

## Original Article

**Running Title:** Impact of Tom and Jerry Cartoon on Chemotherapy-Induced Anxiety

Received: June 28, 2023; Accepted: March 02, 2024

### Effectiveness of Tom and Jerry Cartoon in Reducing Anxiety in Cancer Patients Undergoing Chemotherapy: A Pilot Study

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#### Abstract

**Background:** Anxiety is a significant psychological challenge for patients newly diagnosed with cancer and scheduled for chemotherapy, potentially affecting their treatment adherence. This study aimed to evaluate the impact of watching the Tom and Jerry cartoon on reducing anxiety in individuals undergoing chemotherapy for the first time.

**Method:** This pilot study employed a prospective, non-randomized, observational, two-arm, pre- and post-test design involving literate English-speaking patients (test group) and non-literate patients (control group) who were about to receive cytotoxic chemotherapy for their cancer. The test group viewed Tom and Jerry cartoons via video systems, whereas the control group was exposed to Kannada movies. An 11-point Likert scale featuring facial expressions assessed patients' anxiety levels three times: twenty minutes before, 30 minutes after, and following the chemotherapy session. Data analysis included frequency, percentage, chi-square tests for patient and treatment data, and repeated measures ANOVA with Bonferroni correction for anxiety scores at three-time intervals. A  $P$ -value of  $<0.05$  was considered statistically significant.

**Results:** The anxiety assessment outcomes indicated a significant reduction in anxiety levels among the test group patients who watched Tom and Jerry compared to the control group ( $P \leq 0.001$ ). Inter-group comparisons, analyzed using the Bonferroni test, revealed significant differences in anxiety reduction thirty minutes post-viewing ( $P = 0.001$ ) and after the treatment ( $P = 0.04$ ).

**Conclusion:** To the authors' knowledge, this is the inaugural study demonstrating the efficacy of the Tom and Jerry cartoon in alleviating anxiety among cancer patients undergoing chemotherapy, suggesting broad clinical applicability.

**Keywords:** Anxiety, Virtual reality, Pain, Distraction

## Introduction

Chemotherapy is an essential modality in the treatment of cancer and, depending on the tumor type, clinical stage, and general health of the patient, may be used before or after surgery or radiotherapy or may be used concomitantly with radiation (chemoradiation) to achieve adequate control and cure.<sup>1</sup> From a clinical perspective, for some cancers, chemotherapy is the principal treatment modality (e.g., hematological malignancies and lympho-proliferative disorders), while for solid tumors (like cancers of the breast), it is a crucial constituent. In addition to this, for cancers of the head and neck, esophagus, rectum, and cervix, low doses of chemotherapy are administered before radiation (termed as chemo-irradiation) to enhance the radiation cell kill of neoplastic cells.<sup>1</sup>

Studies have shown that in patients receiving their first chemotherapy, anxiety is the most common psychological symptom.<sup>2</sup> At times, a small minority of patients may display clinically significant anxiety by envisaging worst-case scenarios about chemotherapy and its side effects, become paranoid, and find it challenging to handle.<sup>2</sup> This undue anticipatory anxiety, which at times results from a range of etiologic factors, can complicate treatment plans and is distressing for both patients, the family caregivers and the treating team.<sup>2</sup>

In the recent past, art therapy like music,<sup>3-6</sup> guided imagery,<sup>7,8</sup> mindfulness meditation,<sup>9,10</sup> funny movies, and virtual reality<sup>11</sup> that do not interfere with the systemic treatment are useful in reducing anxiety and stress during cancer treatment and later. Principally, these complementary therapies are not curative applications, but they aim to alleviate the symptoms of the disease, reduce the therapy's adverse effects, and improve the individual's general well-being and quality of life.<sup>12,13</sup>

Of all the visual forms, cartoons, which by definition mean "funny and thought-provoking drawing that handles any event about people or society and indicates it with exaggeration<sup>14</sup>, are loved by children and adults alike. Cartoon is reported to be effective in reducing anxiety in children during induction of anesthesia,<sup>15</sup> during

phlebotomy,<sup>16</sup> alleviating pain and distress during procedures in the emergency room<sup>17</sup>, and reducing pain behavior in children who have incurred burn wounds.<sup>18</sup> Additionally, studies have shown that instructions accompanied by cartoons reduced mathematics anxiety in students.<sup>14</sup>

Clinical studies have shown that cartoons are effective in alleviating anxiety in children during induction of anesthesia<sup>15</sup> during venipuncture<sup>16,19</sup> and in reducing anxiety during dental treatment.<sup>20-22</sup> Of the different cartoons, Scientific observations with cancer patients indicate that laughter treatment and humor reduce anxiety, depression, tension, anger, and insomnia, facilitate pain relief, and improve pulmonary function, immune functioning, and general health.<sup>23-27</sup>

Tom and Jerry, a series of theatrical animated cartoon films focusing on a rivalry between a cat and a mouse, is arguably one of the oldest, most famous, and loved by people of all age groups worldwide. The inspiration for the study was a child who insisted on viewing Tom and Jerry's cartoon while administering and during chemotherapy for cancer. When the hospital staff obliged the request and had the pre-recorded video displayed in the ward through the television sets with a central video program, other patients and caregivers who were in the same ward and watched the cartoon appreciated the endeavor and expressed that they felt very relaxed. The positive response from the bystanders and other patients gave us an impetus to undertake this pilot study to understand the usefulness of the Tom and Jerry cartoon in mitigating anxiety in cancer patients undergoing chemotherapy for the first time.

## Materials and Methods

This study was a pilot, prospective, non-randomized, and observational two-arm pre-and post-test investigation conducted from June 1st to July 30<sup>th</sup>, 2018, at the Mangalore Institute of Oncology's chemotherapy wards. The target population comprised individuals requiring chemotherapy who were admitted to the day-care facility. The study was designed to avoid interfering with planned treatment regimens, drug dosages, or treatment schedules. The hospital administration approved the study's conduct,

ensuring it did not disrupt the standard protocol time or the sequence of patient flow within the hospital.

Patients suspected or confirmed to have cancer typically initiate contact with the treating physicians through scheduled appointments. A tumor board reviews the case upon confirmation of cancer diagnosis based on clinical examinations, diagnostic tests, and pathology results. This board, consisting of senior consultants, deliberates on the appropriate treatment strategy, considering the patient's general health and tumor pathology, and decides on surgery, radiation, or chemotherapy. Subsequently, the treating physician discusses the proposed treatment plan and schedule with the patient and their family caregivers.

Patients consenting to treatment are referred to a trained medical social worker as part of the standard procedure. This professional assesses the patient's psychological status and provides pre-treatment counseling. Additionally, the GAD-7 scale is administered as a routine measure. The GAD-7 questionnaire is a 7-item self-report instrument designed to identify anxiety symptoms in both primary care settings and the general population over the preceding two weeks, in line with the criteria outlined in the DSM-IV.<sup>28</sup> Responses to the questionnaire are given on a 4-point Likert scale, which quantifies symptom frequency from 0 (not at all) to 3 (nearly every day), yielding a total score range from 0 to 21. The scoring interpretation is as follows: 0–4 indicates no or minimal anxiety, 5–9 suggests mild anxiety, 10–14 denotes moderate anxiety, and 15–21 signifies severe anxiety.<sup>28</sup>

#### ***Inclusion and exclusion criteria***

The study included patients who were literate and diagnosed with cancer for the first time, as confirmed by pathology reports. Eligible participants were those requiring curative chemotherapy or chemo-radiotherapy, aged 18 years or older, capable of reading and understanding English or Kannada, and free from any hearing or visual impairments. Additionally, participants were required not to have any known mental illnesses (such as bipolar disorder, schizophrenia, or Parkinson's disease) and to exhibit mild,

moderate, or severe anxiety levels as measured by the GAD-7 scale.

The study excluded illiterate individuals who had experienced cancer relapse or recurrences, had previously undergone cancer treatment, were under the age of 18, had hearing or visual impairments, or were known to suffer from mental illnesses.

#### ***Conduct of the study***

Participants meeting the inclusion criteria were assigned to either the control or the test group based on their proficiency in English. Those fluent in English were placed in wards where Tom and Jerry's cartoons were shown or provided with tablets featuring the cartoons. Conversely, literate patients not proficient in English were placed in a different ward where Kannada movies were broadcast. The experimental and control group assignments were then communicated to the medical oncology nurse in charge.

The medical social worker, who had previously conducted initial counseling and assessed anxiety levels using the GAD-7, coordinated the study. Before the study commenced, patients and their caregivers were informed about the study's objectives, benefits, and risks during pre-chemotherapy counseling. They were also assured that non-participation would not affect their treatment and that their data would remain confidential. Written informed consent was obtained from all participants who agreed to volunteer for the study.

On the day of chemotherapy, the oncology nurse and medical social worker assessed the volunteers' vital health indicators (blood pressure and respiratory rate). Based on the hospital's previous findings, they applied a lidocaine 10% aerosol spray to the IV insertion area to minimize pain.<sup>29</sup> A 22-gauge IV cannula was then carefully inserted into the dorsal metacarpal vein.

Participants were asked to complete the 11-point visual facial anxiety scale (VFAS) developed by Yumul and coworkers in 2015.<sup>30</sup> at three specific times: 20 minutes before chemotherapy, 30 minutes after starting chemotherapy, and at the end of the session. The experimental group watched Tom and Jerry cartoons, while the control group viewed Kannada movies on TV. Family members were allowed to stay with

the patients, and reading materials were provided upon request.

### ***Ethical statement***

This prospective study was approved by the Institutional Ethics Committee (MIO/IEC/2017/02/05), and written informed consent was obtained from all participants. The study was conducted following the Helsinki Declaration and the ICMR 2008 guidelines for human research.<sup>31</sup>

### ***Statistical analysis***

Data were collected and entered into Microsoft Excel, with statistical analysis performed using SPSS (Statistical Package for the Social Sciences) version 17.0. The analysis included calculating numbers, percentages, and chi-square tests to compare the two groups. Mean and standard deviations were calculated for anxiety levels at all time points for both groups, and an unpaired t-test was used to compare pre-and post-intervention data. Additionally, data were stratified based on patient and treatment information and analyzed using ANOVA/Kruskal-Wallis tests. Results were evaluated at a 95% confidence interval, with a *P*-value of  $< 0.05$  considered statistically significant.

### **Results**

The study's findings are articulated through tables 1 to 3, providing insights into demographic characteristics, anxiety scores, and the impact of the intervention on anxiety levels among participants.

#### ***Demographic and clinical characteristics***

According to table 1, there were no significant differences between the test and control groups in terms of demographic details such as age, gender, cancer stage, cancer site, treatment group, duration of chemotherapy, and baseline GAD-7 anxiety scores. The most common cancer type among participants was head and neck cancer, comprising 33.83% of the sample.

#### ***Anxiety reduction over time***

The analysis revealed a decrease in anxiety levels over time in both cohorts, with repeated ANOVA measures indicating a high significance level ( $P \leq 0.001$ ), as shown in table 2. This suggests that either interventions, whether exposure to Tom and Jerry cartoons or Kannada movies, were

associated with reduced anxiety among participants.

#### ***Intra-group and inter-group comparisons***

When examining changes in anxiety scores within each group across the three time points, the Bonferroni test revealed a significant difference ( $P = 0.001$ ), highlighting the effectiveness of the interventions in reducing anxiety throughout the study. Comparisons between the groups showed significant differences in anxiety reduction from the start to 30 minutes post-intervention ( $P = 0.001$ ) and from 30 minutes post-intervention to the end of treatment ( $P = 0.04$ ), as detailed in Table 3.

These results underscore the potential of visual entertainment, such as cartoons and movies, in mitigating anxiety among cancer patients undergoing chemotherapy. The significant reduction in anxiety levels, both within and between groups, points to the beneficial effects of providing engaging and distracting content during chemotherapy sessions.

### **Discussion**

The current study shows that viewing Tom and Jerry was effective in mitigating anxiety before the start of chemotherapy and is the first study that addresses the usefulness of this virtual distraction technique in cancer care. In people affected with cancer, the life-threatening aspect associated with the disease, fear linked with the treatment modalities and the side effects, triggers immense psychosocial concerns, fear of pain, and anxiety. About Tom and Jerry, the cartoons revolving around mice and cats are filled with fun and comedy, and the results (Table 2 and 3) suggest that watching them mitigates anxiety.

Previous studies have affirmatively shown that distraction with fun-filled comical events that induce laughter, draw attention away from the pain, trigger the sensory components, enhance the tolerance to pain, and mitigate distress, all of which contribute to improving the individual's emotional status. Additionally, observations with regular comedy club participants show increased pain tolerance levels, indicating the role of humor/laughter for the beneficial effects.<sup>23</sup> Reports also suggest that

distraction is very effective in assuaging psychosocial distress and that techniques like listening to music; watching funny television programs, guided imagery, virtual reality, movies and comedy plays, directed images; performing rhythmic breathing; massage; hypnosis; playing with interactive toys, puzzles, cards or electronic games; used as non-pharmacological therapeutic intervention, are very effective and to assuage the psychosocial distress.<sup>32-36</sup>

Distraction helps the individual move their attention away from the stressor. It is one of the essential cognitive-behavioral techniques in psychology and is shown to be extremely useful in reducing stress.<sup>36,37</sup> From a mechanistic view, distraction is proposed to be a means by which perception of pain and distress is mitigated by attracting brain-related recipients faster than the thoughts of distress.<sup>32</sup> Distraction can be classified as active (e.g., interactive toys, electronic games, rhythmic breathing, guided imagery, and relaxation) or passive (watching or listening to music).<sup>38</sup> Visual distraction technique has been shown to mitigate anxiety levels in people undergoing lumbar punctures,<sup>39</sup> colonoscopy<sup>34</sup> and in orthopedic patients after surgery (postoperative).<sup>36</sup>

In cognitive psychology, laughter therapy has been used since 1970<sup>23,40</sup>, and watching comic videos is a vital humor intervention in health care services.<sup>40,41</sup> Studies carried out to understand the effectiveness of humor therapy on patients recuperating from operative procedures have shown that when compared to the controls who did not watch fun videotapes, the cohorts who did had lesser requests for light-acting medicines and pain intensity, indicating the usefulness of humor in improving pain tolerance and mitigating stress.<sup>42</sup> Subsequent studies with people experiencing cold-pressor pain,<sup>43</sup> affected with severe chronic obstructive pulmonary disease (COPD),<sup>44</sup> women who have undergone mastectomy,<sup>45</sup> cancer patients who have undergone surgery,<sup>32</sup> and with community-dwelling older adults<sup>46</sup> have all shown that watching humorous contents (comedy therapy) that trigger laugh was effective in mitigating anxiety.

From a molecular and biochemical viewpoint, laughter is shown to increase

breathing rate, relax muscles, reduce distress and anxiety, increase tolerance to pain, trigger the release of endorphins that are known to cause analgesia, reduce blood pressure and production of stress hormones and increase immune system.<sup>24-27, 40, 47, 48</sup>

From a physiological viewpoint, the underlying events are attributed to the changes triggered in the hypothalamus, the center coordinating emotional changes,<sup>24, 25, 40</sup> to mediate the beneficial effects. Cumulatively, all these physiological events contribute towards the reduction of stress and anxiety in the individual.

The biggest drawback of this study is that it is a pilot, unblinded, non-randomized, observational study using a visual facial anxiety scale as an evaluation method.

## Conclusion

The outcomes of this study unequivocally demonstrate that viewing the Tom and Jerry cartoon significantly reduced anxiety among cancer patients undergoing chemotherapy, thus fulfilling the primary objective of the research. A noteworthy finding was the consistent reduction in anxiety levels in patients exposed to Tom and Jerry across all measured time points, underscoring the effectiveness of visual distraction as a method for stress alleviation throughout the treatment process. Future research will further explore the efficacy of the Tom and Jerry cartoon in stress reduction by comparing it with other cartoons and comedy series, employing the globally recognized State-Trait Anxiety Inventory as the anxiety measurement tool. The critical insight from this study is that watching the Tom and Jerry cartoon presents a non-invasive and cost-effective approach to mitigating anxiety in chemotherapy patients, setting the stage for additional investigations in this area.

## Acknowledgments

The authors thank all the participants for their involvement in the study.

## Conflict of Interest

None declared.

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Table 1. Demographic, tumor, and treatment details of patients included in the study to ascertain the effectiveness of viewing Tom and Jerry on anxiety reduction

Demographic parameter	Choices	Total	Control	Tom and Jerry	Chi-square/Fisher exact test
Age	Below 50	55(41.4)	23(34.8)	32(47.8)	0.13
	Above 50	78(58.6)	43(65.2)	35(52.2)	
	Total	133(100)	66(100)	67(100)	
Gender	Female	74(55.6)	37(56.1)	37(55.2)	0.92
	Male	59(44.4)	29(43.9)	30(44.8)	
	Total	133(100)	66(100)	67(100)	
Stage	Early	47(35.3)	22(33.3)	25(37.3)	0.63
	Advanced	86(64.7)	44(66.7)	42(62.7)	
	Total	133(100)	66(100)	67(100)	
Cancer site	Breast	29(21.8)	18(27.27)	11(16.42)	0.71
	Cervix	11(8.27)	5(7.58)	6(8.96)	
	HNC	45(33.83)	22(33.33)	23(34.33)	
	Liver + Pancreas	7(5.26)	3(4.55)	4(5.97)	
	Lung	15(11.28)	5(7.58)	10(14.93)	
	Esophagus	13(9.77)	7(10.61)	6(8.96)	
	Ovary	13(9.77)	6(9.09)	7(10.45)	
	Total	133(100)	66(100)	67(100)	
Treatment group	Chemotherapy	66(49.6)	33(50)	33(49.3)	0.93
	Chemoradiation	67(50.4)	33(50)	34(50.7)	
	Total	133(100)	66(100)	67(100)	
Duration of chemotherapy	Less than 2.5 hours	69(51.9)	34(51.5)	35(52.2)	0.93
	More than 2.5 hours	64(48.1)	32(48.5)	32(47.8)	
	Total	133(100)	66(100)	67(100)	
GAD 7 grade	Mild anxiety	36(27.1)	16(24.2)	20(29.9)	0.77
	Moderate anxiety	35(26.3)	18(27.3)	17(25.4)	
	Severe anxiety	62(46.6)	32(48.5)	30(44.8)	
	Total	133(100)	66(100)	67(100)	

HNC: Head and neck cancer; GAD 7: generalized anxiety disorder

Table 2. In mitigating anxiety, visual analog scores were obtained before, during, and after treatment in the two groups (control versus Tom and Jerry)

Group		Mean ± Std. deviation	95 CI for mean		Repeated measures ANOVA P value
			Lower bound	Upper bound	
Control N = 66	VAS anxiety pre-0	4.09±1.68	3.68	4.50	0.0001 HS
	VAS anxiety post-30	2.65±1.13	2.37	2.93	
	VAS anxiety end of treatment	1.52±1.24	1.21	1.82	
Tom and Jerry N = 67	VAS anxiety pre-0	4.18±1.42	3.83	4.53	0.0001 HS
	VAS anxiety post-30	2.12±0.83	1.92	2.32	
	VAS anxiety end of treatment	1.49±1.41	1.15	1.84	

CI: Confidence interval; Std.: Standard; N: Number; HS: Highly significant

Table 3. Post hoc analysis within and between the two study groups (control versus Tom and Jerry) on anxiety, as determined using the Visual Analogue Scale at three-time points (before, 30 minutes after beginning, and at the end of chemotherapy)

	Group	Mean difference	Within the group comparison	Between the group comparison
			Bonferroni test <i>P</i> value	<i>P</i> value
VAS anxiety pre 0 - VAS anxiety post 30	Control	1.44 ± 0.99	< 0.0001 HS	0.001 Highly significant
	Tom and Jerry	2.06 ± 1.14	< 0.0001 HS	
VAS anxiety pre 0 - VAS anxiety end of treatment	Control	2.58 ± 1.83	< 0.0001 HS	0.70 Not significant
	Tom and Jerry	2.69 ± 1.48	< 0.0001 HS	
VAS anxiety post 30 - VAS anxiety end of treatment	Control	1.14 ± 1.37	< 0.0001 HS	0.04 significant
	Tom and Jerry	0.63 ± 1.47	0.001 HS	