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ORIGINAL RESEARCH

Association Between Pain Severity, Pain Beliefs, Pain Coping and Attitudes Towards Complementary and Alternative Treatments among Physical Therapy Patients

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Abstract
Objective: The study aimed to determine the correlation between pain severity, pain beliefs, pain coping, and attitudes toward complementary and alternative treatments among physical therapy patients.
Material-Method: This cross-sectional and analytical was conducted in a physical therapy and rehabilitation hospital in north-eastern Türkiye. The sample consisted of 150 physical therapy patients. Data were collected using Demographic Information Form, Pain Beliefs Questionnaire, Pain Coping Questionnaire, and Attitudes towards Complementary and Alternative Medicine Questionnaire. Spearman's Correlation Analysis and Multiple Linear Regression Analysis were used in data analysis.
Results: The study revealed that the patients had negative attitudes towards complementary (13.64 ± 4.00) and alternative medicine use (13.18 ± 4.14). The scores were moderate for the patients' psychological (18.62 ± 3.69) and organic belief (33.68 ± 5.17). A significant correlation was determined between patients' attitudes towards complementary medical treatment and conventional medical treatment for pain (p=0.020). The patients had moderate pain intensity (5.70±2.44), and there was a significant correlation between pain intensity and attitudes towards alternative medicine (p=0.012).
Conclusion: Physical therapy patients' attitudes towards complementary and alternative medicine are associated with pain coping and severity. The patients should be educated to cope with pain and manage it by health professionals.
Keywords: Pain Severity, Pain Beliefs, Pain-Coping, Complementary and Alternative Medicine

INTRODUCTION

Pain is seen in most musculoskeletal disorders such as osteoarthritis patients and chronic low back pain admitted to physical therapy clinics.[1,2] Pain can be experienced in physical pain resulting from tissue damage; however, it can also be a psychological experience originating from psychological factors.[3,4] Pain beliefs include a person's perception of pain severity, pain adaptation, attitude towards pain, influence on pain functionality, and coping mechanisms.[5,6] In other words, pain beliefs determine how a person reduces, prevents, or copes with pain. They include one's subjective beliefs about the efficiency of such behaviour and one's own capability to obtain pain relief.[5] It is known that organic and psychological pain beliefs are closely associated with disability and dissatisfaction.[7] Dissatisfaction with conventional treatments leads patients receiving physical therapy to seek complementary and alternative medicine (CAM) methods to cope with pain. These methods are herbal therapy, balneotherapy, cupping, and massage manipulation.[8] Patients receiving physical therapy often suffer from pain and experience physical and psychological problems. The intensity, duration, or location of pain have a decisive influence on a patient's physical performance, diminishing physical activity and causing disability.[9] The effects of chronic pain on psychophysical health were distress, loneliness, lost identity, and low quality of life.[10] Many people with chronic pain reported experiencing psychological problems such as depression, anxiety, somatization, anger/hostility, low self-esteem, and low self-efficacy.[11] Because physical and psychological outcomes of pain such as disability, anxiety, and depression were associated with organic and psychological pain beliefs, the pain beliefs of patients should be determined in the treatment of pain.[7]
Relevant studies have shown a correlation between

patients' pain beliefs and coping strategies. A study conducted with elderly patients suffering pain revealed that patients believing they had control over the pain tried to cope with it themselves. In contrast, the patients who thought the nurses had control over the pain tended to seek medical help.[12] A study investigating the correlation between pain beliefs and coping strategies demonstrated that those who believed the pain had an organic cause did not cope effectively and tended to feel hopeless.[13] Another study with fibromyalgia patients reported that patients who used passive coping strategies were less likely to control pain than those who used other techniques.[14] One study evaluating the attitudes and beliefs about pain management noted that the patients who believed that stressors caused the pain also believed that exercise influenced the pain.[15]

As mentioned earlier, it is essential to determine patients' beliefs regarding their ability to control pain effectively. The research indicates that patients have inadequate knowledge about pain, its causes, and how to manage it.[16-17] Other report revealed that 49.1% of the patients hospitalized in the medical and surgical clinics used nonpharmacological methods for pain.[18] Of them, 77.5% reported nonpharmacological practices were effective. In another study, perceived pain control, severity, and duration were persistent correlates of complementary and alternative medicine usage.[19] These studies have determined the various CAM therapies used to reduce pain and correlate CAM use.[8,18-19] Pain characteristics associated with CAM use should be determined because of physical and psychosocial health outcomes. Therefore, this study aimed to determine the correlation between pain severity, pain beliefs, pain coping, and attitudes toward complementary and alternative treatments in patients at a physical therapy and rehabilitation hospital in north-eastern Türkiye.

MATERIALS AND METHODS

Design

This cross-sectional and analytical study aimed to investigate the attitudes towards CAM of patients at a physical therapy and rehabilitation hospital in north-eastern Türkiye and the correlation between the use of CAM, pain severity, pain beliefs, and pain coping strategies.

Study Population and Sample

The study consisted of 1100 patients hospitalized at a physical therapy and rehabilitation hospital for one year. The G*Power analysis was used to determine the study sample of 150 volunteers. The study sample was calculated with an 80% response rate; the sample size was confined within a 90% confidence interval, and the significance level was 5%. The purposive sampling method was used. The inclusion criteria required volunteers to be literate, between 18-65, to have pain, give oral and written consent to participate in the study, fill in the questionnaire and scale forms completely, and receive inpatient physical therapy. The exclusion criteria were any mental or physical illness affecting cognition and speech.

Data collection tools

The Demographic Information Form, Pain Beliefs Questionnaire, Pain Coping Questionnaire, and Attitudes towards Complementary and Alternative Medicine Questionnaire collected the study data.

The researchers prepared a Demographic Information Form. It included information regarding patients' age, gender, marital status, educational status, income status, place of residence, physical therapy history, number of previous physical therapy sessions, the reason for physical therapy, pain severity, and questions about physical diseases.[12-17]

Pain Beliefs Questionnaire (PBQ) evaluates the psychological and organic causes and consequences of pain.[20,21] The total score was not obtained from the 6-point Likert scale from "6=always" to "1=never", consisting of 12 items. The organic and psychological pain beliefs scores were calculated. There are no cut-off values for the scores, and higher scores obtained from the subscale indicate high levels of pain belief. The Cronbach alpha coefficient was 0.71 for the Psychological Beliefs Subscale and 0.64 for the Organic Beliefs Subscale.[21] In this study, the Cronbach alpha coefficient for the Psychological Beliefs Subscale was 0.63 and 0.54 for the Organic Beliefs Subscale.

Pain Coping Questionnaire (PCQ) consists of four subscales and assesses the organic or psychogenic pain-coping strategies of patients with chronic pain.[22,23] These subscales are "Self-efficacy," "Helplessness," "Cognitive Interventions," and "Medical Treatment Seeking." The self-report scale consists of 29 items rated on a 4-point Likert scale from "0=never" to "3=frequently". The highest score for the Self-Efficacy Subscale was 36, the highest score for the Helplessness Subscale and Cognitive Interventions Subscale was 24, and the highest for the Medical Treatment Seeking Subscale was 27, while the lowest score was 0 for all the subscales. The Cronbach Alpha coefficient for the internal consistency reliability in the original study was 0.75.[23] It was 0.71 in this study.

Scale for Attitudes towards Complementary and Alternative Medicine (SACAM) consists of 8 items

rated as 1= I agree entirely, 2= I agree, 3= I don't know, 4= I disagree, and 5= I disagree entirely.[24] Four items assess patients' attitudes towards complementary medicine, and four evaluate their attitudes towards alternative medicine. The Cronbach Alpha coefficient for internal consistency was 0.85; the Complementary Medicine Subscale was 0.77, and the Alternative Medicine Subscale was 0.76.[24] The lowest score was eight, and the highest score was 40. Higher scores indicate positive attitudes towards complementary and alternative medicine. In this study, the Cronbach Alpha coefficient was 0.88 for the Complementary Medicine Sub-Scale and 0.81 for the Alternative Medicine Subscale.

Collection of data

The data were collected during face-to-face patient interviews between December 1, 2018, and February 28, 2019. Before filling out questionnaires and scales, the researcher introduced herself, gave information about the purpose and duration of the study, stated that the names would be kept confidential, and the data would be used for research purposes only. Verbal and written consent was obtained from the patients. Patients needed approximately 25-30 minutes to complete the data collection forms.

Ethical considerations

Before the study, written consent was obtained from the Provincial Health Directorate and Giresun University Clinical Research Ethics Committee (dated October 17, 2018, and numbered 04/10). All stages of the study followed the principles of the Helsinki Declaration.

Data analysis

Data were analyzed using the SPSS (Statistical Package for Social Sciences) version 22.0. The Kolmogorov - Smirnov (KS) test was used to evaluate data conformity to the normal distribution. The data were not normally distributed ($p<0.05$). Spearman's Correlation Analysis determined the correlation between descriptive statistics such as number, percentage, arithmetic mean and standard deviation, pain severity, pain beliefs, pain coping, and complementary and alternative treatment use.[25] The Multiple Linear Regression Analysis was used to evaluate multivariate correlations between SACAM, PBQ, PCQ, and pain severity. The level of significance was accepted as $p <0.05$.

RESULTS

Demographic, pain, and clinical characteristics of patients (Table 1)

More than half of the patients (50.7%) were 60 years and over; 56.7% were female, and 76.7% were married. In addition, 72% of participants reported that income equals expenses; 66% were primary school graduates, and 42.7% came from the town. For the first time, patients undergoing physical therapy comprised 49.3% of the group; 28.7% of the patients had hand/arm pain; 51.3% had knee/leg pain; 13.3% had neck pain; 16% had back pain and 28% had lumbar pain. Fifty-six percent (56%) of patients had hypertension; 23.3% had diabetes mellitus; 16.7% had chronic obstructive pulmonary disease; 24% had heart disease; 34.7% had rheumatism; 22% had a neurological illness; 14.7% had a psychological condition, and 51.3% had a sleep disorder.

The mean scores for SACAM, PBQ, PCQ, and pain severity (Table 2)

The evaluation of the mean scores for SACAM revealed that the mean alternative medicine score was 13.18 ± 4.14, and the mean complementary medicine score was 13.64 ± 4.00. When the mean scores for PBQ were evaluated, the mean for the Organic Beliefs Subscale was 33.68 ± 5.17, and the Psychological Beliefs Subscale score was 18.62 ± 3.69. The mean score for the PCQ was 19.16 ± 5.91 on the Self-Efficacy Subscale, 12.14 ± 3.99 for the Helplessness Subscale, 12.62 ± 3.84 for Cognitive Intervention Subscale, and 11.97 ± 4.25 on the Medical Treatment Seeking Subscale. The mean score for Pain Severity of the patients was 5.70 ± 2.44.

Bivariate and multivariate correlations between SACAM, PBQ PCQ and pain severity (Tables 3 and 4)

Table 4 reveals a weak positive correlation between the Self-Efficacy Subscale of the PCQ and the Psychological Beliefs Subscale of PBQ ($r=0.291$, $p=0.000$); the Helplessness Subscale of the PCQ and the Organic Beliefs Subscale of PBQ ($r=0.201$, $p=0.014$); the Cognitive Strategies of PCQ and the Psychological Beliefs Subscale of PBQ ($r=0.229$, $p=0.005$). In addition, there was a weak positive correlation between Pain Severity and the Organic Beliefs Subscale of the PBQ ($r=0.191$, $p=0.019$) and the Helplessness Subscale of PCQ ($r = 0.191$, $p = 0.019$). There was no significant correlation between the mean scores on the SACAM and the mean scores on the PBQ, PCQ, and Pain severity ($p> 0.05$). The Multiple Linear Regression Analysis revealed that the most important predictor of patients' use of alternative medicine was pain severity ($B = -0.245$, $p = 0.012$). The most important predictor of the use of complementary medicine was treatment-seeking ($B = -0.230$, $p = 0.020$).

Table 1. Demographic, Clinical and Pain Characteristics of the Patients (n=150)

		n	%
Age	20-39	14	9.3
	40-59	60	40.0
	60- ↑	76	50.7
Gender	Female	85	56.7
	Male	65	43.3
Marital status	Married	115	76.7
	Single	35	23.3
Income status	Income is equal to expenses	108	72.0
	Income is less than expenses	38	25.3
	Income is more than expenses	4	2.7
Educational status	Primary school	99	66.0
	Secondary school	23	15.3
	High school	17	11.3
	University	11	7.3
Place of residence	Village	45	30.0
	Town	64	42.7
	City	41	27.3
Undergoing physical therapy for the first time	Yes	74	49.3
	No	76	50.7
Pain locations*	Hand/arm pain	43	28.7
	Knee/leg pain	77	51.3
	Neck pain	20	13.3
	Back pain	24	16.0
	Lumbar pain	42	28.0
History of chronic disease*	Hypertension	84	56.0
	Diabetes Mellitus	35	23.3
	Chronic obstructive pulmonary disease	25	16.7
	Heart disease	36	24.0
	Sleep disorder	77	51.3
	Rheumatism	52	34.7
	Neurological disease	33	22.0
	Psychological disease	22	14.7

*Patients mark multiple options.

Table 2. The Mean Scores for SACAM, PBQ, PCQ, and Pain Severity

	X±SD	**Min**	**Max**
Scale for Attitudes towards Complementary and Alternative Medicine			
Alternative medicine	13.18±4.14	4.00	20.00
Complementary medicine	13.64±4.00	4.00	20.00
Pain Beliefs Questionnaire			
Organic beliefs	33.68±5.17	21.00	48.00
Psychological beliefs	18.62±3.69	4.00	24.25
Pain Coping Questionnaire			
Self-efficacy	19.16±5.91	6.00	32.00
Helplessness	12.14±3.99	1.00	21.00
Cognitive intervention	12.62±3.84	4.00	21.00
Medical treatment-seeking	11.97±4.25	1.00	24.00
Pain Severity	5.70±2.44	0.00	10.00

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Table 3. Bivariate Correlations Between SACAM, PBQ PCQ, and Pain Severity

		AM	CM	OB	PB	SE	H	CI	MTS	PS
Alternative medicine (AM)	r	1.000								
	p	.								
Complementary medicine (CM)	r	0.662	1.000							
	p	0.000	.							
Organic beliefs (OB)	r	0.001	0.141	1.000						
	p	0.995	0.085	.						
Psychological beliefs (PB)	r	0.089	0.143	0.351	1.000					
	p	0.281	0.081	0.000	.					
Self-efficacy (SE)	r	0.044	0.045	0.005	0.291	1.000				
	p	0.590	0.583	0.953	0.000	.				
Helplessness (H)	r	-0.023	0.054	0.201	0.075	0.066	1.000			
	p	0.780	0.515	0.014	0.362	0.425	.			
Cognitive intervention (CI)	r	0.092	0.017	0.019	0.229	0.705	0.330	1.000		
	p	0.265	0.833	0.821	0.005	0.000	0.000	.		
Medical treatment-seeking (MTS)	r	0.005	-0.122	0.054	0.062	0.122	0.543	0.403	1.000	
	p	0.949	0.137	0.513	0.454	0.136	0.000	0.000	.	
Pain severity (PS)	r	-0.134	-0.063	0.196	0.078	0.029	0.191	0.048	0.045	1.000
	p	0.102	0.445	0.016	0.344	0.721	0.019	0.560	0.581	.

Table 4. Multivariate Correlations between SACAM, PBQ, PCQ, and Pain Severity

Scale	Alternative medicine			Complementary medicine		
	B	S.E (B)	p value	B	S.E (B)	p value
Organic beliefs	-0.003	0.049	0.944	0.072	0.070	0.311
Psychological beliefs	0.117	0.070	0.100	0.115	0.100	0.252
Self-efficacy	-0.024	0.061	0.693	0.007	0.086	0.938
Helplessness	0.047	0.073	0.521	0.128	0.103	0.217
Cognitive intervention	-0.017	0.101	0.865	-0.010	0.144	0.944
Medical treatment-seeking	-0.108	0.069	0.118	-0.230	0.098	0.020
Pain severity	-0.245	0.096	0.012	-0.229	0.137	0.096

DISCUSSION

This study aimed to determine the correlation between the use of CAM, pain severity, pain beliefs, and pain coping strategies. The present study determined that patients receiving physical therapy had negative attitudes towards both alternative and complementary medicine. Other report defined that using CAM therapies such as massage with essential oils, balneotherapy, phytotherapy, cupping, and acupuncture is frequent in patients with knee osteoarthritis.[26] The CAM use was high among rheumatoid arthritis patients because of the lack of benefit from anti-rheumatoid drugs.[27] Still, patients who were dissatisfied with the results of these methods and who also had a negative perception of pain tended to use CAM less frequently.[28] Another study evaluating the factors affecting CAM use in patients with chronic disease revealed that it was more common among people with a strong commitment to traditional health beliefs, such as herbal treatment methods.[29] The negative attitudes obtained in this study may be related to the inclusion of patients in the present study who were older than 60 years old and who had low educational levels. A negative attitude towards the use of CAM may also be associated with patients' knowledge, awareness of taste use is not at a desired level and patients' higher medical expectations. The negative attitudes to CAM use may be related to moderate pain severity of patients. Another reason for the patients' negative attitudes could be the lack of benefit from CAM because of chronic diseases and extended periods of illness. Since CAM use can contribute to the improvement of the disease symptoms, the slowing of disease progression, and the development of strategies to modify the disease, it is essential to carry out new studies to determine the factors affecting patients' negative attitudes towards CAM use.[30] Because CAM use may contribute to an improved quality of life by reducing pain intensity, sleep problems and improving patients' ability to carry out their usual daily activities.[31]

The present study found that patients' psychological and organic belief scores were moderate, which means their belief scores about the source and results of the pain were middle. However, study results also found no correlation between the patients' pain beliefs and attitudes towards CAM. Similarly, other report with patients in the internal and surgical clinics revealed no significant difference between the organic and psychological pain beliefs of the patients who used and did not use non-drug treatment methods for pain relief.[18] A study on patients with shoulder pain noted that patients felt uneasy and unsure when they exaggerated their pain levels. Patients perceived this as unfavorable and avoided physical activity or situations which could exacerbate the pain. This dynamic resulted in low self-efficacy and recovery expectations.[32] It can, however, provide a new perspective on how pain beliefs influence the feelings of ineffectiveness in patients who use and do not use CAM. Because of negative beliefs about their disease, treating and controlling the symptoms may lead patients to different treatment methods.[33] In this study, the lack of a correlation between the attitudes towards CAM and pain beliefs may be due to patients' general belief that the pain has organic causes and that they are all receiving physical therapy for pain.

The present study revealed a significant correlation between pain beliefs and pain coping. This finding is like other studies. Other report defined that patients believing they had control over the pain tried to cope with it themselves, while the patients who thought the nurses had control over the pain tended to seek medical help.[12] A study investigating the correlation between pain beliefs and coping strategies demonstrated that patients with organic pain beliefs did not cope with pain and felt more helpless.[13] Another study with fibromyalgia patients reported that passive coping strategies felt low pain control.[14] Pain beliefs of patients receiving physical therapy can be related to their coping strategies with pain.

When coping strategies were determined, self-efficacy strategies, helplessness, and medical treatment-seeking behaviors had moderate levels. A significant correlation was determined between patients' attitudes towards complementary medical treatment and treatment-seeking behavior for pain. This finding can be attributed to patients' beliefs which consider alternative and complementary medicine as part of overall medical treatment strategies. For example, a study with patients suffering chronic pain who chose CAM revealed that as their perception of pain management improved, they were more likely to use CAM.[19] It is attributed to using complementary medicine approaches as part of patients with chronic pain problems.[34] At this point, the patient's perception of self-efficacy for pain control also plays an important role. In addition, patients with low self-efficacy and perceptions of inadequacy regarding pain management may resort to complementary and alternative treatment methods.[35] Individuals who feel ineffective in the control of pain may seek medical treatment, and as a result, they may resort to complementary and alternative treatment methods.

This study revealed that the patients had moderate pain intensity, and there was a significant correlation between pain intensity and attitudes towards alternative medicine. Similarly, a study that included patients with chronic pain demonstrated that the patients applied to acupuncture treatment more frequently.[34] Another study revealed that pain intensity was a significant predictor for CAM use among cancer patients with chronic pain.[36] Complementary treatments reduce pain and improve the patients' functionality.[37] The present study highlights that the patients with chronic and severe pain use CAM therapies because of a lack of benefit from conventional treatment.

Study limitations

This study has some limitations. The findings of this study cannot be generalized for all patients undergoing physical therapy. The attitudes of patients towards CAM were evaluated through a self-report scale. Therefore, the evaluation of patients' perceptions, information levels, and CAM methods is limited. Another limitation is that the duration of chronic pain and using analgesic drugs in patients were not evaluated. But these variables are essential criteria that can affect the severity of pain. Finally, this study did not assess the length of patients' hospital stay. But the length of hospital stay could be helpful to see the severity of pain and its effect on complementary and alternative treatment.

CONCLUSION

In conclusion, the study revealed that the patients had negative attitudes towards CAM use. There was a significant correlation between patients' attitudes towards complementary medicine and medical treatment seeking. There was also a significant correlation between their attitudes towards alternative medicine and pain severity. However, the study showed no correlation between patients' pain beliefs and attitudes towards CAM. These results indicate that a more extensive study should be conducted to determine the other factors that

influence patients' negative attitudes towards using CAM for pain management.

Furthermore, additional studies are needed to determine how pain beliefs affect the feelings of inefficacy in patients who use and do not use CAM. The patients should be educated to cope with pain and manage it by health professionals. To obtain more information on this topic, it would be helpful to evaluate patients' perception of CAM use, their level of knowledge, and the methods they prefer to use. The relationship between the duration of chronic pain, attitudes toward CAM, and CAM use should be defined. Finally, this study should be conducted with outpatients, and the use of complementary and alternative treatment between inpatients and outpatients should be compared.

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ORIGINAL RESEARCH

The Effect of CAM Methods Plan to Apply by Pregnant Women in Order to Cope with Birth Pain on Fear of Childbirth and Childbirth Self-Efficacy

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Abstract
Objective: In the study, it was aimed to determine the effect of CAM methods planned to be used by pregnant women in order to cope with birth pain on fear of childbirth and childbirth self-efficacy
Material-Method: The cross-sectional study was completed with 455 pregnant women. The study data were collected through Identifying Information Form, which also aimed to determine CAM methods planned to be used, The Wijma Delivery Expectancy/Experience Questionnaire (W-DEQ) Version A, and Childbirth Self-Efficacy Inventory (CBSEI).
Results: In the study, it was determined that the pregnant women planned to use mind-body based CAM methods by 31.4%, manipulative and body-based methods by 25, biologically based methods by 1.1%, energy therapy methods by 0.9%, and alternative medicine methods by 0.7%. In addition, it was determined that there was a significant difference between CBSEI efficacy and outcome expectancy subscales mean scores and CBSEI total scale mean score of the pregnant women who did not plan to apply CAM methods to reduce their labor pain compared to those who planned to use these methods.
Conclusion: It was found in the study that the pregnant women planned to use mind-body based methods the most in order to cope with labor pain in childbirth. It was also determined that there was no significant difference between the groups in terms of fear of childbirth according to their planning to use CAM methods to cope with labor pain in childbirth, and that childbirth self-efficacy levels of those who planned to use CAM methods were significantly low.
Keywords: Traditional Medicine, Pregnancy, Fear of Childbirth, Self-Efficacy.

INTRODUCTION

While alternative methods in health include methods used instead of independent or modern medical methods, complementary medicine involves methods which are applied together with modern medical therapy and complement medical therapy. Application of both methods together is named as Complementary and Alternative Medicine (CAM). The rate of women using these methods especially in pregnancy and childbirth is quite high.[1] When the rate of CAM use in developed countries is considered, it is seen that these rates are 35.5% in Austria, 39.5% in Germany, 28.8% in Norway, 39.9% in Switzerland, and 31.5% in Sweden.[2] Although it is known that CAM is used in certain diseases in Türkiye, no data are available regarding its use in pregnancy and childbirth.[3] It is used at high rates in obstetrics clinics in pregnancy and childbirth in the USA, England, Germany, and Australia.[4, 5]

With regard to their childbirth, pregnant women are afraid of experiencing severe fear during labor, long duration of labor, not being able to push their baby, not using breathing techniques accurately, and losing their control in labor.[6-8] It is well-documented that fear of childbirth negatively affects pregnancy process and leads to stress in pregnancy.[9] Complementary and alternative methods (relaxation techniques, mental imagery/mental stimulation, sensual stimulation techniques, breathing techniques) preferred at birth have effects on labor pain.[10] Providing the pregnant woman with information about childbirth and psycho-socio-cultural support positively affects the pregnant woman's physical processes, attitude towards childbirth, and childbirth self-efficacy.[11] Childbirth self-efficacy of the pregnant woman shapes her belief and expectations related to childbirth.[12] Nonpharmacological methods

can enable the pregnant woman to use her own power in childbirth, cope with the childbirth process, and strengthen her communication with her baby.[13] The reasons for insufficient data about the use of CAM in Türkiye are that patients hide their use of CAM from healthcare professionals, CAM use is not the responsibility of healthcare professionals and they do not have adequate information about it, and healthcare professional do not approve of its use.[14]

Hence, identifying CAM methods that pregnant women in Türkiye plan to use and determining the effects of these methods on childbirth can be important in terms of getting healthcare professionals to consider CAM use and raising their awareness of CAM methods. This is because supporting pregnant women in the pregnancy process is vitally important for their psychosocial well-being and childbirth preparation. Therefore, in this study, it was aimed to determine the effect of CAM methods that pregnant women planned to use in cope with birth pain on fear of childbirth and childbirth self-efficacy.

Research questions:

(1) What is the rate of CAM methods that pregnant women plan to apply in order to cope with labor pain in childbirth?

(2) What are CAM types and rates that pregnant women plan to apply in order to cope with labor pain in childbirth?

(3) Are there any differences between the mean scores of WDEQ A, CBSEI total and sub-dimensions according to the CAM methods that pregnant women plan to apply in cope with birth pain?

MATERIALS AND METHODS

Study design, setting and study participants

This cross-sectional study was conducted in 4 Family Health Centers (FHCs) with the highest patient population located in the center of a province in the east of Türkiye between April – August 2022. The population of the study consisted of 551 pregnant women registered to the relevant FHCs on these dates. All pregnant women were reached by telephone. The study sample was composed of pregnant women who met the inclusion criteria (having no communication problem, planning to give normal birth, having a healthy fetus, being in the gestational week of 28-40, being older than 18 years, and having no risk related to pregnancy diabetes, preeclampsia, chronic diseases, and any diagnosed psychiatric disorder, etc.). and who agreed to participate in the study. Since the number of pregnant women was low, sampling was not used. Pregnant women who had a risky pregnancy according to medical records, had a risky fetus, and had a psychiatric disorder were excluded from the study. The study was completed with 455 pregnant women.

Data collection

The study data were collected through face-to-face interviews held in pregnancy rooms in FHCs. Data collection process lasted approximately 20 minutes. Pregnant women were informed about the study, their inclusion and exclusion criteria were evaluated, and they were invited to participate in the study. The purpose of the study was explained to the pregnant women who agreed to participate in the study, and they were assured that their confidentiality would be respected. 44 of the pregnant women who were accessed did not want to participate in the study due to time constraints, and 32 were excluded from the study due to not meeting the inclusion criteria. Eventually, the study was completed with 455 pregnant women. The data were evaluated by dividing the pregnant women into two groups as those who planned to use CAM methods and those who did not.

Data collection tools

Identifying information form

The form developed by the researchers in order to determine individual characteristics of the pregnant women consisted of 11 questions. Questions 1 to 5 inquired about certain sociodemographic characteristics of the women (age, education level, income status, employment status, and place of residence), questions 6 to 10 sought information about certain obstetric characteristics and knowledge about experiencing pain in childbirth (number of pregnancies, miscarriage status, status or receiving information about childbirth, the source of knowledge, and belief related to experiencing pain in childbirth). Question 11 included items related to CAM methods the women planned to use in childbirth (music, yoga, prayer, dreaming, acupressure, acupuncture, aromatherapy, ayurveda, plant use, bioenergy, hydrotherapy/thermal spring, hypnosis, homeopathy, massage, meditation, ozone therapy, special diets, reflexology, reiki, painting/music/art/dance therapy, therapeutic touch, vitamins, pain relieving drug). CAM method types in question 11 were grouped under 5 categories by performing a literature review (mind-body therapy, alternative medicine methods, biologically-based therapies, manipulative and body-based therapy, energy therapy), and evaluations were made accordingly.[15]

The Wijma delivery expectancy / experience questionnaire version A (W-DEQ A)

In this study, the Turkish version of the scale[16] was

used, which was developed by Wijma et al.[17] The questionnaire was used in order to determine the level of fear of childbirth the pregnant women experienced. The scale consists of 33 items. The 6-point Likert type scale is scored between 0 and 5. The negative statements on the scale (2, 3, 6, 7, 8, 11, 12, 15, 19, 20, 24, 25, 27, 31) are reversely scored. The minimum score is 0, and the maximum score is 165. A high total scale score shows a high level of fear. The Cronbach's alpha coefficient of the scale was found as 0.88 for primiparous pregnant women and as 0.90 for multiparous pregnant women.[16] In the present study, the Cronbach's alpha coefficient of the scale was determined to be 0.84.

Childbirth self-efficacy inventory (CBSEI)

The Turkish validity and reliability of the scale developed by Ip, Chung & Tang was done by Ersoy.[18-19] The Turkish version of the scale, which measures women's self-confidence regarding childbirth and their cope skills, was used in the study. The scale has two subscales, which are outcome and efficacy expectancy. Each subscale of the scale has 16 questions. The minimum and maximum scores to be obtained from the subscales are 16 and 160, respectively. A high point obtained from the subscales shows a high efficacy and outcome expectancy in pregnant women related to childbirth. In the Likert type scale, items are scored from 1 to 10. In the outcome expectancy subscale 1 corresponds to "not useful at all" and 10 expresses "very useful". As for efficacy expectancy subscale, the first 13 questions are responded as 1 "totally sure" and 10 "not sure at all", while questions from 14 to 16 are responded as 1 "not sure at all" and 10 "totally sure." The questions between 1 and 13 in the efficacy expectancy subscale are reversely scored. The lowest and highest scores to be obtained from the scale ranges from 32 to 320. High scores to be obtained from the scale indicate high efficacy levels of pregnant women in childbirth. The Cronbach's alpha coefficient of the scale was found to be 0.90.[18] In the present study, this value was determined as 0.82.

Data analysis

Statistical analyses of the study data were performed by using SPSS 25.0 (Statistical Package for the Social Sciences) software. Compliance of the data with normal distribution was examined with Kolmogorov-Smirnov test. The percentages and distribution of identifying characteristics were expressed as "frequencies". In the comparison between the identifying characteristics of those who planned to use CAM methods and those who did not, Chi-square test was used for categorical variables. The categorical variable that caused the difference between the columns in the categorical data was determined with Bonferroni method. In the comparison of the participants' W-DEQ A, CBSEI Total scale and subscale mean scores with their status of planning to use CAM to cope with labor pain in childbirth, Mann-Whitney U test was employed. The results were evaluated at the significance level of $p<0.05$.

Ethical considerations

The study was conducted in compliance with the principles of the Helsinki Declaration. Ethical approval for the study was obtained from Inonu University Health Sciences Scientific Research and Publication Ethics Committee (Decision no: 2021/2648). The pregnant women who presented to the FHCs were explained that participation in the study was on a voluntary basis, that they could quit the study whenever they wished, and they were informed about the purpose and duration of the study and invited to participate in the study. Verbal consent was taken from those who agreed to participate and met the inclusion criteria. Official written permission was taken from the Provincial Health Directorate to which the institutions where the study was conducted were affiliated (Issue: E-72527474-771).

RESULTS

The comparison of certain identifying characteristics of the pregnant women according to their status of planning to use CAM methods to cope with labor pain in childbirth is presented in Table 1. Accordingly, it was determined that the women who planned to use CAM to cope with labor pain in childbirth and those who did not were similar in terms of their education level, employment status, and place of residence, and that there was no statistically significant difference between the groups ($p>0.05$). It was also found that the groups were different in terms of number of pregnancies, miscarriage status, receiving information about childbirth, the source of information, and expecting to experience pain in childbirth, and that the difference between the groups was statistically significant ($p<0.05$). The differences between the columns were determined to be between those with one pregnancy and the others, those who received information related to childbirth from a midwife and the others, and those who expected to experience pain in childbirth and the others. The mean age of the pregnant women participating in the study was 28.037±5.20.

The CAM methods that the pregnant women planned to use in order to cope with labor pain in childbirth

are presented in Table 2. Accordingly, it was determined that 31.4% of the pregnant women planned to use mind-body therapy, 2% manipulative and body-based therapy, 1.1% biologically based therapy, 0.9% energy therapy, and 0.7% alternative medicine methods.

In Figure 1, the types and frequencies of CAM methods the pregnant women planned to use in order to cope with labor pain in childbirth are given. Accordingly, it was determined that the pregnant women planned to use prayer the most (n=88), followed by listening to music (n=27), yoga (n=11), breathing exercise (n=10), massage (n=8), dreaming (n=6), vitamins (n=3), ozone therapy (n=2), reiki (n=2), therapeutic touch (n=2), acupuncture (n=1), plant use (n=1), hydrotherapy (n=1), special diets (n=1), walking (n=1), and swimming (n=1).

The comparison of the pregnant women's W-DEQ A, CBSEI total scale and subscale scores according to their status of planning to use CAM in reducing their pain in childbirth is presented in Table 3. CBSEI efficacy and outcome expectancy subscale and CBSEI total scale mean score of the pregnant women who planned to use CAM for reducing their pain in childbirth were determined to be statistically significantly different compared to those who did not plan to use CAM ($p<0.05$). No statistically significant difference was found between W-DEQ A total scale mean scores of the pregnant women who planned to use CAM in reducing their pain in childbirth and those who did not ($p>0.05$).

Table 1. Distribution of the pregnant women according to their descriptive characteristics

Characteristics	**Those who did not plan to use CAM (n=290; %63.7)**		**Those who planned to use CAM (n=165; %36.3)**		
	n	**%**	**n**	**%**	**Test and p value**
Education level					
High school and below	197	67.9	120	72.7	X^2=1.145
University and above	93	32.1	45	27.3	p=0.285
Employment status					
Employed	44	15.2	24	14.5	X^2=1.369
Unemployed	246	84.8	141	85.5	p=0.504
Income status					
Low	72	24.8	45	27.3	X^2=2.048
Medium	194	66.9	110	66.7	p=0.727
High	24	8.3	10	6.1	
Place of residence					
Village/town/district	96	33.1	55	33.3	X^2=0.003
Province	194	66.9	110	66.7	p=0.960
Gestation					
1	108[a]	37.2	36[a]	21.8	X^2=12.330
2	73[b]	25.2	58[b]	35.2	**p=0.002**
3 and above	109[b]	37.6	71[b]	43.0	
Miscarriage history					
Yes	57	19.7	52	31.5	X^2=8.120
No	233	80.3	113	68.5	**p=0.004**
Receiving information about childbirth					
Yes	167	57.6	123	74.5	X^2=13.087
No	123	42.4	42	25.5	**p=0.000**
Source of information					
Midwife	52 [a]	17.9	62 [a]	37.6	
Doctor	100 [b]	34.5	43 [b]	26.1	X^2=21.615
Internet	138 [b]	47.6	60 [b]	36.4	**p=0.000**
Expecting to experience pain in childbirth					
Strongly agree	131 [a]	45.2	40 [b]	24.2	
Agree	121 [b]	41.7	75 [a]	45.5	X^2=31.729
Undecided	33 [c]	11.4	46 [c]	27.9	**p=0.000**
Disagree	4 [a,b,c]	1.4	4 [a,b,c]	2.4	
Strongly disagree	1 [a,b,c]	0.3	0 [a,b,c]	0	
Age	**Mean:±SD**				
	28.037±5.20				

Each subscript letter denotes a subset of categories whose column proportions do not differ significantly from each other at the 0.05 level.

Table 2. Distribution of CAM methods planned to be used by the pregnant women

Variables	Frequency (n)	Percentages (%)
Mind-body therapy	143	31.4
Alternative medicine methods	3	0.7
Biologically based therapy	5	1.1
Manipulative and body-based therapy	10	2.2
Energy Therapy	4	0.9
Total	165	36.3

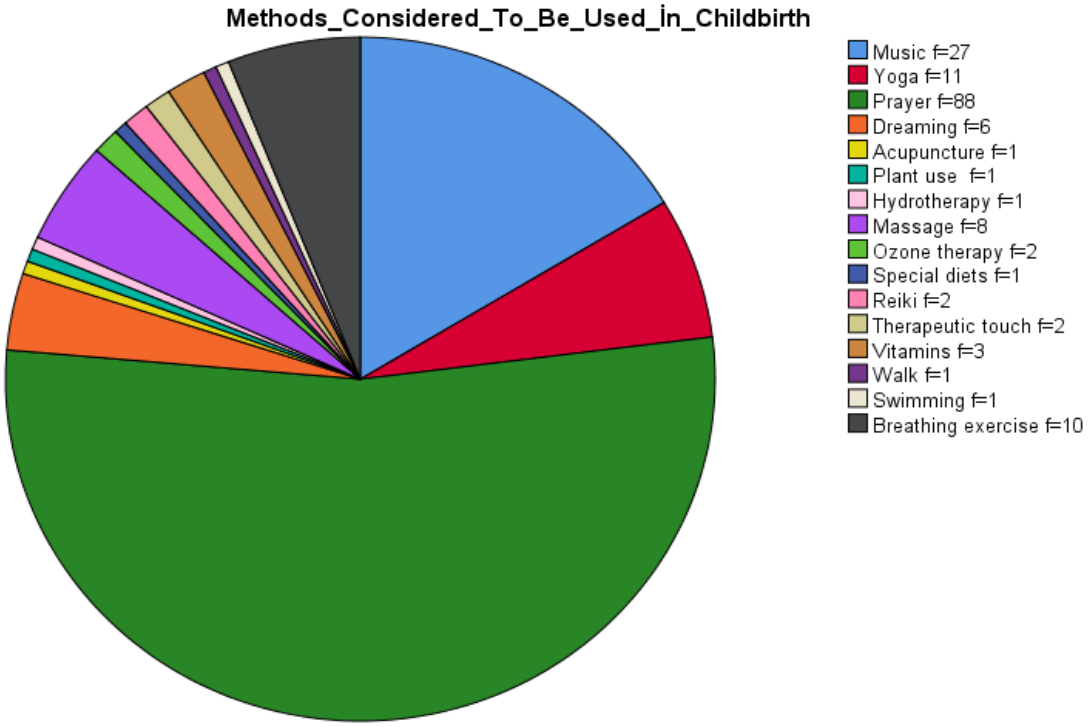

Figure 1. Types and frequencies of CAM methods that pregnant women planned to use in order to cope with labor pain in childbirth

Table 3. Comparison of the pregnant women's W-DEQ A, CBSEI total scale and subscale mean scores with respect to those who planned to use and did not plan to use CAM methods in childbirth

Characteristics	W-DEQ A	Efficacy Expectancy	Outcome Expectancy	CBSEI Total
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Those who did not plan to use CAM (n=290)	65.71±19.22	80.16.±19.29	126.32±21.95	206.48±29.02
Those who planned to use CAM (n=165)	67.86±19.41	74.59±16.45	119.38±22.98	193.98±28.03
Test and p value	U=22568.500 p=0.314	U=19201.000 **p=0.000**	U=19085.50 **p=0.000**	U=16860.00 **p=0.000**

U: Mann-Whitney U Test; SD: Standard Deviation

DISCUSSION

In the present study, in which it was aimed to determine the relationship between CAM methods that the pregnant women planned to use in order to cope with labor pain in childbirth and their fear of birth and childbirth self-efficacy, it was determined that 36.3% of the participating women planned to use CAM methods to reduce their labor pain. In Türkiye, there is no study conducted to determine CAM methods which pregnant women planned to use in order to reduce their labor pain. The studies conducted in the national literature are generally on the use of CAM methods in women's health, the use of CAM in infertility, and the use of CAM in the postpartum period.[20-22] The studies on CAM use in pregnancy were mostly conducted to determine CAM types used related to complaints experienced in pregnancy, and these studies are usually compilation studies.[23-25] In two studies conducted in the west of Türkiye in order to determine CAM use in pregnancy-related complaints, the rates of women using CAM methods were found to be 41.1% and 47.3%.[26, 27] These rates were found to be 69% in Russia, 43.8% in Australia, and 49.8 in Poland.[28] It is known that CAM usage rates are high in developed countries, while they are lower in developing countries. Considering that the present study was conducted in the west of Türkiye, it can be claimed that the results support the study results in the literature.

In the present study, the CAM method that the pregnant women planned to use in order to reduce their labor pain the most was determined to be mind-body based methods. Among the mind-body based methods, the most preferred ones were prayer, music, and yoga. While no study was encountered in Türkiye which investigated pregnancy and prayer in childbirth, there are many compilation studies and randomized controlled trials on CAM methods such as music, yoga, acupressure, acupuncture, and massage.[29-34]

In a thesis study in which the use of complementary and alternative health approaches were evaluated in 199 pregnant women, the CAM methods that were used the most in pregnancy were found to be plant use (82.3%), prayer (81.4%), and massage (45.1%).[35] In the present study, it was found that the CAM methods which the pregnant women planned to use the least were manipulative body based methods (massage, reflexology, hydrotherapy, acupressure), biologically based methods (plant use, special diets, vitamins), energy therapy (reiki), and alternative medicine methods (acupuncture, ozone therapy). In a study conducted, it was reported that the majority of healthcare professionals (81.3%), who could inform the pregnant woman in terms of CAM use, had received no information about CAM.[36] When CAM usage preference of the pregnant women in the present study is examined, it is seen that they mostly preferred the methods which do not require interaction or active training and which are easily accessible. It is thought that the differences between the studies stemmed from the fact that pregnant women have little knowledge about these methods, and that the number of health professionals competent in CAM is low. In addition, the legal restriction imposed on the use of CAM by midwives and nurses may have contributed to this difference.[14]

In the present study, it was determined that childbirth self-efficacy levels of those who did not plan to use CAM methods were significantly high, that their fear of childbirth was lower compared to those who planned to use CAM methods, but that the difference between them was not significant. It is expected for individuals with high levels of childbirth self-efficacy to have lower levels of fear of childbirth.[12, 37] In the present study, the finding that self-efficacy levels of those who did not plan to use CAM methods were high despite their low levels of fear of childbirth is thought to be a result of their existing self-confidence. This result is consistent with the literature. In the national and international literature, there are no studies conducted on the relationship between CAM methods that pregnant women plan to use in order to cope with labor pain in childbirth and fear of childbirth and childbirth self-efficacy. Studies conducted are mostly pretest-posttest application studies which were conducted in order to reduce labor pain.[38-41] In these studies, CAM methods were directly applied to the experimental groups by CAM experts. Koyuncu et al.[40] applied yoga to pregnant women in trimester, and they reported that yoga application increased the pregnant women's childbirth self-efficacy and decreased fear of childbirth. In the systematic compilation study by Stoll et al.[42] it was reported that yoga decreased pregnant women's worries about childbirth. Health professionals who are responsible for the follow-up of healthy pregnant women in Türkiye are midwives and nurses working at primary care health institutions. The knowledge level of midwives and nurses about CAM methods in Türkiye is quite low.[14] The cause of this difference can be explained in two ways. Firstly, it could be that pregnant women do not have adequate information about the effects of CAM methods. Secondly, this may have resulted from the

very low number of the pregnant women who planned to use CAM methods other than mind-body based methods. This is because there is no clear information about the effects of the methods.

CONCLUSION

In conclusion, it was determined in the study that the CAM methods which the pregnant women planned to use the most in order to cope with labor pain in childbirth were mind-body based methods, and that among these methods, they preferred prayer method the most. It was also found that there was no difference between the groups in terms of their fear of childbirth according to their status of planning to use CAM methods in order to reduce their labor pain, and that childbirth self-efficacy levels of those who planned to use CAM methods were significantly low. Considering the results of the study, it is seen that the pregnant women did not plan to use certain CAM methods. Hence, it is recommended to conduct studies that will ensure that pregnant women receive training on CAM methods that they can use in childbirth and their effects. Secondly, it is recommended to conduct studies with larger samples, to evaluate the status of pregnant women in terms of receiving training on CAM methods and their current knowledge levels, and to determine how and where they would like to get information on the issue. Thirdly, it would be useful to conduct studies that will determine the effects of CAM methods on childbirth self-efficacy and fear of childbirth. Finally, training on the effects of CAM methods can be included in the education of midwives and nurses.

Limitations of the Study

The study has certain limitations. First of all, questionnaire method was used in collecting the data. The reports of the pregnant women were limited to the items in the questionnaire. While clear responses to the questionnaire items were obtained, this situation limited our ability to obtain the pregnant women's other opinions on the issue. Another limitation is that the sample size was small in terms of certain variables (CAM methods and types). Finally, as the study was conducted in only 4 family health centers in a province in the east of Türkiye, the results cannot be generalized to the whole region and the country.

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ORIGINAL RESEARCH

Antioxidant, Antimicrobial and Phenolic Component Analysis of Some Edge Medicinal Plants

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Abstract
Objective: The plants, which grow wild in the Eastern Anatolia Region and are known as kari (*Arum elongatum*; *Ae*) and mende (*Chaerophyllum macrospermum*; *Cm*), are used for treatment purposes such as pain reliever and wound healing properties. It is aimed to determine some biological properties of these plants, which are also used medicinally.
Material-Method: Firstly, hexane (H), ethanol (E) and acetone (A) extracts of dried plants were prepared and antimicrobial activities of extracts against 13 indicator microorganisms were determined by agar well diffusion method. Antioxidant activities were determined by DPPH and ABTS analyses and the total phenolic component contents were determined by the Folin-Ciocalteu method.
Results: The maximum extract yield was obtained in the ethanol extracts of the plants (*Ae*E;10.4011% *Cm*E;2.4898%), the minimum extract yield was obtained in the acetone extracts (*Ae*A;0.8422% *Cm*A;0.3510%). The hexane extract of *A. elongatum* has no inhibition activity against *E. faecalis* and *L. monocytogenes*, but it has inhibition activity against other indicator microorganisms. The other extracts of *A. elongatum* and all extracts of *C. macrospermum* were found to have inhibitory activity against all indicator microorganisms. Furthermore, the highest phenolic content was calculated as 54.60±0.486 µg mL^{-1} (*Ae*E) and the lowest content as 3.47±0.001 µg mL^{-1} (*Cm*A). As a result of the DPPH method the highest IC_{50} was calculated as 32.4140 µg mL^{-1} (*Cm*H) and the lowest IC_{50} as 12.7876 µg mL^{-1} (*Ae*A) and ABTS method the highest IC_{50} was calculated as 10.3203 µg mL^{-1} (*Cm*E), and the lowest IC_{50} as 0.2744 µg mL^{-1} (*Cm*A).
Conclusion: These results show that the plant extracts have strong antimicrobial activity and antioxidant activity.
Keywords: Antimicrobial, Antioxidant, Extraction, Medicinal Plants, Phenolic Component.

INTRODUCTION

Plants have ability to produce some phytochemicals against different environmental conditions or diseases. However, these chemicals are not always important to the plant, they have potential to used in different areas for people.[1,2] Nowadays, in the treatment of diseases, especially phytochemicals synthesized by medicinal and aromatic plants attract attention and studies in this field are increasing. In recent years, the number of microorganisms with multiple antibiotic resistance has increased considerably. Unfortunately, the effectiveness of existing antibiotics is decreasing day by day. In this context, phytochemicals that can be used against pathogens that are difficult to combat appear as natural products alternative to antibiotics. Furthermore phytochemicals have fewer side effects when compared to synthetic drugs.[3,4] It is seen that many different studies are carried out in different countries to show the usability of medicinal plants in the treatment of diseases.[5] It has been reported that phytochemicals of medicinal plant generally do not have side effects like synthetic drugs, and pathogens cannot quickly develop resistance against these phytochemicals.[4,6] Today, finding new antibacterial substances with different chemical composition and mechanisms of action are essential, as there is a shocking increase in new and re-emerging infectious diseases. For this reason, ethnopharmacologists work to identify bioactive molecule producing plants and to reveal the properties of these molecules, depending on modern research. New molecules are sought in plant biodiversity using ethnopharmacological data.[6] There are a growing number of reports regarding the assessment of antimicrobial effects of medicinal

plants. The emergence of resistant new pathogens and the ineffectiveness of chemotherapeutic agents against these pathogens reveals the need for potential antimicrobial molecule discovery, and medicinal plants become the most important element in new molecule discovery.[7] However, it is known that some medicinal plants contain antioxidant molecules that may have an important role in disease prevention by reducing oxidative stress.[8] It is known that free radicals play a very significant role in the development of tissue damage in very different human diseases. Until now, many medicinal plants have been claimed to exhibit beneficial health effects such as antioxidant and antimicrobial properties. However, the potential of many plants as sources for new drugs remains largely unexplored.[5]

The genus *Arum* and *Chaerophyllum* are among the plants frequently used for nutritional and therapeutic purposes in the different regions. Although the genus *Arum* (Araceae) is poisonous, it has been used for centuries for nutritional and medicinal purposes[9]. It is known that *Arum* species are used with traditional methods in removing the sores and swelling in the breasts of women, reducing the worms formed in the intestines, relieving the pains of postpartum women, treating headaches and treating some internal diseases.[10,11]

The *Arum* species have been widely explored by modern research for pharmaceutical discovery.[9] Furthermore, it is known that the genus *Chaerophyllum* (Apiaceae) is frequently used to relieve abdominal pain.[12] Traditionally, this plant has been used to reduce chest pains and relieve abdominal pain.[13] Studies were conducted with the genus *Arum* and *Chaerophyllum* in different regions and the results showed that these plants have the opportunity to be used in pharmacology.[9,14] Although, the species of these two plants have traditionally known medicinal and other uses in Hakkari (in Türkiye), their pharmacological properties have not yet been studied by scientific research. Based on the knowledge that plants have different characteristics in different ecological environments, some biological characteristics of these plants in Hakkari province were evaluated for the first time in this study.

In this study, antimicrobial activity assay, antioxidant activity assay and phenolic content assay of plant extracts were carried out in order to reveal some biological properties of *Arum elongatum* (Kari) and *Chaerophyllum macrospermum* (Mendi), which are frequently used for food and treatment purposes in Hakkari province.

MATERIALS AND METHODS

Plants, extraction and percentage yield analysis

The plants were obtained from markets in Hakkari (April-May 2016). The plants defined with the help of Prof. Dr. Fatih SATIL (Faculty of Arts and Science, Balıkesir University). The freshly supplied plants (stem and leaf parts) were dried at 40 °C and ground into powder. The samples were gradually extracted with hexane, ethanol and acetone for 24 hours. HPLC grade solvents were used. After each extraction, the substances were filtered and the liquid was taken to be evaporated. Evaporation was carried out at approximately 30 °C at 80-150 rpm. The percent yields of the extracts obtained after evaporation were calculated and were dissolved in Dimethyl Sulfoxide (DMSO, Merck) at rates of 20-100 µg ml^{-1}. Samples were stored at +4 °C.[15,16]

Microorganisms and culture conditions

In order to define the antimicrobial properties of plant extracts, the spectrum was kept wide and eukaryotic/prokaryotic pathogens were preferred as the causative agents of different diseases. In antimicrobial activity tests, *Salmonella* Typhimurium ATCC 14028, *Staphylococcus epidermidis* ATCC 12228, *Pseudomanas aeruginosa* ATCC 27853, *Klebsiella pneumoniae* ATCC 13883, *Yersinia pseudotuberculosis* ATCC 911, *Proteus vulgaris* ATCC 13315, *Enterococcus faecalis* ATCC 29212, *Bacillus subtilis* ATCC 6633, *Enterobacter cloaceae* ATCC 13047, *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 35218, *Listeria monocytogenes* ATCC 7644, and *Candida albicans* ATCC 90028 were used. Mueller Hinton Broth (MHB, Merck) or Mueller Hinton Agar (MHA, Merck) is used for the cultivation of microorganisms. Furthermore, microorganisms were cultured at 37°C for 16-18 h.[17,18]

Determination of antimicrobial activity

The inhibition activity of the plant extracts was determined with agar well diffusion assay.[19] Firstly, the indicator bacteria were incubated in MHB for 18-24 h. After incubation, bacterial dilutions were prepared at 10^8 cells/ml and 100 µl was spread on petri dishes containing MHA. Then, wells (6 mm diameter) were drilled on the petri dish and 100 µl of extracts were added to the wells and incubated at 37 °C for 16-18 h. At the end of the incubation period, it was detected by the zones around the wells. Antibiotic (ciprofloxacin 30µg/disc, Bioanalyse) was used as a positive control and DMSO was used as a negative control.[20,21]

Antioxidant activity by DPPH assay

Antioxidant activity of plant extracts were measured

by DPPH (1,1- diphenyl-2-picryl hydrazyl).[22,23] BHA was used as the standard compound. The mixture of DPPH and methanol was used as the control solvent. The antioxidant activity was evaluated as percent inhibition.[24]

Antioxidant activity by ABTS assay

ABTS radical scavenging activity assay was performed using ABTS (2,2-Azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)) free radical according to the method reported by Miller et al. (1993)[25] and developed by Re et al[26.] Methanol was used as the control solvent and Trolox (500-2500 µg mL^{-1}, Aldrich) was used as a standard compound.[27] Trolox is a water-soluble analog of vitamin E. Studies were repeated twice. The antioxidant activity was evaluated as percent inhibition.[24,27]

Evaluation of total phenolic component

The total phenolic content of the plants extracts was determined with the Folin-Ciocalteu reagent. The amounts of phenolic compounds corresponding to the gallic acid standard of the extracts were determined in the study.[28] Firstly, the stock solutions of the standard at a ratio of 1:1 (gallic acid:dH_2O) were prepared. Solutions were prepared at different concentrations (25-100 µg mL^{-1}) from the stock solution, and 100 µL of the solutions were taken and 4500 µL of dH_2O was added. Then, 100 µL of Folin-Ciocalteu reagent was added and after 3 minutes, 300 µL of 2% Na_2CO_3 solution was added and mixed. The samples were incubated in the dark for 2h. Then, absorbance was measured at 760 nm.

RESULTS

Percentage yield analysis of plant extracts and total phenolic component analysis

In this study, some biological properties of the genus *A. elongatum* and *C. macrospermum* were revealed. The % yields of the extracts obtained from the plants are given in Table 1. Highest extract yield *A. elongatum* ethanol extract (*Ae*E) 10.4011%, the lowest extract yield was *C. macrospermum* acetone extract (*Cm*A) calculated as 0.3510%. While the ethanol extract yield was the highest for both plants, the acetone extract yield was the lowest (Table 1).

The total phenolic content of the plant extracts was defined as gallic acid equivalent (µg mL^{-1}). When the plant extracts were compared, the total phenolic content of the extracts was found for *A. elongatum* as *Ae*E > *Ae*H > *Ae*A, for *C. macrospermum* as *Cm*E > *Cm*H > *Cm*A (Table 1). The maximum amount of phenolic compounds was determined in *A. elongatum* ethanol extract (54.60 ± 0.486 µg GAE mL^{-1}).

Antioxidant activity

DPPH radical scavenging activities of extracts of *A. elongatum* and *C. macrospermum* were evaluated as % inhibition and the results were compared with synthetic antioxidant BHA (Figure 1). Then the IC_{50} value of the extracts was calculated (Table 1).

ABTS radical scavenging activities of hexane, ethanol, and acetone extracts of *A. elongatum* and *C. macrospermum* were evaluated as % inhibition and the results were compared with the ABTS radical scavenging activity of synthetic antioxidant Trolox. According to the total graphic % inhibition data, the extracts showed ABTS radical scavenging activity close to Trolox (Figure 2). Then the IC_{50} value of the extracts was calculated (Table 1).

Table 1. The percent yield of extraction, antioxidant performance and total phenolic contents from *A. elongatum* and *C. macrospermum* plants.

Extracts	Yield of Extract (%)	Antioxidant activity (IC_{50})		Total Phenolic Content (µg GAE mL^{-1})
		DPPH	ABTS	
*Ae*H	2.20560	17.2355	3.84830	20.36 ± 0.199
*Ae*E	10.4011	31.5686	1.28930	54.60 ± 0.486
*Ae*A	0.84220	12.7876	2.87930	12.68 ± 0.092
*Cm*H	1.25650	32.4140	8.25350	09.44 ± 0.015
*Cm*E	2.48980	22.9518	10.3203	15.33 ± 0.004
*Cm*A	0.35100	15.6458	0.27440	03.47 ± 0.001
BHA	-	4.39670	-	-
Trolox	-	-	5.64650	-

*Ae*H; hexane extract of *A. elongatum*, *Ae*E; ethanol extract of *A. elongatum*, *Ae*A; acetone extract of *A. elongatum*, *Cm*H; hexane extract of *C. macrospermum*, *Cm*E; ethanol extract of *C. macrospermum*, *Cm*A; acetone extract of *C. macrospermum*. BHA and Trolox; standard compounds.

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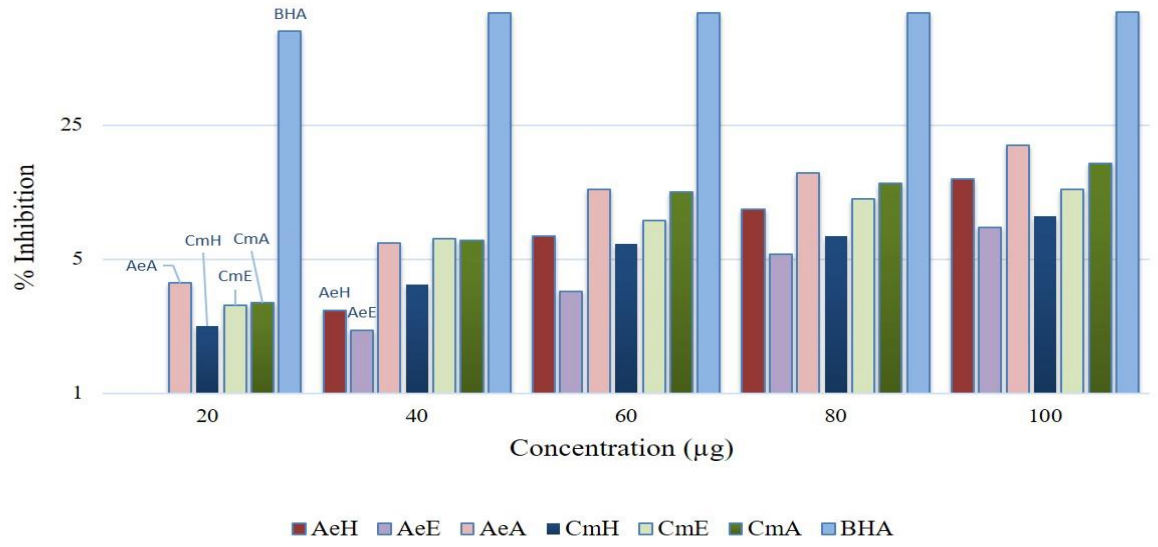

Figure 1. DPPH radical scavenging activity. AeH; hexane extract of *A. elongatum*, AeE; ethanol extract of *A. elongatum*, AeA; acetone extract of *A. elongatum*, CmH; hexane extract of *C. macrospermum*, CmE; ethanol extract of *C. macrospermum*, CmA; acetone extract of *C. macrospermum.*

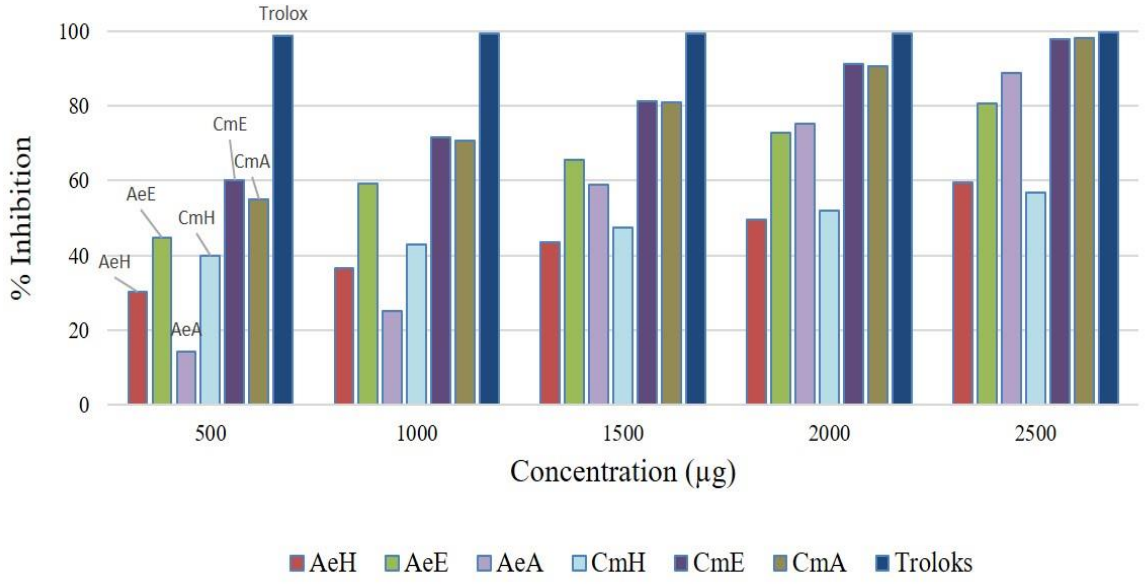

Figure 2. ABTS radical scavenging activity. AeH; hexane extract of *A. elongatum*, AeE; ethanol extract of *A. elongatum*, AeA; acetone extract of *A. elongatum*, CmH; hexane extract of *C. macrospermum*, CmE; ethanol extract of *C. macrospermum*, CmA; acetone extract of *C. macrospermum.*

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Antimicrobial activity

When the hexane extract of *A. elongatum* are evaluated, it can be said that the hexane extract has high antimicrobial activity against microorganisms such as *E. cloaceae*, *S. typhimurium*, *S. epidermidis*, *P. vulgaris*, *Y. pseudotuberculosis*, *S. aureus*, *P. aeruginosa*, *K. pneumoniae*, *B. subtilis*, *E. coli* and *C. albicans* (Table 2). Furthermore, it was determined that ethanol and acetone extracts of *A. elongatum* showed inhibitory activity against all test microorganisms. It was determined that all three extracts of *C. macrospermum* had inhibitory activity against all indicator microorganisms (Table 2, Figure 3).

Table 2. Antimicrobial performance of the extracts from *A. elongatum* and *C. macrospermum.*

	Extracts / Inhibition zones (mm)							
Microorganisms	***Ae*H**	***Cm*H**	***Ae*E**	***Cm*E**	***Ae*A**	***Cm*A**	**CPFX**	**DMSO**
E. faecalis	-	07.5	12.5	21.0	17.5	18.0	29.0	-
***S.* Typhimurium**	24.0	21.5	13.0	20.0	21.0	23.0	36.0	-
K. pneumoniae	22.0	20.5	25.0	24.0	23.5	24.0	36.0	-
E. coli	06.5	18.5	06.5	16.5	06.5	16.5	35.0	-
P. vulgaris	15.5	15.0	15.0	14.0	15.5	14.0	36.0	-
L. monocytogenes	-	07.0	19.0	21.5	16.5	11.5	30.0	-
Y. pseudotuberculosis	17.0	18.5	17.0	19.0	18.5	18.0	26.0	-
P. aeruginosa	16.0	16.5	06.5	06.5	06.5	16.5	29.0	-
S. epidermidis	17.5	11.5	18.5	22.5	17.5	12.0	20.0	-
S. aureus	14.5	13.0	17.5	19.0	13.5	12.5	30.0	-
E. cloaceae	20.5	19.0	09.0	08.0	11.5	13.0	35.0	-
B. subtilis	14.5	14.0	14.5	13.5	15.0	17.0	38.0	-
C. albicans	24.5	26.0	19.0	20.5	19.0	20.0	-	-

CPFX; Ciprofloxacin, DMSO; Dimethyl Sulfoxide

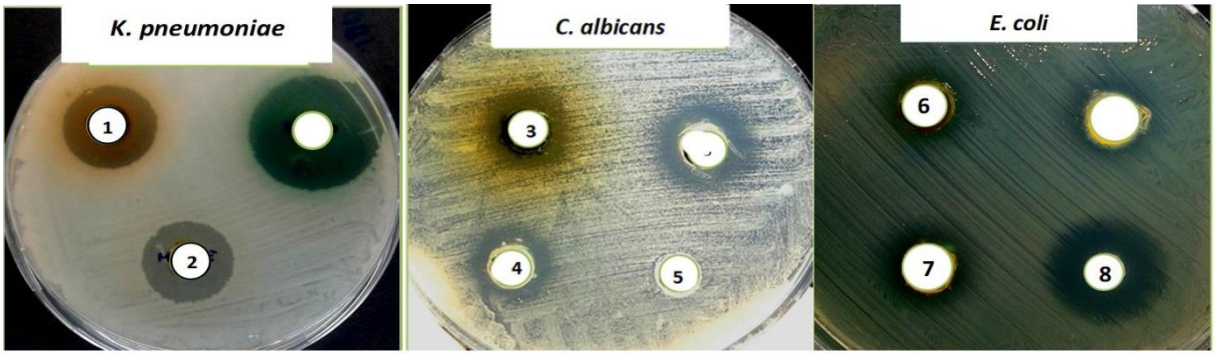

Figure 3. Antimicrobial activity analysis. 1;*Ae*E, 2;*Cm*E, 3;*Ae*A, 4;*Cm*A, 5;DMSO, 6;*Ae*H, 7;*Cm*H, 8; Streptomycin

DISCUSSION

Due to their increasing traditional uses and in daily life, the medicinal plants attract great attention and also gain global importance due to their low side effects. Herbal medicines, which in many cases are more cost-effective than synthetic medicines, are promoted by most of the developing countries. In this context, many studies are carried out on medicinal plants and their derivatives.[29] The plants of the genus *Arum* (Araceae) and *Chaerophyllum* (Apiaceae) have become a source of trade for the people of the different regions in Türkiye due to their intense use for food and especially for medicinal purposes. In this context, the plants of *A. elongatum* and *C. macrospermum* distributed in the Eastern Anatolia region, have also attracted the attention of some scientists, but there are few studies on these plants. However, there are no studies on the biological activities of *C. macrospermum* and *A. elongatum* distributed in Hakkari. In this study, some biological properties of the genus *A. elongatum* and *C. macrospermum* were revealed.

Results of the studies, the maximum extract yield was obtained in the ethanol extracts of the plants (*Ae*E;10.4011% *Cm*E;2.4898%), the minimum extract yield was obtained in the acetone extracts (*Ae*A;0.8422% *Cm*A;0.3510%). As a result of the DPPH method the highest IC_{50} was calculated as 32.4140 µg mL^{-1} (*Cm*H) and the lowest IC_{50} as 12.7876 µg mL^{-1} (*Ae*A) and ABTS method the highest IC_{50} was calculated as 10.3203 µg mL^{-1} (*Cm*E), and the lowest IC_{50} as 0.2744 µg mL^{-1} (*Cm*A). In a study conducted by Zengin Kurt et al.,[30] the biological abilities of *Arum maculatum* distributed in Ordu were evaluated. Similar to our study, hexane and ethanol extraction of the plant was performed in this study, and the antioxidant activities of the extracts were evaluated by ABTS method. When the results of this study are compared with the results of our study, it is seen that there is a very low extraction efficiency and a very low antioxidant capacity from our results. An extraction efficiency of 0.08% was obtained with hexane in this study, whereas an extraction efficiency of 2.21% was achieved with hexane in our study. In this study, 0.29% extraction efficiency was achieved with ethanol, and 10.40% extraction efficiency was achieved in our study. Accordingly, it is seen that the IC_{50} of our exracts values are considerably higher than in this study. Although *A. maculatum* and *A. elongatum* are members of the same genus, it is possible that both species differences and the environment in which they are distributed may have revealed these results.[30] In another study carried out by Alaca et al., some biological activities of 12 different types of edible plants, including *Arum conophalloides*, distributed in Hakkari and Van, were evaluated. It was observed that the results of the DPPH study were similar, especially due to the similar habitat with this study. However, considering the ABTS results, it can be said that they found a lower IC_{50} value than this results.[31] In another study conducted in 2022, the antioxidant activity of the essential oils of the *Chaerophyllum libanoticum* were determined. In this study, the IC_{50} values of different extracts of the genus *C. macrospermum* calculated as 0.27440-10.3203 mg mL^{-1}. In this study, the IC_{50} value of essential oil was calculated as 0.027 ± 0.008 mg mL^{-1}.[32] In this case, it can be said that the antioxidant activities of essential oils are higher than the antioxidant activities of plant extracts. Essential oils contain components with phenolic hydroxyl groups and therefore show strong antioxidative properties.

As a result of total phenolic analysis, the highest phenolic content was calculated as 54.60±0.486 µg mL^{-1} (*Ae*E) and the lowest content as 3.47±0.001 µg mL^{-1} (*Cm*A). In another study published in 2021, it is observed that the antioxidant properties of the *Arum italicum* plant grown in Trabzon were evaluated. In this study, the total phenolic contents of different extracts of the *A. elongatum* were determined as 12.68±0.092 - 54.60 ± 0.486 µg GAE mL^{-1}. In 2021, the total phenolic content of the inedible parts of the *A. italicum* plant was determined as 164 µg GAE mL^{-1}. It can be said that the phenolic contents of inedible plant parts were found higher than the phenolic contents of the edible parts in this study.[33]

The hexane extract of *A. elongatum* has no inhibition activity against *E. faecalis* and *L. monocytogenes*, but it has inhibition activity against other indicator microorganisms such as *S.* Typhimurium, *S. epidermidis*, *P. aeruginosa*, *K. pneumoniae*, *Y. pseudotuberculosis*, *P. vulgaris*, *B. subtilis*, *E. cloaceae*, *S. aureus*, *E. coli*, and *C. albicans*. The other extracts of *A. elongatum* and all extracts of *C. macrospermum* were found have inhibitory activity against all indicator microorganisms such as *S.* Typhimurium, *S. epidermidis*, *P. aeruginosa*, *K. pneumoniae*, *Y. pseudotuberculosis*, *P. vulgaris*, *B. subtilis*, *E. cloaceae*, *S. aureus*, *E. coli*, *E. Faecalis*, *L. monocytogenes*, and *C. albicans*. When the hexane extract of *A. elongatum* is evaluated, it can be said that the hexane extract has high antimicrobial activity against microorganisms such as *E. cloaceae*, *S. typhimurium*, *S. epidermidis*, *P. vulgaris*, *Y.*

pseudotuberculosis, *S. aureus*, *P. aeruginosa*, *K. pneumoniae*, *B. subtilis*, *E. coli* and *C. albicans*. Furthermore, it was determined that ethanol and acetone extracts of *A. elongatum* showed inhibitory activity against all test microorganisms. It was determined that all three extracts of *C. macrospermum* had inhibitory activity against all indicator microorganisms. In a study conducted in 2018, ethanol and water extracts of *Arum elongatum* plant collected from the Muş Province in Türkiye were obtained. As a result of the study, it was determined that the ethanol extract has low antimicrobial activity against microorganisms such as *B. subtilis* and *S. aureus, E. aerogenes, E. coli, P. aeroginosa K. pneumonia, S. cereviciae*. It is seen that the antimicrobial activity results are considerably lower than the antimicrobial activity results obtained in this study. In addition, in 2018, it was seen that the *A. elongatum* plant had a good antioxidant activity capacity as in our study.[11] The other study conducted in 2009, leaf extracts of the *Arum maculatum* plant distributed in Kahramanmaras (Türkiye) were obtained and it was determined that the extracts have high inhibition activity against different microorganisms such as *Bacillus cereus, Micrococcus luteus, Pseudomonas phaseolicola, Yersinia enterocolitica, Enterobacter aerogenes* and *Aspergillus niger*.[34] In this study, the extracts of the *Arum elongatum* were found *E. faecalis, S. typhimurium, K. pneumoniae, E. coli, P. vulgaris, L. monocytogenes, Y. pseudotuberculosis, P. aeruginosa, S. epidermidis, S. aureus, E. cloaceae, B. subtilis* and *C. albicans* have been found to have high inhibitory activity. When these results are evaluated, it shows that the extracts of the genus *Arum* have broad-spectrum antimicrobial activity. In another study, antimicrobial and antioxidant activity studies of the extracts obtained from the *Arum hygrophilum* plant collected from the Jordan region were carried out. The extracts were found to have high antimicrobial activity against *S. aureus* ATCC29213, *Listeria monocytogenes* ATCC7644 and methicillin-resistant *Staphylococcus aureus* (MRSA).[35] It is promising that the extracts have high activity especially against MRSA. In this study, there were no resistant pathogens as an indicator for the determination of the efficacy of the extracts, but it will be important to study the effectiveness of such resistant pathogens in future studies.

In a study conducted in 2021, it is observed that only the essential oil compositions of the aerial parts of *Chaerophyllum macrospermum* collected from Bitlis and Hakkari in Türkiye are detected.[14] In a 2018 study, the antioxidant and antimicrobial activity properties of methanol, ethanol, and acetone extracts of some plants, including the genus *Chaerophyllum*, were investigated. Antioxidant activities of the extracts were determined by DPPH and ABTS radical methods and antimicrobial activities were determined by agar well diffusion method. As a result of this study, it was seen that the extracts of plants can be used as natural antimicrobials and antioxidants in food processing.[36] The results of this study support our study. In another study, local cheese (Van herbed cheese) containing more than 60 plant species belonging to 9 different families, including the genus *Chaerophyllum*, were examined. As a result of this study, it was determined that the local cheese was enriched in vitamin C, crude fiber, macro and micronutrients due to the plants used, and also these plants gave the cheese antimicrobial and antioxidant properties due to the bioactive substances they contain.[37] In a study conducted in 2005, the inhibitory activity of *Chaerophyllum crinitum*, one of the plants added to herbed cheese, against some pathogenic bacteria was investigated and this plant has been described as having inhibitory activity against *K. pneumoniae, P. aeruginosa* and *S. aureus.*[19] In a study by Hayta et al., the antioxidant and antimicrobial activities of the extracts obtained from the *Chaerophyllum crinitum* plant grown around Bitlis (in Türkiye) were tested. When the result of the study was evaluated, it was observed that the DPPH activity could not be defined. While it was determined that the extracts of the genus *Chaerophyllum* had inhibitory activity against *E. faecalis and S. aureus*, it did not have inhibitory activity against *E. coli.*[38] However, when these results are compared with the results of antimicrobial activity studies performed in this study, it is seen that our *C. macrospermum* extracts have much higher antimicrobial activity against all bacteria, including *E. coli*. In 2016, the antioxidant and antimicrobial activities of the plant extract of *Chaerophyllum aureum* were determined.[39] When the results are examined, it is seen that the extracts have a very high antioxidant capacity, as in this study.[39] However, inhibition activity could not be detected against *Bacillus subtilis* ATCC 6633, *Staphylococcus aureus* ATCC6538, *Escherichia coli* ATCC 8739, *Pseudomonas aeruginosa* ATCC9027, *Salmonella abony* ATCC6017.[39] On the other hand, the extracts of *Chaerophyllum macrospermum* obtained in this study seem to have high antimicrobial activity.

CONCLUSION

In this context, bioactive molecule extraction of the

A. elongatum and *C. macrospermum* grown in Hakkari for the first time, and then antimicrobial, antioxidant and total phenolic component analyzes of these extracts were performed in this study. As a result of this study, which was planned to reveal the scientific importance of these plants, which is frequently used and very valuable in Hakkari and the surrounding provinces, it was determined that the *A. elongatum* and *C. macrospermum* each showed good antioxidant and antimicrobial properties. However, to use these plants in pharmacological studies, some biological properties of which were investigated in the study, more detailed studies are required.

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Author contributions: Conceptualization: [SU]; Design: [SU]; Writing: [SU, SUL]; Investigation/ Data collection: [SU, SUL]

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ORIGINAL RESEARCH

Investigating the Astonishing Antimicrobial Potential of Papaya seeds against *Salmonella* spp and *Candida albicans*

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Abstract
Objective: This study focused on the in vitro antibacterial efficacy of papaya seed ethanolic and aqueous extracts against *Salmonella* spp. and *Candida albicans*.
Material-Method: Dry seeds of *Carica papaya* were extracted with ethanol and hot water and tested for antimicrobial activity against *Salmonella* spp and *Candida albicans* using agar well diffusion method on Muller Hilton agar.
Results: The study found that the extracts worked better against *Salmonella* spp than *Candida albicans*, however, ethanol extract was stronger against the isolates with inhibition zone diameter (IZD) ranging from 10 mm to 32 mm, compared to the aqueous extract which only had 4 mm to 9 mm zones at certain concentrations.
Conclusion: The activity of *Carica papaya* seed extracts demonstrates that the seeds are as significant as other parts of the plant and provides a scientific basis for the seeds' use in the treatment of many ailments in the local community. The extracts were more effective against *Salmonella* spp., with the ethanol extract having the highest antibacterial activity, indicating that the components of papaya seeds are more soluble in organic solvents and had stronger bactericidal characteristics. As a result, extensive analyses of the bioactive chemicals in *Carica papaya* seeds and their modes of action are required to present a full picture.
Keywords: Antimicrobial Effects, Power of Papaya Seeds, Plant Medicine, Plant Waste

INTRODUCTION

Medicinal plants are abundant sources of diverse secondary metabolites, such as tannins, terpenoids, alkaloids, and flavonoids, which have been shown to possess antimicrobial properties in vitro. In light of the increasing side effects associated with synthetic drugs, experts have refocused their attention on the potential benefits of medicinal plants[1]. With the emergence of new and drug-resistant diseases affecting both humans and animals, the limited effectiveness of antibiotics and other conventional drugs has highlighted the urgent need for alternative therapies. The antibacterial effects of certain plant extracts can be profound and effective against resistant infectious pathogens when used in combination. Several studies have demonstrated the potential of herbal medicines as safe, effective, and cost-efficient alternatives to conventional drugs for treating certain bacterial infections.[2]

The *Carica papaya* plant is a tropical plant that has many pharmacological activities and is rich in nutrients such as vitamins C, A, and E, minerals magnesium and potassium, pantothenic acid, folate, and fiber.[3-4] It has been extensively studied and its various parts, including the flesh, pulp, root, leaves, and stems, have been shown to have medicinal properties.[5-6] The leaves and flowers of *Carica papaya* have antioxidant and antibacterial properties against *Salmonella typhi*, *Klebsiella pneumonia*, and *Bacillus subtilis*.[7-9] The plant has also been found to have additional medicinal uses, including anticancer, reducing hepatotoxicity, anti-amoebic, hypoglycemic, anti-fertility, and anti malarial activities.[5-12]

Although the seeds of the *Carica papaya* plant are

typically discarded, they have been found to have bacteriostatic activity against gram-positive and negative organisms and could be useful in treating chronic skin ulcers.[13] However, there are only a few reports on antibacterial activities from *Carica papaya* seeds.[14-16] Therefore, it is important to study the in vitro antibiotic activity of ethanolic and aqueous extracts of papaya seeds against *Salmonella* spp and *Candida albicans* to provide more scientifically proven information on the antibacterial activity of this plant. This will help pharmacies and the general public understand the importance of consuming papaya seeds instead of treating them as waste.

MATERIALS AND METHODS

Collection and identification of plant materials

The seeds of *Carica papaya* were obtained from fresh pulp of Papaya fruit obtained from Modern Market Lafia, Nasarawa State, Nigeria. *Carica papaya* seeds were oven-dried at 65^{o}C for 1 hour and crushed with a sterile mortar and pestle to form a coarse powder. The powder was collected in an air tight container and stored in a cool, dry place, away from sunlight[17]. The ethanol and aqueous extract of the seed was carried out. A measure of, 10 grams, 7.5 grams, 5 grams, and 2grams respectively of the extract concentrate was reconstituted in 10 ml of sterile distilled water to obtain solution of different concentrations (100% , 75%, 50% and 20%) used for the antimicrobial screening.[18]

Preparation of media

The media used include Nutrient agar (Oxoid^{TM}) and Potato Dextrose Agar (Oxoid^{TM}) for the maintenance of the test isolates, Nutrient broth (Oxoid^{TM}) for broth culture and Muller Hilton agar (Oxoid^{TM}) for the antimicrobial assay. The media were prepared according to manufacturer's specifications.

Test organisms

The test organisms were collected from the stock cultures of the Medical Microbiology and Parasitology Department, Dalhatru Alhraf Specialist Hospital. The isolates include *Salmonella* spp and *Candida albicans*. Broth culture of the test organisms were prepared by plating the organism in test tube containing 10 mL of nutrient broth and this was incubated at 37^{o}C for three (3) hours prior to the time for antimicrobial test.[19]

Antibacterial screening

The agar well diffusion method established by[20] was used to conduct the antibacterial susceptibility test. A 3-hour-old broth culture of each isolate was swabbed onto the surface of solidified Muller-Hinton agar with even coverage over the entire agar. After drying for five minutes, extract solutions were introduced into wells created in each appropriately labeled petri-dish using a sterile micropipette. To determine the sensitivity of the isolates, commercial antimicrobials (gentamicin and fluconazole) were used as controls. The plates were then incubated at 37°C for 24 hours. The zone of inhibition diameter (IZD) observed was measured using a metric ruler, reported in millimeters (mm), and compared to the gold standard. The results were reported as either resistant or sensitive.

Statistical data

Data obtained was analyzed using Microsoft Excel programme and presented in charts to visualize the impact of the extracts on the different pathogenic microorganism.

RESULTS AND DISCUSSION

In this study, the dried seeds of the *Carica papaya* seeds were tested for their antimicrobial properties against *Salmonella* spp and *Candida albicans*. The seeds were extracted using ethanol and hot water and the results showed that the ethanol extract had weak antimicrobial effects against *C. albicans* with an inhibition zone diameter of 10 mm and 6 mm (Figure 1) compared to the control that had IZD as high as 43 mm. The aqueous extract had no antibacterial effect. These findings are similar to previous studies that also found low antifungal activity against *C. albicans* in papaya seed extract, bacang mango leaf extract, and the combination of red betel leaf and avocado seed extract.[21-23] The antimicrobial properties of papaya seeds may stem from the presence of chemical compounds such as benzyl isothiocyanate which has been found to exhibit antibacterial activity against different strains of bacteria like *Salmonella typhi* and *Staphylococcus aureus*.[24] Other compounds present in papaya seeds, such as carpaine and pseudocarpaine, have also demonstrated antimicrobial activity against various strains of bacteria and fungi.[25-27]

On the other hand, the ethanol extract showed stronger antibacterial activity against *Salmonella* spp than the aqueous extract but lower than gentamycin (control) (Figure 2). The inhibition zone diameter of the ethanol extract increased from 10 mm to 32 mm with an increase in concentration, while the aqueous extract only had IZD of 4 mm and 9 mm at 75% and 100% concentration. This suggests that the components of *Carica papaya* seeds are more readily soluble in ethanol than in water, which aligns with previous findings that ethanol extracts of papaya leaves and stem were found to be more effective against bacteria than aqueous extracts.[9]

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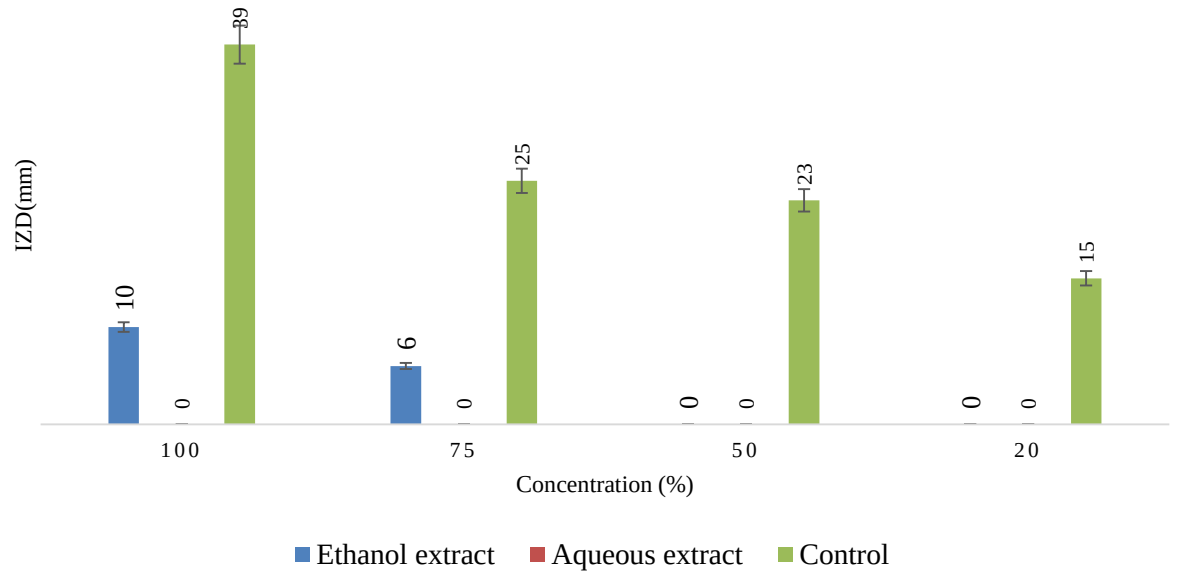

Figure 1. Antibacterial activity of *Carica papaya* seeds on *Candida albicans* showing its inhibition zone diameter, IZD (mm).

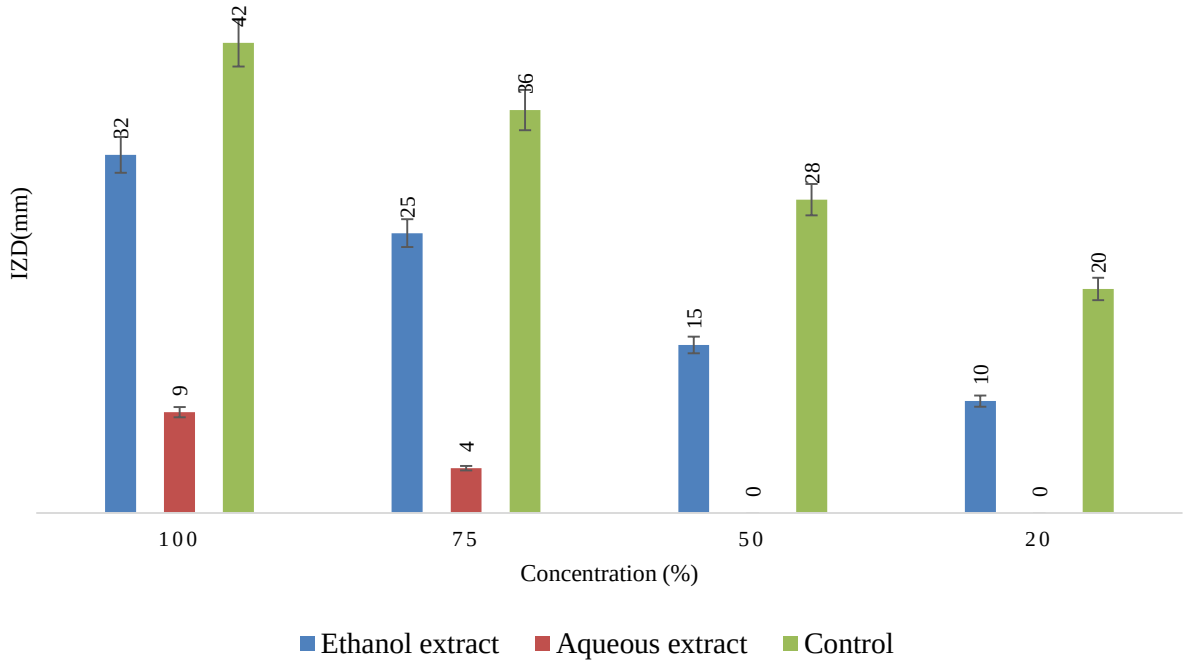

Figure 2: Antibacterial activity of *Carica papaya* seeds on *Salmonella* spp showing its inhibition zone diameter, IZD (mm).

The results of this study indicate the potential antimicrobial efficacy of *Carica papaya* seeds against *Salmonella* spp and *Candida albicans*, however, the small sample size may limit the generalizability of the findings to other microorganisms. The underlying mechanism of the antibacterial activity is not elucidated in this study, and additional research is necessary to shed light on this matter.

CONCLUSION

Carica papaya seed extract activity reveals that the seeds are as important as other parts of the plant and

provides a scientific foundation for the seeds' use in the treatment of many ailments in the local community. The extracts were more efficient against *Salmonella* spp., with the ethanol extract having the higher antimicrobial activity, showing that papaya seed components are more soluble in organic solvents and had better bactericidal properties. As a result, in order to offer a complete picture, thorough investigations of the bioactive compounds in *Carica papaya* seeds and their modes of action are required.

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REVIEW

History of Traditional Medicine Practices in Sudan

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Abstract
In this review study, it is aimed to summarize the information cited about the history of Sudanese traditional medicine practices. The information cited about the history of Sudanese traditional medicine practices was summarized. Sudanese traditional medicine practices are well-established and ancient since the civilization of Kush and Meroe, through the Islamic kingdoms in Sennar, Kordofan and Darfur, up to the period of Turkish and English-Egyptian colonization, and the development of traditional medicine until it reached what it is now in Sudan from the spread of folk healers. The traditional medicine healers are those who practice medicine by genetics, experience, knowledge, and subjective experience. In this chapter, the most important traditional healing practices such as Alfaki, Alkaiy, All Basir, etc. have been highlighted throughout history.
Keywords: Alfaki, Alkaiy, All Basir, History, Traditional Medicine, Zar

INTRODUCTION

Traditional medicine was known to human civilizations before BC, and it is a medicine that is passed on to generations of its practitioners who have had great experience. Its practitioners relied on herbs, plants, and some spiritual methods. This type of medicine has contributed a great deal to improving human health, especially the provision of primary care services at the community level. This medicine still retains its popularity all over the world.[1] Traditional medicine is defined by the World Health Organization as: The set of medical practices, approaches, knowledge, and beliefs that includes the use of medicines, spiritual healing methods, manual techniques, and exercises based on plants, animals, and minerals, which are individually or collectively applied for the treatment, diagnosis, prevention, or maintenance of disease on health.[2] Today, traditional medicine is often called complementary and alternative medicine in many countries. The Attar he is the seller of popular medicines, and he is called (the herbalist) or (the Attar), that is, the pharmacist in our contemporary sense, who sells medicines and drugs in the market. Sudan knew perfumery through the perfumes, herbs and spices that came to it, and it made its way to Sudan through the port of Suakin, which received ships from all over the world, and it began as a well-known trade since 1800 AD.[3] The most famous perfumers known as Al-Taiman, who are brothers: Hamza and Othman, have two adjacent shops in Omdurman market. They are famous for selling bakhur al-taiman (the twin's incense) (Figure 1), which was collected from several aromatic and medicinal herbs by them.

Figure 1. bakhur al-taiman (the twin's incense) (Asia Sudan for Sudanese and Gulf products,

https://www.facebook.com/profile.php?id=100069230589467)

THE HISTORY OF TRADITIONAL MEDICINE

The first thing mankind knew of medicine was using natural plants and herbs, which man searched for and explored after experiencing his pain and healing methods. The history of the study of herbs in written records goes back 5,000 years to the ancient Sumerians who described successful medicinal uses of plants.[4,5] The ancient Chinese civilization knew medicine in the year 2500 BC and wrote many rare medical manuscripts. Historians mention that the ancient Egyptian man used various types of herbs in medicine and folk medicine, and this goes back to the year 1000 BC. M. Manuscripts of Indian folk medicine was found among the ancient Greeks.[6]

1. Sudanese traditional medicine

Traditional folk medicine in Sudan is one of the richest types of folk medicine in the world. It is part of the many ancient Sudanese cultures that date back to the civilizations that were established on the Nile centuries before the birth of Christ, such as the Kushite civilization, the civilization of Kerma, Meroe, Al-Maqra and Alwa. In Sudan, as in other African countries, modern medicine entered with the entry of the colonizer from 1898-1956. And from the reality of the geographical population map of health services, we find that millions are resorting to folk medicine to treat their physical, psychological, and mental ailments. This is due to the inability of modern medical services to reach them, and there is the strongest reason for their belief in the folk healers who were associated with their religious beliefs and sanctities.[7]

Traditional medicine is a complete science that includes Sudanese medicinal herbs and spirituality, which usually includes clairvoyants, midwives, and herbalists.[8] Diagnosis is made through spiritual means, then treatment is prescribed which usually consists of herbal remedies which not only have healing powers, but also symbolic and spiritual significance.[9] The Sudanese traditional healer believes that illness does not occur by chance, but through a spiritual or social imbalance.

Paleopathology, a science that appeared in the period between the eighteenth and nineteenth centuries, which represents the period of interest of archaeologists in ancient diseases, that paleopathology is concerned with the study of diseases that affect the skeletons and through which science can identify diseases.[10] And that among the diseases that are considered common between the ancient Sudan and the modern period, including the Islamic and the current ones, are the diseases of "tuberculosis, anemia, cancer, fractures in the bones, influenza, and malaria. The diseases of fevers, smallpox and cholera spread during the Islamic civilization period. The ancients used folk medicine and local materials for treatment, such as boiling oil, some herbs, minerals, mahreeb (*Potentilla reptans*), ardeb (*Tamarindus indica*), beeswax, and sanamaca (*Cassia angustifolia*).[11]

It became clear that the health conditions in the ancient Sudan were very poor, as diseases spread due to environmental and health conditions, which led to a high death rate among the third decade groups in the period of the ancient Kerma civilization and the Kingdom of Kush.

Traditional Sudanese medicine used through the history for different types of surgery for medical, aesthetic, and social purposes. Most of them were simple practices. The ancient Sudanese sewed the stomachs buried in wars with horsehair, after covering the intestines with squash plants without its skin, so that the wound healed without becoming inflamed, and they marked and scarred women and men. They prevented the disease and practiced cupping and ironing, circumcised boys and girls, repaired fractures and treated bleeding wounds. It is worth noting that all the surgical operations were bleeding due to the ignorance of the popular practitioners in the basics of anatomy and the locations of the arteries and veins, and because they were not familiar with the simplest rules of hygiene and sterilization.[7]

2. Specialties of traditional medicine

The multiplicity of diseases and their differences created the need for specialization so that the specialist excels in the service he provides. Many examples of Sudanese specialized in traditional medicine e.g.

2.1. Al-Faki or AL- Sheikh

He is usually the imam of the mosque, and the religious scholar who has a special religious culture in the countryside. The Sheikh Al-Faqih who teaches the boys the Qur'an and jurisprudence in the maseed. He uses a wood board (loah) which is a stick with a flat surface, on which the verses of the Noble Qur'an are written for memorization (Figure 2). He uses Al-Dawiya, which is a bottle containing ink made of glue, carbon (carbon powder) and water, used for writing on the board. Verses of healing on a wooden board, washed with water and drunk by the patient, its locally known as Mihaya (erasure of holy verse).[12]

In treatment, the Sheikh uses traditional methods,

namely, determination, mihaya, Amulets (hijab), and there is beating, chains, and dieting, which is like coercive treatment in psychiatry, and with an ample space and enough Sheikh's assistants, and the various group and individual activities in the master, all help. A lot in the implementation of rehabilitation and work therapy programs.

Figure 2. Wood board (loah).
Source: https://www.brooklynmuseum.org/opencollection/objects/2909

Figure 3. Amulets (The hijab). Source: Al Safi, A. (2007). Traditional Sudanese Medicine. Azza publishing house, Khartoum, Sudan.

As for the hijab, (Figure 3) which are: papers or leather or other things that are attached to the patient, in which are written Quran verses or supplications that are attached to the patient against weapons, or against the jinn.[13]

2.2. Al-kaiy (Cauterization)

Cauterization (al-kaiy in Arabic) includes using a heated metal instrument (nail or metal rod) for skin application. It is a method commonly used in Arab folk medicine, where the treating healer (Al-Kwai) heat a piece of metal and put it on the place of pain or on a place determined by the healer, given that this place in the human body controls the source his sense of pain. Arabic traditional cauterization was known and practiced before the rise of Islam. Prophet Mohammed (peace be upon him) did not like to be cauterized as he said, "Healing is in three things: cupping, a drink of honey and cauterization (branding with fire) but I forbid my followers to use cauterization"[14].

Although this type of treatment often comes after using other methods of treatment because of the pain it causes for the patient, and there is a well-known popular proverb about cauterization: (the last cautery treatment).

Cautery healers believe that the heat generated by cauterization helps increase the flow of vital energy in the body, dispel cold and strengthen the immune system, and can stimulate blood circulation to alleviate health problems, from chronic pain to digestive issues.

The Sudanese use cautery to treat abdominal pain, headache, stomach, back pain, and other internal diseases. They treat themselves, horses, camels, and all other animals, and believe that it is the most

effective medicine for joint ailments, psychological and nervous diseases.[14, 15]

2.3. Traditional bone setters or All Basir

Traditional bone setters Al Basir is the one who forces fractures, makes medicine for the broken organ, and has knowledge and experience in the bones. The most famous of Al-Basra (All Basir) in Sudan are Al-Basira Zainab Butt Betty, which she inherited from her father, Mustafa Ahmed Betty, and Al-Baseera Betul. The most famous men of insight or vision are Wad Mukhtar, Sheikh Al-Ataya, Awlad Ajeeb, Tayman Rabk, Sheikh Abu Duqan, and Wad Azraq. In Africa traditional bone fracture healers work on splinting bone fractures, by placing simple bandages from any available cloth over the fracture site, then fixing the member with wooden splints made of tree branches known in Sudan as (the tab), as well as working to return the jaw, separation, and retraction.[16]

2.4. The circumciser (Altahar)

The circumciser is one who circumcises boys by traditional methods, and circumcision is a practice practiced by the followers of the monotheistic religions. In some countries, circumcision is practiced by the barber who cuts hair for decoration, because circumcision is a seasonal profession, so the barber practices it in the old barbershop, or when the guardians of the boys request it. In many African societies, male circumcision is carried out for cultural reasons, particularly as an initiation ritual and a rite of passage into manhood. The procedure herein referred to as traditional male circumcision is usually performed in a non-clinical setting by a traditional provider with no formal medical training.[17]

2.5. Cupping (Al-hijama)

Cupping is locally known as Al-hijama in Sudan, it is pressing a glass cup or similar instrument, e.g., hollowed horn, tightly against the skin to draw blood to the surface. The procedure either ends at this stage, or is then called dry cupping, or it becomes wet cupping when the drawn blood is incised and let out.[7] Cupping healer or hajam (local name), is a traditional healer who use cup to treat some diseases. Cupping is an old practice in Sudan inherited from generation to generation.[15] The one who practices cupping epresented by extracting corrupt blood from the body. Cupping is a method for removing bad or excess blood in the human body and suctioning it by using a tool to suction the blood and collect it in certain places of the body, such as the back of the head, the ankles, the stomach of the leg, the thigh, under the chin, the back of the foot, or the lower chest.[18] The instrument used in cupping is a glass cup or the horn of an animal, which cuts the place where the blood was trapped and collected and left to bleed until the collected blood is drained.

The process of suctioning the blood may take about ten minutes, after which the therapist treats the wound by thickening the ashes on it. This method of treatment is derived from the Prophet's medicine, where it was narrated from the Messenger, may God's prayers and peace be upon him and his family, what confirms the feasibility of cupping therapy.[19]

2.6. Traditional surgeon (Al-Jarrah)

Traditional surgeon he is a person who specializes in treating wounds with medicines and herbal compounds, and it is called (albukha), which is a group of herbs or one herb that is crushed and turned into a fine powder, some oils or warm water are added to it, placed in the place of the wound, and wrapped with a piece of cloth. Treat various types of light or deep wounds.[7]

2.7. Traditional folk psychiatry

The disease is as old as man and before modern medicine was treated with folk medicine. The literature of folk medicine indicates that it is an authentic human heritage that relied on the approach of innate observation and trial and error as an entry point to crystallize and embody the phenomenon.[7] The literature of folk medicine is also full of values and concepts derived from belief in patterns of spiritual and psychological treatment, and herbal and natural treatment, and this played a role in establishing its rules and gaining its distinctive position.[20] The treatment in this field comes through responding to the therapist and trusting the medicine with a deep belief in it.

Zar is a group of rituals based on the belief that if a group of spirits of ancestors, masters, and elders conjure up spirit possession or reincarnate their sick souls and respond to their requests, the sick will recover from their disease. The phenomenon of reincarnation of the souls of ancestors and healing through them is a phenomenon rooted in African tribes and has been found in many parts of the Sudan with different names: Al-Rih Alahmar, Al-Zuhr, Al-Dastur, Al-Kjur. The Zar phenomenon is present in many countries neighboring Sudan, African, Arab, and Asian countries.[21]

Zar rite

Zar has many rituals performed by a sheikh or Sheikha Zar. The sheikh is the main figure in performing the rituals, and he has assistants like the female sitter, who is the deputy sheikh, and she must keep the fires of incense burning all the time, monitor and control the participants in the zar ceremony, and

flog anyone who violates the rules. And the Najeeba (Clever) mission is to serve the audience.[22] There is the Jrayah (Runner) which is responsible for distributing invitations and messages. The The grandmother of the Brazier her task is cooking. The girls of the kit must play musical instruments and keep them clean. The bride or the visitor also has an assistant called the minister.

1-Open the box rite

It is a diagnostic ritual. The box is the incense box that represents the sheikh's authority. There are four white, red, black, and multi-colored boxes. Each thread has its own incense. In the Sheikh's first interview with the patient, the Sheikh asks the patient about the symptoms and problems she suffers from, and then releases incense. If there is a response such as crying, convulsions, or a tremor, the patient is diagnosed as possessed, the diagnostic rituals are followed, such as the inspection in which short tones are played, the response of the patient is in mostly for the same type of incense characteristic of the type of thread.[23]

2- Henna rite

The hands and feet of the sick person are covered with henna, as well as the feet of the slaughtered animal and the drum machine. Henna is associated in Sudanese culture with joy and is practiced in circumcision and marriage. And an adornment for a married woman who does not leave her except in cases of mourning, besides henna is applied to the hands and feet of male and female children as part of the ritual circumcision.[24]

Sudanese Zar is found as a therapeutic ritual associated with spiritual beliefs that lasted for centuries and is still ongoing, and in which a process of dialogue and cultural overlap took place, with which this region has been known throughout history and that there are no geographical barriers between it and its neighbors of Arab, African, and European peoples. It was found that the Zar helps a lot in the treatment of mental illness because it is an integrated social psychodrama.[25]

CONCLUSION

Traditional medicine in Sudan has a legacy and a long history in treating ailments, maintaining health, resisting diseases, and physical and psychological rehabilitation. The multiplicity of diseases and their differences created the need for specialization so that the specialist excels in the service he provides. In Sudan Alfaki, Alkaiy, and All Basir are considered good examples of Sudanese specialized in traditional medicine.

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Erratum

The corrections made in the article titled "Comparison of Medical Treatment and Acupuncture in Treatment of Psychogenic Erectile Dysfunction: a Prospective, Randomized, Placebo-Controlled Study" in the 2021, 2nd Volume, 3rd issue of the International Journal of Traditional and Complementary Medicine Research are as follows:

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Corrected Version:

Ismail Evren[1], Ilhan Oztekin[2], Ali Timucin Atayoglu[3*], Noor Buchholz[4], Eyup Veli Kucuk[5]

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Correction Explanation: In the article with the reference of "Evren, I., Oztekin, I., Atayoglu, A.T., Buccholz, N. (2021). Comparison of Medical Treatment and Acupuncture in Treatment of Psychogenic Erectile Dysfunction: a Prospective, Randomized, Placebo-Controlled Study. International Journal of Traditional and Complementary Medicine Research, 2 (3), 121-125. DOI: 10.53811/ijtcmr.985680. Retrieved from https://dergipark.org.tr/tr/pub/ijtcmr/issue/66332/985680" published in the International Journal of Traditional and Complementary Medicine Research Journal in 2021, it was stated by the corresponding author that the author named "Eyup Veli Kucuk, who should be in the 5th place (last author) and whose information is given below, was not written by mistake. The authors apologize to the readers for this mistake. This correction text is presented in order to correct the error in the article.

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