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Effects of Aroma Inhaling on Blood Pressure, Stress and Sleep Quality in Colorectal Cancer Patients Treated With Chemotherapy

Jiwon Jang [1] ,Miyoung Lee* [2]

[1] Department of nursing, Eulji University Hospital,Deunsansero 95, Segu, Daejeon, 35233, south Korea

[2] NursingCollege, EuljiUniversity, Yondudong 143-5, Junggu, Daejeon, 34823, South K orea

Abstract

The purpose ofthis research was to test the effectiveness of aromatherapy on subjective stress,stress indicator,blood pressure and sleep quality in colorectal cancer patients treated with chemotherapy. The subjects were colorectal cancer patients admitted to E University Hospital for chemotherapy (treatment group: 33,non-treatment group: 30).The treatment groupinhaledan aroma oil consisting of a 2:1 lavender and ylang-ylang mix on the second and third days of admission. Regarding data collection, data from the non-treatment group was first collected. Analysis data were measured four times, and t-test and repeated measurement variance analysis were performed.The average age of the subjects was 63.13±8.49. The comparison of the subjective stress and stress indicator measured twice in the preliminary survey preceding the treatment showed that, for both groups, the measured levels were higher on day two of admission than on the day of admission. The measurement condition during the preliminary survey was, for the day of admission, the time before chemotherapy, and for day two of admission, the time after chemotherapy. Subjective stress showed no time-dependent significant difference (F=.665, p=.575), with no significant difference per group (F=3.035, p=.087); however, for the interaction with the group and time, a significant difference was found (F=6.441, p<.001). SBP showed no time-dependent significant difference (F=.780, p=.507), with no significant difference per group (F=.002, p=.968); however, for the interaction with the group and time, a significant difference was found (F=3.245, p=.023). Sleep quality showed a time-dependent significant difference (F=4.733, p=.003), with a significant difference per group (F=5.611, p=.021) and in the interaction with the group and time (F=4.057, p=.008).The findings showed that aromatherapy was effective for patients receiving chemotherapy. Hence, we can use aromatherapy as the nursing care of the colorectalcancer patients undergoing chemotherapy.

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*Corresponding Author

Name:Miyoung Lee

Email: mylee1029@hanmail.net

Contact: +82-010-9409-1109

Fax: +842-259-1709

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INTRODUCTION

The incidence of colorectal cancer in Korea reached 12.3% in 2016, the second highest overall cancer incidence, due to Westernized dietary habits and lifestyle changes (Center NCI, 2017). In 2017, the mortality rate was 11.1%, which was the third highest overall cancer mortality rate, surpassing gastric cancer for the first time since mortality statistics were analyzed(Statistics Korea, 2017).The recurrence rate of colorectal cancer is relatively high. During the early stage when recurrence has a low probability, surgical treatment alone can lead to a complete cure; however, for stage II high-risk groups with an observed risk factor of recurrence, and for stage III groups, chemotherapy is applied as an adjuvant therapy to lower the risk of postoperative recurrence, while for cases of metastasis or recurrence and for stage IV groups, palliative chemotherapy is used to reduce symptoms and prolong life (Baek Y A*et al*.,2015). As can be seen, chemotherapy is performed as the main treatment for colorectal cancer to reduce the rates of recurrence and mortality and to increase the survival rate(Center NCI, 2013), but patients receiving chemotherapy also experience frequent side effects including not only physical symptoms like nausea, vomiting, and reduced appetite, but also psychological symptoms such as stress and sleep disorders. Stress due to repeated admissions and discharges increases the blood pressure and heart rate of colorectal cancer patients, and continuous stress could further deteriorate their health (Jang H S*et al*., 2016).Sleep disorders in patients receiving chemotherapy are caused by a combination of the inherent pain of the disease and the side effects of chemotherapy, stress due to the unclear prognosis, and anxiety about death as well as metastasis or recurrence(Jang H S*et al*., 2016).. However, both patients and medical staff tend to focus on the disease treatment and diagnosis itself, with relatively less interest in the psychological symptoms, while the treatment of such symptoms often relies on drug use with limited effects in colorectal cancer patients receiving chemotherapy(Jang H S*et al*., 2016).

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Aroma inhaling as a method of aromatherapy has been reported as the fastest and simplest way to cause a physical or psychological response, with a positive influence on reducing one's blood pressure and heart rate, relaxing the body and mind, and enhancing the emotional or sentimental state. Thus, it was reported that the stress decreased while improving the sleep disturbance by using this method(Tian J*et al*., 2015;Bae IY*et al*., 2018). In previous studies where aromatherapy was applied to cancer patients, aroma-massage was found efficientat decreasing anxiety and enhancing sleep disturbance in colorectal cancer patients(Ali B*et al*., 2015) and for prolonging the state of sleep in patients after colectomy (CahideA*et al*., 2018).Therefore, the present study aimed to investigate theinfluences onaroma inhaling in colon cancer subjects undergoing chemotherapy with respect to blood pressure, stress, and sleep quality, and to provide the findings as basic data for establishing a nursing intervention.

METHODS

This research used pre-post design of quasi-treatment group and non-equivalent non-treatment group to identify the effects of aroma inhaling on blood pressure, stress, and sleep quality for colorectal cancer patients who undergoing chemotherapy.

Participants

The subjects were colorectal cancer patients admitted to E University Hospital for chemotherapy treatment in the period between August 1 and September 30, 2018. The inclusion criteria were as follows: colorectal cancer patients admitted to the hospital for chemotherapy scheduled for 3 days and 4 nights; patients showing a knowing the purpose of the study and voluntarily consenting to participation in the study;adult subject aged ≥ 20 years with the ability to communicate normally; patients without rhinitis, asthma, or a cold that may affect the olfactory sense. The exclusion criteria were as follows: patients affected by a side effect of aroma oil and patients taking an antianxiety drug or sleeping pill.The size of the sample was determined by using the statistic program(G*Power version 3.1.2). To compare the intergroup differences, the patients of the treatment group was 26 and that of the non-treatment group was 26, based on a previous study(Song E J*et al*., 2018)that applied an .80effect size(d),.80 statistical power (1-beta), and significance level .05(1-alpah). The sample size based on a 20% dropout rate was 33 in each group (i.e., a total of 66 patients).Three patients in the non-treatment group was excluded from the study: one for an elevated liver index in their blood test upon admission, one for severe nausea and vomiting and one for receiving central vein cannulation. Thus, data were collected from 63 patients.

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Participant protection

This study was experimented with priorwith the prior approval of IRB(Approval No. EMC 2018-010-001). This study was enrolled for prior approval to protect study subjects(Registration No. KCT0003395). The collected data were given a unique ID according to the guidelines for personal information control for protection.

Measurements

Blood pressure

Portableblood pressure monitor (HBP-1300, OMRON, China) was used for measuring the systolic blood pressure (SBP) and diastolic blood pressure (DBP), and in unit of mmHg.

Stress

Subjective stress wasexpressed as a number between 0 and 10., where 0 indicated *no stress* and 10 *the worst stress possible*, with an increase in the score indicating an increase in the subjective stress.The Stress indicator was measured using a Canopy9 PLUS (IEMBIO, Korea), a measuring device for the autonomic nervous system. An increase in its numerical value indicated increased exposure to a stressful situation, where 1 indicated *no stress at all* and 10 indicated an extremely high level of stress.

Sleep quality

Sleep quality was measured by the VSHSleep Scale, comprised ofeight questions in total. The measured score of each item was given on a scale of 0 to 10, where an increase in the score indicated an increase in sleep quality.

Experimental procedures

Selection of aroma oil

The oil was a blend of lavender and ylang-ylang at a 2:1 ratio, placed in a light-resistant container and stored in a refrigerator.

Data collection

The treatment group was guided to apply 3 drops (1 drop = 0.05 cc) of the aroma essential oil on an aroma stone, then place it 10 cm in front of their nose 4 times for 15 secofinhaling within 1 minute, followed by sleeping with the oil placed within a 30 cm radius of their pillow. The non-treatment group was guided to sleep after general nursing care.The preliminary surveypreceding the treatment was carried out twice to comparesleep quality at home with that at the hospital, while the treatment was also performed twice to compare the effect after a single treatment with that after two consecutive treatments.Regarding data collection, the data of the non-treatment group was collected first to prevent the potential

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disclosure of the treatment details. The detailed experimental procedure was as follows. The followingsix data (A= general characteristics, B= disease-related characteristics, C=subjective stress, D=stress indicator, E= blood pressure, and F= sleep quality on the previous day) were collected.

Pre-test I: On the day of admission.The following data(A, B, C, D, E, F) were measured.

Pre-test II: On the second day of admission (8AM). The data(C, D, E, F) were measured.

Treatment I: On the second day of admission (8PM).The treatment group was guided to sleep following aroma inhaling, while the non-treatment group was guided to sleep after general nursing care.

Post-test I: On the third day of admission (8AM). The data(C, D, E, F) were measured.

Treatment II: On the third day of admission (8PM). The treatment group was guided to sleep following aroma inhaling, while the non-treatment group was guided to sleep after general nursing care.

Post-test II: On the fourth day of admission (8AM). The data(C, D, E, F) were measured.

Data analysis

For the general characteristics, disease-related characteristics, and dependent variables, the homogeneity was tested by the X^2-test, Fisher's exact test, and t-test. The differences between before and after treatment time in the blood pressure, stress, and sleep quality were analyzed by t-test and repeated measures analysis of variance.

RESURT AND DISCUSSION

The homogeneity test of general characteristics in the two groups found no meaning singularityin age, gender, marital status, education, occupation, religion, exercise, alcohol drinking, smoking, coffee drinking, and pain. That of disease-related characteristicsfound no meaning singularityin chemotherapy times, chemoport use, cancer stage, and chemotherapy regimenas seen in Table 1. That of the dependent variables between the two groups prior to treatment also found no significant differences in subjective stress(t=.314, p=.755), stress indicator(t=-1.799, p=.077), SBP (t=1.662, p=.102), DBP (t=1.598, p=.115), or sleep quality(t=1.125, p=.267), thus verifying the homogeneity between the two groups as shown in Table 2.

Table 1:Disease-related and general trait outcome tests. (n=63)

Characteristic	Type	Treatment group(n=33)	Non-treatment.group(n=30)	X^2 *or* t	p

Annals of R.S.C.B., ISSN:1583-6258, Vol. 25, Issue 1, 2021, Pages. 1602 - 1612

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		M±SD/n(%)	M±SD/n(%)		
Average years		64.03±8.85	62.13±8.11	.884	.380
Sex	Male	23(69.7)	18(60.0)	.650	.420
	Female	10(30.3)	12(40.0)		
Marriage	Married	32(97.0)	27(90.0)	1.284	.340*
	Not married	1(3.0)	3(10.0)		
Academic background	primary school	10(30.3)	7(23.3)	3.484	.365
	Junior high school	6(18.2)	3(10.0)		
	Senior high school	13(39.4)	11(36.7)		
	college	4(12.1)	9(30.0)		
Job	Yes	14(42.4)	18(60.0)	1.942	.163
	No	19(57.6)	12(40.0)		
Religion	Christian	7(21.2)	6(18.2)	.355	.966*
	Buddhist	6(18.2)	4(13.3)		
	Catholic	1(3.0)	1(3.3)		
	No religion	19(57.6)	19(63.3)		
Exercise	Yes	26(78.8)	21(70.0)	.641	.424
	No	7(21.2)	9(30.0)		
Alcohol drinking	Yes	0(0)	1(3.3)	1.118	.476*
	No	33(100)	29(96.7)		
Smoking	Yes	3(9.1)	4(13.3)	.286	.700*
	No	30(90.9)	26(86.7)		
Coffee	Yes	17(51.5)	16(53.3)	.021	.885
	No	16(48.5)	14(46.7)		
Pain	Yes	8(24.2)	4(13.3)	1.213	.271
	No	25(75.8)	26(86.7)		
Chemotherapy time	1–3	13(39.4)	9(30.0)	.979	.832*
	4–6	9(27.3)	9(30.0)		
	7–9	4(12.1)	3(10.0)		
	10 over	7(21.2)	9(30.0)		
Chemoport	No	10(30.3)	10(30.3)	.001	.979
	Yes	23(69.7)	23(69.7)		
Cancer stage	Stage II	8(24.2)	8(24.2)	.305	.858
	Stage III	15(45.5)	14(42.4)		

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	Stage IV	10(30.3)	11(33.3)		
Chemotherapy regimen	Avastin+Folfiri	4(12.1)	6(20.0)	1.260	.865*
	Avastin+Folfox	7(21.2)	7(23.3)		
	Cetuximab+Folfiri	6(18.2)	6(20.0)		
	Folfiri	2(6.1)	1(3.3)		
	Folfox	14(42.4)	10(33.3)		

M±SD.Mean±Standard Deviation,*fisher's exact test

Table 2:Pre-validation of outcome variablesbetween two groups(n=63)

Variable	Treatment.group (n=33) M±SD	Non-treatment.group (n=33) M±SD	*t*	*p*
Subjective stress(NRS)	4.48±3.03	4.27±2.42	.314	.755
Stress indicator(Canopy9)	6.30±3.41	7.67±2.58	-1.799	.077
SBP(systolic blood pressure)	125.09±14.93	118.30±17.49	1.662	.102
DBP(diastolic bloodpressure)	77.52±9.05	73.27±11.97	1.598	.115
Sleep Quality(VSH)	55.76±7.92	52.27±15.23	1.125	.267

Table 3 summarizes the dependent variable results. Subjective stress showed no time-dependent significant difference (F=.665, *p*=.575), with no significant difference per group (F=3.035, *p*=.087); however, for the interactionin two time-based groups, a significant difference was found (F=6.441, *p*<.001). The effect of aroma inhaling on subjective stresswas thus supported by a significant intergroup difference.The stress indicator showed no time-dependent significant difference (F=.143, *p*=.934), with neither a significant difference per group (F=.121, *p*=.729) nor in the interactionin two time-based groups (F=2.509, *p*=.067). The effect of aroma inhaling on thestress indicatorwas thus rejected due to the lack of a significant intergroup difference.SBP showed no time-dependent significant difference (F=.780, *p*=.507), with no significant difference per group (F=.002, *p*=.968); however, for the interaction between the group and time, a significant difference was found (F=3.245, *p*=.023).Thus, the effect of aroma inhaling on SBP in interaction in two time-based group was statistically significant.

DBP showed no time-dependent significant difference (F=1.320, *p*=.269), with no significant difference per group (F=.159, *p*=.691) or in the interactionin two time-based groups(F=1.701,

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p=.168). The effect of aroma inhaling on DBP was thus rejected due to the lack of a significant intergroup difference.Sleep quality showed a time-dependent significant difference (F=4.733, *p*=.003), with a significant difference per group (F=5.611, *p*=.021) and in the interaction in two time-based groups(F=4.057, *p*=.008). Effect of aroma inhaling on sleep qualitywas thus supported by a significant intergroup difference.

Table 3:Comparison of dependent variables between two groups(n=63)

Variable	Time	Treatment. group (n=33) M±SD	Non-treatment. group(n=30) M±SD	t	*p*	Sources	F	*P*
Subjective stress	Pre-testI	4.48±3.03	4.27±2.42	.314	.755	Group	3.035	.087
	Pre-testII	4.55±3.29	4.70±2.28	-.218	.828	Time	.665	.575
	Post-testI	4.45±3.17	5.27±2.59	-1.107	.273	Group*Time	6.441	<.001
	Post testII	2.94±2.98	5.87±2.54	-4.175	<.001			
Stress indicator	Pre-testI	6.30±3.41	7.67±2.58	-1.799	.077	Group	.121	.729
	Pre-testII	7.24±2.65	6.73±3.10	.704	.484	Time	.143	.934
	Post-testI	7.18±2.57	6.57±2.98	.880	.382	Group*Time	2.509	.067
	Post testII	6.55±2.92	7.03±2.80	-.676	.502			
SBP	Pre-testI	125.09±14.93	118.30±17.49	1.662	.102	Group	.002	.968
	Pre-testII	118.64±15.06	119.33±18.44	-.074	.870	Time	.780	.507
	Post-testI	118.06±16.83	124.57±17.75	-1.467	.141	Group*Time	3.245	.023
	Post testII	122.33±14.89	121.4±15.66	.395	.809			
DBP	Pre-testI	77.52±9.05	73.27±11.97	1.598	.115	Group	.159	.691
	Pre-testII	72.76±11.00	73.33±9.88	-.218	.828	Time	1.320	.269
	Post-testI	72.18±9.25	74.00±11.81	-.684	.497	Group*Time	1.701	.168
	Post testII	75.42±11.69	73.9±12.38	.503	.617			
Sleep Quality	Pre-testI	55.76±7.92	52.27±15.23	1.125	.267	Group	5.611	.021
	Pre-testII	45.88±17.84	46.63±18.14	-.166	.868	Time	4.733	.003
	Post-testI	51.90±16.78	42.93±15.23	2.215	.031	Group*Time	4.057	.008
	Post testII	57.45±10.77	43.47±18.15	3.760	<.001			

The comparison of the stress(subjective stress,stress indicator) measured twice in the preliminary survey preceding the treatment showed that, for both groups, the measured levels were higher on day two of admission than on the day of admission. The measurement condition during the preliminary survey was, for the day of admission, the time before chemotherapy, and for day two of admission, the time after chemotherapy. In addition, both stress indicator and subjective stress in the non-treatment group were found to have increased. This confirmed that chemotherapy was a factor that increased the colorectal cancer patients'

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stress.

In a study that applied aroma inhaling to patients who had received a coronary angiography (Song E J*et al*., 2018), a contrasting result to the present study was reported, where no significant difference was found for subjective stress, while statistically significant difference was shown in stress indicator. Nonetheless, a gradually decreasing trend in subjective stress was observed following the treatment(Song E J*et al*., 2018) in this study . Moreover, when aroma inhaling was applied to patients with solid cancer (Choi E M *et al*., 2012), stress was found to have significantly decreased, thus lending support to the present study. The findings collectively suggested that aroma inhaling contributed to alleviating stress in colorectal cancer patients admitted for chemotherapy treatment.The result of testing the effects of aroma inhaling on the blood pressure of colorectal cancer patients receiving chemotherapy showed that, while a significant difference was found for SBP, no significant difference was found for DBP. The interaction between the group and time also showed a significant difference for SBP, but due to the lack of correlation between SBP and the treatment in both groups, the effects of aroma inhaling could not be verified, with no significant result.In a study that applied aroma inhaling to patients who received a coronary angiography , a significant difference in blood pressure was found. However, in a study that applied aroma inhaling(Song E J*et al*., 2018), to admitted to the intensive care unit for myocardial infarction(Mirbastegan N *et al*., 2016), no significant difference was found, in line with the present study.The lack of a significant result in this study is thought to be due to the lack of coincidence in the individual situation of the subjects, as they differed in terms of chemotherapy times, while a test to examine the chemotherapy result, tumor size, and metastasis was carried out on the day of discharge every fourth chemotherapy session. In addition, the blood pressure of the subjects was mostly stable prior to the treatment, with no sudden change after the treatment.Sleep quality after the treatment, on the contrary, showed a significant intergroup difference.Although the comparison with previous studies and respective interpretation is limited due to the differences in subjects, aroma essential oil types, and application methods, the results of this study agreed with a study that applied the treatment in patients who received colorectal cancer resection (CahideA*et al*., 2018)and a study that applied an oil blended with lavender and sweet almond to patients with solid cancer or blood cancer (Tian J*et al*., 2015), where sleep quality after the treatment was found to have increased in the treatment group but decreased in the non-treatment group. The results thus verified the effect of aroma inhaling on enhancing sleeping quality, and as sleep quality

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in the non-treatment groupdecreased in line with the progress of chemotherapy, it was shown that chemotherapy is a factor that reduces sleep quality,meaning that the findings of this study are significant.Sleep quality was also shown to have increased in a study applying aroma oil massage to patients who received a colectomy (Choi E M *et al*., 2012). As in this study, lavender oil was used in the intervention to verify its effecton insomnia, which lends support to the findings of this study. Aroma inhaling is thus reported to have a beneficial effect on enhancing sleep quality, and based on the findings, aroma inhaling could be applicable to various patient groupsto get bettersleep quality in admitted patients.

CONCLUSION

This study investigated the effects of aroma inhaling on stress and found reduced stress and enhanced sleep quality in the treatment group. Effects were greater after two consecutive treatments than a single application. The subjects in this study were patients with colorectal cancer, and for three nights and fourdays, the effects after four consecutive treatmentswith aroma inhaling were comparatively analyzed. The significance of this study lies in that the analysis included the interaction between the group and time regarding stress and sleep quality.

Hence, the positive effects of aroma inhaling on stress and sleep quality have been verified. To generalize these verified effects, further studies should be conducted with a wider scope of subjects.

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