM in the management of CKD should be conducted to determine if there are any proven benefits for CKD patients.

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Declaration of interest

None.

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