

## Original Article

# Assessing Cognitive Function in Cancer Patients After Chemotherapy

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**This study was conducted in the oncology clinic of Goztepe Prof. Dr. Suleyman Yalcin City Hospital. e- mail: istanbuleah13@saglik.gov.tr**

### Abstract

**Background:** Chemotherapeutic agents frequently used in cancer treatment cause changes in cognitive functionality.

**Aim:** This study was conducted to assess the cognitive functionality of cancer patients receiving chemotherapy treatment.

**Methods:** The study had a cross-sectional design and adhered to the STROBE Guidelines. The present study was conducted in the oncology department of a state hospital in Turkey in descriptive design. It was conducted between September 2018 and February 2019 with 100 patients using the purposeful sampling method. The “Montreal Cognitive Assessment Scale (MoCA)” was used in the study to assess cognitive status.

**Results:** The average of the general scores were found to be  $18.73 \pm 3.7$ , and the cognitive function of 70% of the patients was low. The patients scored below the average scores that could be obtained in the language ( $1.31 \pm 0.971$ ) and delayed recall ( $0.9 \pm 1.168$ ) sub-dimensions. Those who took platinum and Taxane-containing cures had lower abstract thinking score averages than those who took only Taxane-containing cures.

**Conclusion:** Risky groups that might be affected in terms of cognitive functionality in cancer patients were female gender, being married, having low educational status, not working in an active job, and receiving platinum and Taxane-containing chemotherapy.

**Keywords:** Cancer, chemotherapy, cognitive functioning, cognitive impairment

### Introduction

Today, cancer has become an important healthcare issue in terms of its incidence. More than 19.3 million (19.300.000) new cancer cases were identified and reported according to 2020 data (Ferlay et al., 2021). Constant cancer cases worldwide have led to the emergence of strong treatment modalities. Surgery, chemotherapy, and radiotherapy are among the most basic methods used in the treatment of cancer (Hermelink, 2015). These treatments can be used alone or in combination. Chemotherapy, which is one of the most widely used

treatment types, eliminates rapidly divided cancer cells but affects the healthy cells of the body. This mostly causes side effects that affect the quality of life of the individual negatively (Pearre and Bota, 2018). Progress in cancer treatment led to an increased number of survivors of cancer. For this reason, the quality of life of the patients receiving chemotherapy has become an even more important issue.

One of the factors affecting the quality of life of cancer patients receiving chemotherapy treatment negatively is the decreased cognitive functionality because of the

treatment (Ahles et al., 2012; Hess & Insel, 2007; Kovalchuk & Kolb, 2017; Barry et al., 2018; Pearre & Bota, 2018 2018). Cognitive functionality is possible with the healthy conduct of attention, naming, language, orientation, memory, and abstract thinking activities, which support individuals' learning, communication, movement, and observation. Decreased cognitive functionality may affect the capacity of people to return to daily life activities. These changes in cognitive functions affect the functionality of individuals in self-care negatively along with their social participation and producer activities. In some previous studies, cognitive functions were examined in patients with breast cancer treatment and it was reported that cognitive deterioration was detected in executive functions (HSU et al., 2021, Ibrahim et al., 2021).

The change in cognitive functions receiving chemotherapy brought up the concept of "Chemobrain" in the 1980s (Ahles et al., 2012; Hess & Insel, 2007; Kovalchuk & Kolb, 2017). Chemobrain is a general concept about the side effects of chemotherapy on cognitive functions and has changed over time (Barry et al., 2018; Hurri et al., 2006; Kovalchuk & Kolb, 2017). The concept of Chemotherapy-Related Cognitive Impairment (CRCI) is a problem that defines a widely defining cognitive functionality following the administration of chemotherapy treatment in cancerous patients in the present day (Bernstein et al., 2017). An increasing number of meta-analyses and studies have now acknowledged the presence of cognitive disorder following treatment known as cognitive disorder (CRCI) attributed to chemotherapy (Bernstein et al., 2017; Collins et al., 2014; Menning et al., 2016; Ono et al., 2015). According to the available evidence, CRCI prevalence varies between 7.3% and 33% in six-nine weeks receiving chemotherapy (Cheung et al., 2015; Ng et al., 2018; Weis et al., 2009). CRCI incidence was reported in 16-48 % of patients up to one year immediately following the chemotherapy. Cognitive deterioration was often determined at a higher level especially in attention, memory, processing speed, and functions

(Collins et al., 2013, 2014; Menning et al., 2016).

Previous studies reported that CRCI may continue for months receiving chemotherapy and for this reason, patients face difficulties in maintaining their role and responsibilities in their lives (Alwia et al., 2021). The effect of factors such as the type, duration, number of cycles, and dosage density of chemotherapy on CRCI maintains its uncertainty yet (Alwia et al., 2021). In a study that was conducted with individuals who were receiving chemotherapy because of breast cancer, word loss, and memory problems were found to be the most common problems in the cognitive field. It was reported in the same study that patients had difficulty in maintaining their daily activities because of decreased focus/attention capabilities (Boykoff et al., 2009). According to Ahles et al. (2012), patients faced problems in areas such as memory, attention, naming, and performing multiple tasks, as well as generally decreased cognitive functions (Ahles et al., 2012). Lange et al. (2019) reported that 75 % of their patients had cognitive problems in their study conducted with 1393 cancer patients and that 76% of the patients had problems with continuing and continuing their daily lives (Lange et al., 2019). It was reported in a meta-analysis study that Taxane-based chemotherapy treatments disrupted nerve transmission by distorting the neurons. It was also reported in the same study that this deterioration in neurons caused changes in hippocampal functions and led to the deterioration of cognitive functions and triggered depression (Ibrahim et al., 2021). Taxane-based chemotherapy also caused deteriorations in cortex-based task performance, including cortical gray ore loss, attention, verbal memory, and administrative functions (Ibrahim et al., 2021)

Considering that the basic philosophy of treatment and care is to maintain the health of individuals or bring them to better levels, the quality of cognitive and mental life of cancer patients as well as their physical health must be maintained. In this context, it is considered that the results of the study will contribute to the clinicians working in the field of oncology in terms of assessment of the cognitive functions affecting mental

health and taking necessary measures. Considering that the cognitive functions of patients with breast cancer was assessed in previous studies, it is considered that the results of this study will contribute to the literature on cognitive functionality levels of other chemotherapy patients.

**Aim:** This study was conducted to assess the cognitive functionality of cancer patients receiving chemotherapy treatment.

### **Materials and Methods**

**Design:** The study had a cross-sectional design and adhered to the STROBE Guidelines.

**Setting and study participants:** The study was conducted at a university hospital in Turkey. The study population consisted of patients who completed curative chemotherapy because of cancer in 2020 and came to follow-ups in the 6th month. The size of the population could not be reached because the treatment and follow-up dates in the hospital records were not specified. In the study that was conducted by Araújo et al., "Trajectories of Cognitive Performance Over Five Years in a Prospective Cohort of Patients With Breast Cancer (NEON-BC)" was reported to be 25.9% (Araújo et al., 2021). In this respect, according to 95% power analysis, the minimum sample size was determined as 90 patients. In the sample size calculation, the size of the effect was 0.3 and the first type of error ( $\alpha$ ) was 0.05. The G Power (Ver.3.1.9.4) program was used in the calculation of power analysis. Patients with neurological medical diagnoses such as vision and hearing obstacles known to affect cognitive function, especially stroke, and dementia, were excluded from the study. Patients who had brain tumors or metastases and patients who had not received radiotherapy treatment in the head and neck area were included in the study. A total of 100 patients who agreed to participate in the study formed the sample of the study in accordance with the inclusion/exclusion criteria.

**Data Collection:** Patient file data were examined by the researchers, and the patients who fit the criteria of the study sample were identified. The data were collected in a special interview room to eliminate external factors such as sound, light, and crowd, which might affect cognitive functions to ensure the effectiveness of the MoCA scale. The

application of each form took an average of 15 minutes. The Demographic Characteristics Form and the Montreal Cognitive Assessment Scale (MOCA) were used in the study as the data collection tools. The Demographic Characteristics Form consisted of 10 questions on demographic information such as age, gender type of treatment, and file information such as the number of cures chemotherapeutic agents used in the treatment, and number of cures of the patient (Jansen et al., 2011, Ibrahim et al., 2021) In the present study, the Montreal Cognitive Assessment (MoCA) showed acceptable internal reliability among participants, with a Cronbach's alpha coefficient of 0.781.

**Montreal Cognitive Assessment:** MOCA was developed in 1996 by Ziad Nasreddine as a quick scanning test for the mild cognitive disorder. The MoCA is one page, 30-point test that assesses several cognitive domains including executive function, visuospatial function, complex attention, language, memory recall, and abstract thinking. The total score ranges from 0 to 30, with a test result of  $\leq 24$  points indicating cognitive impairment and  $>24$  points indicating normal cognitive function. The MoCA has good reliability (Cronbach alpha 0.73-0.85). The Turkish validity of the scale and its reliability study was conducted by Selekler et al. (2010) and the cut-off point was determined as 21 in this sample. The Turkish validity of the scale and its reliability study was conducted by Selekler et al. (2010) and the cut-off point was determined as 21 in this sample. In the present study, the Montreal Cognitive Assessment (MoCA) showed acceptable internal reliability among participants, with a Cronbach's alpha coefficient of 0.781.

**Ethical considerations:** The study conformed with Helsinki Good Clinical Practice Principles. Official permission letters were obtained from the Uskudar University Ethics Committee (Date:10.09.2018, No:23898784-604.01.01) and the university hospital where the study was conducted to conduct the study. All participants received verbal and written information and voluntarily provided consent before commencing the study. Low MoCA scores were reported to the oncology care team.

**Data analysis:** It was found in the normality analysis (Shapiro-Wilk) that the sub-dimensions of the scale were not normally

distributed and the whole scale was distributed normally. In the analysis of the MOCA scale with independent variables, the One-Way Anova Test was used for more than two groups, and the Independent Samples T test was used for binary groups. In case there was statistical significance ( $p < 0.05$ ) in ANOVA Test, the Tukey Test was applied in homogeneously distributed groups to determine which group of significance was caused. Because of the normal disintegration of the sub-dimensions of the MOCA scale, the Mann-Whitney U Test was used for binary groups from nonparametric tests, and the Kruskal-Wallis test was used for more than two groups. In the post-hoc analysis of the Kruskal-Wallis Test, the Mann-Whitney U Test was used in the form of binary comparisons between the groups. In all assessments, when the P value was below 0.05, it was accepted that there were statistically significant differences between the groups.

## **Results**

A total of 66% of the patients who participated in the study were over 46 years of age, 81 %were women, 88% were married, 65% were primary school graduates, and 69% did not work in an active job. Half of them were breast cancer patients (50%), 51% were in the third stage, 41% received only chemotherapy treatment with Taxane Content, and 68% completed the treatment cure between 6 and 8 (See Table 1).

A total of 70 %of the cancer patients were found to have a total average score of MOCA of  $18.73 \pm 3.79$  following the treatment of under 21 points (See Table 2) and the total MoCA score was  $18.73 \pm 3.79$  (See Table 3). When the mean score of MoCA was examined, no patients were detected who had full points in the delayed recall. Some patients had 0 points from MOCA sub-dimensions of visual-spatial functions, language, abstract thinking, and delayed recalling. The patients had the lowest scores in Delay Recalling ( $0.9 \pm 1.168$ ), Abstract Thinking ( $1.12 \pm 0.782$ ), Language ( $1.31 \pm 0.971$ ), and Naming ( $2.41 \pm 0.683$ ) sub-dimensions (See Table 3).

A significant difference was detected between the average MOCA score and the gender and active working status of the patients ( $p < 0.05$ )

(See Table 4). It was seen that the average of female patients in the total score of MOCA and the average sub-dimension scores of the sub-dimension of naming and attention were lower than men ( $p < 0.05$ ). There was a significant difference between education status, MOCA Total Points, Attention, Language, and Abstract Thinking Sub-dimension scores ( $p < 0.05$ ). According to the Post-Hoc analysis, attention is because of the significance in the attention sub-dimension stemmed from the difference in the scores of the primary school graduates and high school and college graduates; the significance in the language sub-dimension stemmed from the difference between the primary school graduate and the graduates of the high school; and the significance in the abstract thinking stemmed from the difference between the primary school graduates and high school and college graduate ( $p < 0.05$ ). It was also found that the average scores of the working patients in visual-spatial, naming, attention, language sub-dimension, and the total MOCA scores were significantly higher than the non-working group ( $P < 0.05$ ) (See Table 4).

No significant differences were detected between patients' cancer type, stage, chemotherapy content, number of cures, and total mean MoCA scores. However, there were significant differences between the average of the cancer type and chemotherapeutic agent contents and the average of attention and abstract thinking sub-dimension scores ( $p < 0.05$ ) (See Table 4). In the Post-Hoc analysis, it was found that the difference in the average attention sub-dimension was caused by breast cancer, and gynecological and urological cancers ( $p < 0.05$ ). The attention sub-dimension scores of patients with urological cancer were found to be higher than breast and gynecological cancers. It was also found that the difference in the average abstract thinking sub-dimension scores was caused by lung and urological cancers and patients with lung cancer had a lower score in this area ( $p < 0.05$ ). The difference in the average abstract thinking sub-dimension scores was because of the difference between platinum and Taxane-containing cure and only platinum-containing cure. Those who received platinum and Taxane-containing cures had lower abstract thinking score averages compared to those with only Taxane cures ( $p < 0.05$ ) (See Table 4).

**Table 1:** The demographic and disease characteristics of the patients (n=100)

		N	%
<b>Age (mean:50.4)</b>	18-30 years old	5	5.0%
	31-45 years old	29	29.0%
	over 46 years old	66	66.0%
<b>Gender</b>	Female	81	81.0%
	Male	19	19.0%
<b>Marital status</b>	Married	88	88.0%
	Single	12	12.0%
<b>Educational status</b>	Primary education	65	65.0%
	High school	20	20.0%
	University	15	15.0%
<b>Active working status</b>	Working	31	31.0%
	Not working	69	69.0%
<b>Cancer type</b>	Breast cancer	50	50.0%
	Gynecological cancers	20	20.0%
	Gastrointestinal system cancers	16	16.0%
	Lung cancer	8	8.0%
	Urological cancers	6	6.0%
<b>Stage of cancer</b>	1. stage	11	11.0%
	2. stage	38	38.0%
	3. stage	51	51.0%
<b>Class of chemotherapy</b>	Based on Platinum	24	24.0%
	Based on Taxane	41	41.0%
	Based on Taxane and platinum	25	25.0%
	Not based on Taxane and platinum	10	10.0%

**Table 2:** The assessment of cognitive impairment

MoCA Scores	N	%
<21	46	51.1
≥21	44	48.9
Total	90	100

**Table 3:** The assessment of cognitive function

MoCA and Domains Scores	min	max	x±SD
Visuospatial function	0	5	2.39±1.86
Naming	0	3	2.38±.77
Attention	0	6	4.11±1.94

Language	0	3	1.80±1.10
Abstract thinking	0	2	.94±.85
Delayed memory	0	5	1.50±1.67
Orientation	2	6	5.67±1.67
Total MoCA Scores	4	30	18.79±6.74

## Discussion

The cognitive functionality of cancer patients who receive chemotherapy was assessed by using the MOCA Scale and the total average of total MOCA was found to be  $18.73 \pm 3.79$  (See Table 3). In previous studies conducted on the subject, cognitive deterioration was seen at rates of 17% and 75% in breast cancer patients who were receiving chemotherapy (Ahles et al., 2012; Hermelink K., 2015; Ibrahim et al., 2021; Pearre & Bota, 2018). When the literature was reviewed, it was found that cognitive function is affected not only by chemotherapy but also the treatments such as surgery, radiotherapy, and hormone therapy (Chen et al., 2017).

It was found that the total MoCA scores of the patients who participated in the study were affected by gender, education, and working status. The total MOCA scores of female cancer patients receiving chemotherapy and the naming and attention sub-dimension scores were lower and cognitive function in these areas was less than in men (See Table 4). Yang et al. (2021) reported that men and women had different biological mechanisms because of their psychological strength and this changed their cognitive functionality. In the same study, considering the protective effects of male testosterone from mood and anxiety disorders, these disorders have a higher risk of occurrence in women and this affects cognitive functionality negatively (Yang et al., 2021). It is already known that this decrease in cognitive functionality affects the performance of individuals in terms of functionality in daily life such as self-care, social participation, and producer activities (Pearre and Bota, 2018). In their study aiming to determine the professional performance priorities of 102 women with breast cancer, Jamshidi et al. (2019) found that women had problems in the fields of social management (shopping), functional mobility

(transportation), home administration (laundry) and socialization (visiting others).

It was found in the present study that the average scores in attention, language, naming, abstract thinking, and visual-spatial sub-dimensions were low in patients with low educational levels and non-working patients (See Table 4). Similar results were reported in the studies conducted on the subject and it was stated that the level of education and working status affect cognitive functionality (Ahles et al., 2012; Lange et al., 2014). This finding can be explained by the concept of cognitive reserve. Arola et. (2021) reported that cognitive reserve affected by the level of education and working status is a protective factor in preventing cognitive deterioration. It is reported in the literature that participation in cognitively stimulating activities reduces cognitive deterioration despite the formation of more cognitive reserves and important brain pathologies (Arola et al., 2021; Stern et al., 2019). These findings show that education and working in any job have effects on maintaining functionality by providing cognitive reserves.

The mean attention sub-dimension score of patients with urological cancer was found to be higher than those of breast and gynecological cancers in the study (See Table 4). In previous studies conducted on this subject, it was reported that the cognitive functionality of female cancer patients is lower than that of men (Ahles et al., 2012; Lange et al., 2014). This can be explained by the fact that most of the participants in the study were women (81%) and the attention sub-dimension scores of the women participating in the study were lower than the men (See Tables 1 and 4). In the study, it was also found that the abstract thinking sub-dimension score average was lower in patients with lung cancer than in patients with urological cancer (See Table 4). Chen et al.

(2008) found in their study that lung cancer patients who were receiving chemotherapy had lower cognitive functionality. This is considered to be because the treatment used in patients with lung cancer is more complex than the treatment applied in urological cancers. A lower average score of abstract thinking was found in patients treated with taxane and platinum-containing chemotherapeutic agents than in patients treated with Taxane-containing agents in the study (See Table 4). In previous studies conducted on the subject, it was reported that platinum and Taxane-based treatments, which are chemotherapeutic agents, often cause neurotoxicity (Colvin, 2019; Kurt & Can, 2018). Inflammatory changes in the hippocampus, which are involved in the regulation of memory and recall, cause cognitive disorders over the interactions between neurons and glial cells. For this reason, neurotoxic side effects such as dementia, depression, learning disability, and cognitive impairment occur because of chemotherapy treatment (Ibrahim et al., 2021; Wilson et al., 2002; Yang & Moon, 2013).

**Limitations:** The present study had several limitations. The study did not provide any findings about the patients receiving treatment in private hospitals because the place of application of this study was a public hospital where patients with low education and socioeconomic status applied. For this reason, it is recommended that the study be conducted in private hospitals where patients with better socioeconomic status apply. Also, only patients who received chemotherapy treatment were assessed in the study. For this reason, assessment of cognitive function is also recommended in patients who receive different treatments such as radiotherapy and hormone therapy together. It is considered that brain imaging studies will also be useful in assessment studies, aside from scales.

**Conclusion:** It was found in the study that the cognitive functionality of cancer patients receiving chemotherapy was low. It was also seen that especially women, patients with low education levels, and non-working patients were in the risk group in terms of cognitive dysfunction. However, cognitive dysfunction was observed more frequently in patients with breast, gynecological, and lung cancer, and in patients receiving Taxane and platinum-

containing chemotherapy. Considering the patients in this group as a risk group, regular cognitive functionality evaluation is recommended by the oncology team. According to the results of the assessments, it is predicted that the quality of life of the patients will increase with the applications to increase the cognitive function to be planned by the healthcare staff working in oncology.

Cognitive functionality of patients who receive cancer treatment such as chemotherapy decreases, and therefore, their quality of life is affected negatively. It is seen that studies conducted on this subject were mostly in breast cancer patients with higher survival rates. For this reason, there is a need for detailed studies to be conducted on how chemotherapy and other cancer treatments affect the cognitive functionality of patients with other cancer types. Based on the results of the study to be obtained, the cognitive functions of cancer patients who receive chemotherapy will be able to determine the level of influence on their daily lives and quality of life.

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**Table 4:** The assessment of MoCA scores according to demographic and disease characteristics of patients

	Variables	Visuospatial function	Naming	Attention	Language	Abstract thinking	Delayed memory	Orientation	Overall Score Average
<b>Age†</b>	18-30	3.80± .447(4)	2.40± .548(2)	4.80± .837(5)	1.40± .548(1)	1.80± .447(2)	1.20± 1.304(1)	6± .00 (6)	21.4±1.14(21)
	31-45	3.34± 1.261(3)	2.34± .721(2)	3.93± 1.361(4)	1.34± 1.010(1)	1.10± .817(1)	.69±1.105 (0)	5.83± .384(6)	18.58±3.55(19)
	Over 46	3.58±1.371(3)	2.44±.682(3)	3.61± 1.380(3)	1.29± .98(1)	1.08± .771(1)	.97± 1.189(0)	5.64± .545(6)	18.59±3.97(18)
		X <sup>2</sup> = 1.223 p=0.543	X <sup>2</sup> = 0.431 p= 0.806	X <sup>2</sup> = 4.606 p= 0.100	X <sup>2</sup> = 0.233 p= 0.890	X <sup>2</sup> = 4.134 p= 0.127	X <sup>2</sup> = 1.907 p= 0.385	X <sup>2</sup> = 4.680 p= 0.096	F= 1.313 <sup>§</sup> p= 0.274
<b>Gender‡</b>	Female	3.48 ± 1.305(4)	2.33 ± .707(2)	3.54 ± 1.323(3)	1.27 ± .949(1)	1.12 ± .765(1)	.85 ± 1.184(0)	5.67 ± .524(6)	18.27 ± 3.68(19)
	Male	3.68 ± 1.336(4)	2.74 ± .452(3)	4.68 ± 1.204(5)	1.47 ± 1.073(1)	1.11 ± .875(1)	1.11 ± 1.100(1)	5.89 ± .315(6)	20.68 ± 3.71(21)
		U = 696.5 p=0.508	U = 536 p = 0.022	U = 415 p= 0.001	U = 687 P = 0.448	U = 766.5 P = 0.978	U = 653 P = 0.259	U = 611 P = 0.071	t = -2.565 <sup>¶</sup> p = 0.012
<b>Education al status †</b>	Primary education	3.23±1.260(3)	2.29±.744(3)	3.37±1.306(3)	1.08±.889(1)	.95± .759(1)	.78±1.152(0.5)	5.68±0.503 (6)	17.38±3.325(18)
	High school	3.85±1.309(4)	2.65±.489(3)	4.40±1.314(5)	1.45±.887(1)	1.35±.754(1)	1.15±1.137 (1.5)	5.70±0.571 (6)	20.40±3.202(21)
	University	4.33±1.113(5)	2.60±0.507(3)	4.60±1.056(5)	2.13±.990(3)	1.53±.743(2)	1.07±1.280 (1)	5.87±.352(6)	22.13±3.159(23)
		X <sup>2</sup> = 2.246 p = 0.325	X <sup>2</sup> = 4.485 p = 0.106	X <sup>2</sup> = 14.625 p = 0.001	X <sup>2</sup> = 13.380 p = 0.001	X <sup>2</sup> = 9.225 p = 0.01	X <sup>2</sup> = 2.246 p = 0.325	X <sup>2</sup> = 1.879 p = 0.391	F = 16.156 <sup>§</sup> p = 0.00

<b>Active working status ‡</b>	Working	3.94±1.315(4)	2.83±.408(3)	4.42± 1.232(4)	1.71± 1.071(2)	1.23±.805(1.5)	1.10±1.165(1)	5.77±.497(6)	20.77±3.547(21)
	Not Working	3.33± 1.268(3)	2.28±.725(2)	3.46± 1.335(3)	1.13±.873(1)	1.07±.773(1)	.81±1.167(0)	5.68±.500(6)	17.77±3.469(18)
		U=753.5 p=0.015	U= 726.0 p=0.004	U=663.0 p= 0.002	U= 734.0 p=0.009	U= 951.0 p=0.346	U= 895.5 p=0.153	U=958.5 p=0.248	t= -3.980 <sup>¶</sup> p=0.000
<b>Cancer type †</b>	Breast Cancer	3.48 ± 1.328(4)	2.38 ±.697(3)	3.52 ±1.297(4)	1.26 ±.965(1)	1.28 ±.671(1)	.96 ±1.245(1)	5.66 ±.519(6)	18.54 ±3.39(19)
	Gynecological cancers	3.45 ±1.504(4)	2.35 ±.671(2)	3.45 ±1.356(3)	1.20 ±1.056(1)	.90 ±.852(1)	.65 ±1.137	5.60 ±.598(6)	17.6 ±4.23(18)
	Gastrointestinal system cancers	3.50 ±1.211(3)	2.31 ±.793(2.5)	3.94 ±1.289(3.5)	1.56 ±.892(2)	.94 ±.854(1)	1.00 ±1.095(1)	5.81 ±.403(6)	19.06 ±4.18(19)
	Lung Cancer	3.63 ±1.302(4)	2.75 ±.463(3)	4.63 ±1.506(5.5)	1.00 ±1.069(1)	.50 ±.356(0)	.63 ±.916(0)	5.88 ±.354(6)	19 ±3.89(18.5)
	Urological cancers	4.00 ±.894(4)	2.67 ±.516(3)	5.17 ±.983(5.5)	1.83 ±.753(2)	1.83 ±.408(2)	1.33 ±1.21(1.5)	6.00 ±.000(6)	22.83 ±1.83(22.5)
		X <sup>2</sup> = 0.777 p = 0.941	X <sup>2</sup> = 3.208 p = 0.524	X <sup>2</sup> = 11.54 p = 0.021	X <sup>2</sup> = 4.83 p = 0.305	X <sup>2</sup> = 14.045 p = 0.007	X <sup>2</sup> = 2.916 p = 0.572	X <sup>2</sup> = 4.99 p = 0.288	F = 2.401 <sup>§</sup> p = 0.055
<b>Class of chemotherapy †</b>	Based on Platinum	3.71 ±1.08(4)	2.38 ±.711(2)	4.17 ±1.308(4)	1.42 ±.830(1)	1.04 ±.859(1)	1.13 ±1.11(1)	5.83 ±.381(6)	19.66 ±3.9(20)
	Based on Taxane	3.44 ±1.28(3)	2.37 ±.698(3)	3.46 ±1.306(3)	1.27 ±1.001(1)	1.37 ±.662(1)	.93 ±1.25(2)	5.73 ±.449(6)	18.56 ±3.29(19)

	Based on Taxane and platinum	3.52 ±1.53(4)	2.44 ±.651(3)	3.84 ±1.546(4)	1.24 ±1.091(1)	.80 ±.816(1)	.60 ±1.04(0)	5.68 ±.557(6)	18.12 ±4.41(18)
	Not based on Taxane and platinum	3.40 ±1.43(4)	2.60 ±.699(2.5)	3.80 ±1.229(4)	1.40 ±.966(1.5)	1.10 ±.738(1.5)	1.00 ±1.24(1.5)	5.40 ±.699(6)	18.7 ±3.91(19)
		X <sup>2</sup> = 0.648 p = 0.885	X <sup>2</sup> = 1.254 p = 0.74	X <sup>2</sup> = 3.757 p = 0.289	X <sup>2</sup> = 0.978 p = 0.807	X <sup>2</sup> = 8.016 p = 0.046	X <sup>2</sup> = 3.135 p = 0.371	X <sup>2</sup> = 4.445 p = 0.217	F = 0.725 <sup>§</sup> p = 0.54
<b>Stage of cancer †</b>	1. stage	3.182±1.172(5)	2.364±.809(3)	3.454±1.368(3)	1.545±1.036(2)	1.000±.744(1)	1.272±1.272(1)	5.545±.522(5)	18.363±5.344(19)
	2. stage	3.605±1.152(4)	2.394±.789(3)	3.763±1.303(3)	1.315±.989(2)	1.158±.717(1)	0.894±1.203(1)	5.658±.534(6)	18.789±3.121(20)
	3. stage	3.529±1.331(4)	2.431±.57(2)	3.823±1.438(4)	1.254±.955(2)	1.117±.840(2)	0.823±1.126(2)	5.784±.461(6)	18.705±3.853(19)
		X <sup>2</sup> =0.443 p=0.801	X <sup>2</sup> =0.04 p=0.968	X <sup>2</sup> =0.208 p=0.902	X <sup>2</sup> =1.257 p=0.533	X <sup>2</sup> =0.955 p=0.622	X <sup>2</sup> =1.8846 p=0.397	X <sup>2</sup> =4.481 p=0.098	F=0.054 <sup>§</sup> p=.947

†,= Kruskal Wallis Test, ‡= Mann Whitney U Test, §= One Way Anova Test, ¶= Student t Test