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RESEARCH ARTICLE

Yoga Protocol for Cancer Patients: A Systematic Exploration of Psychophysiological Benefits

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Abstract: ***Background*:** Several studies report that practicing Yoga may lead to numerous psychophysiological benefits in patients undergoing treatment for cancer. Moreover, it may result in an effective alternative for coping with sleep disturbances, anxiety, depression and fatigue symptoms. A study based on the "Yoga in Oncology" project of the Foundation Poliambulanza was carried out, and it was designed to explore the benefits of Yoga, therefore corroborating Yoga as a therapeutic activity that can have a beneficial impact on patients diagnosed with cancer.

***Methods*:** Seventy patients were recruited, of whom 20% were males and 80% were females 18 years of age and older. All patients were being treated at the oncology department for gastrointestinal, mammary or genital carcinoma, and the disease was metastatic in 80% of patients. Data were collected between April 2013 and May 2017. The protocol consisted of a weekly 90-minute Yoga lesson for 8 consecutive weeks, and the data collection was carried out in 2 phases: (T0) preprotocol assessment and (T1) postprotocol assessment. Psychophysiological assessment was carried out with the following scales: the (BFI) Brief Fatigue Inventory, (HADS) Hospital Anxiety and Depression Scale and (PSQI) Pittsburgh Sleep Quality Index.

***Results*:** Data analysis showed a significant difference between the (T0) and (T1) HADS (Hospital Anxiety and Depression Scale) scores. The constructs of this scale consist of psychological variables for the assessment of anxiety and depression. In contrast, scores from the (BFI) Brief Fatigue Inventory and (PSQI) Pittsburgh Sleep Quality Index did not show significant differences between (T0) and (T1): such scales are relative to psychophysiological variables for an assessment of the perception of fatigue and quality of sleep.

***Conclusion*:** It is noteworthy that the data, once analyzed, showed a significant difference between preprotocol and postprotocol levels of anxiety and depression but not for the perception of fatigue or the quality of sleep. In accordance with the scientific literature, data from this study highlight that practicing Yoga may promote changes in the levels of perceived anxiety and depression in patients undergoing treatment for cancer, thus positively affecting their (QoL). It is clear that the difference in significance between the psychological and physiological variables considered here and the statistical significance found only in levels of anxiety and depression encourage further studies to account for the nature of fatigue and sleep disturbances and how to address these symptoms in oncological patients. Moreover, other points of interest for future clinical research regard the evaluation of the reason for the possible denial to participate to this kind of study, as well as the social-cultural differences in patients' behavior.

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1. INTRODUCTION

The interest in complementary approaches is increasing worldwide in medical facilities and in cancer wards [1, 2]. Integrating the mind-body aspect of care makes it plausible to use approaches such as Yoga for patients being treated for cancer [3]. Yoga is an Indian millenary practice that has spread worldwide and promotes physical and mental well-being; moreover, Yoga provides suggestions for an ethical lifestyle and respiration and meditation exercises: it results in a complementary therapy commonly recommended for cancer-related symptoms [4], which include pain, nausea, vomiting and fatigue [5, 6], which is the most common symptom. Approximately, 80%-100% of breast cancer patients show a strong fatigue perception [7, 8]. Fatigue is a symptom characterized by a strong psychophysiological perception of lack of energy and an increased need for sleep [9]; moreover, it is related to cognitive disorders and to physical, social and mood changes [10, 11]. It was found that fatigue in patients being treated for cancer largely affects patients and their caregivers' QoL [12, 13]. Cancer patient fatigue is rarely discussed with physicians and nurses, and at present, a complete evaluation of fatigue is necessary for cancer wards [14] to enable healthcare professionals to provide appropriate interventions to reduce fatigue, a particularly disabling psychophysiological symptom, as well as improve patients' quality of life [15-17]. In addition to fatigue, psychopathological factors such as depression affect cancer patients' mortality [18-25]. However, other studies do not report any correlation between depressive symptoms and survival, specifically in patients with breast cancer [26, 27]. These differences could be attributed to methodological limits related to the sample, to the moment in which patients are enrolled in the study, to the different stages of the disease in which the data are collected, to the way depression is operationalized or to the cut-offs implemented by different scales. In fact, many women treated for breast cancer report severe depressive symptoms but appear to be below the cut-off for diagnosing major depressive disorder [28]. Consequently, it is necessary to investigate whether the differences between the depressive symptoms not detectable by some scales can affect recovery [29]. In addition to depression, patients with breast cancer have an increased risk of developing depression, anxiety and stress-related disorders after diagnosis [30].

2. METHODS

2.1. Participants

A total of 70 Italian patients were recruited from the Oncology Department of the Poliambulanza Foundation. For 80% of the patients, the disease was metastatic. The sample selection criteria included a confirmed diagnosis of cancer, being 18 years or older, being able to read, to write and to speak Italian, having given informed consent before completing the study requirements and having been subjected to an active standard treatment, *e.g.*, surgery, chemotherapy and/or radiotherapy. All patients underwent chemotherapy for metastatic or localized cancer with gastrointestinal, breast and ovarian carcinoma. The exclusion criteria included the following: infectious diseases, rheumatism, inflammatory bowel disease, acute hepatitis, and liver failure; a previous diagnosis of dementia or psychotic disorders based on the diagnostic and statistical manual of mental disorders, 4th edition (DSM-IV); and a previous history of alcohol or substance abuse. From April 2013 to May 2017, the 70 patients attended weekly 90-minute Yoga lessons for 8 consecutive weeks. Informed written consent was obtained from the patients according to the ethical standards of the Declaration of the World Medical Association of Helsinki [31]. The lesson model implemented for the study is called "Hatha Yoga" (or, with another name, "Mindful Yoga"), which is a widespread practice that includes various types of physical postures that involve an introduction to the basic positions of Yoga [32, 33]. The mindful state is a dominant aspect of the practice of Yoga and involves two components: a cognitive one, characterized by curiosity, openness and acceptance, mediated by the self-regulation of attention to obtain greater recognition of mental events in the present moment; and a physiological component, mediated by the respiration control process, because it is the controlled breath that influences the proper pose-holding of the body. The instructor, therefore, constantly invited and directed the participants to focus on their bodily sensation and their breathing [34], emphasizing the observation of mood changes and encouraging the patients to cope with them by observation rather than judgment [35-37]. All the Yoga sessions were held in a special room adjacent to the Department of Medical Oncology of the Poliambulanza Foundation.

The tools implemented for data acquisition included a validated Italian version of the Hospital Anxiety and Depression Scale (HADS), the Pittsburgh Sleep Quality Index (PSQI) and the Brief Fatigue Inventory (BFI). The **HADS** is a 14-item measure widely used for the assessment of generalized emotional distress [38] and consists of two subscales with seven items each that assess the levels of anxiety and depression. All items have four response options ranging from 0 ("Nothing at all") to 3 ("Very"). Higher scores show higher levels of suffering: 0-7 normal, 8-10 borderline and 11-21 abnormal.

The Pittsburgh Sleep Quality Index is a questionnaire that assesses sleep disorders within a month [39]. Lower scores reflect minor sleep disorders. Considering 19 items, the PSQI measures several different aspects of sleep, offering seven component scores and one composite score. The component scores consist of subjective sleep quality, sleep latency (how long it takes to fall asleep), sleep duration, habitual sleep efficiency (the percentage of time in bed that one is asleep), sleep disturbances, use of sleeping medication, and daytime dysfunction. Each item is weighted on a 0–3 interval scale. The global PSQI score is then calculated by totaling the seven component scores, providing an overall score ranging from 0 to 21, where lower scores denote a healthier sleep quality. Traditionally, the items from the PSQI have been summed to create a total score to measure overall sleep quality. Statistical analyses also support three factors, including sleep efficiency (using sleep duration and sleep efficiency variables), perceived sleep quality (using subjective sleep quality, sleep latency, and sleep medication

Table 1. Patient characteristics (n=70).

	Mean	Standard Deviation	Range
Age	54,94	10,68	32-75

	N°	%
	Sex	
Male	14	20
Female	56	80
	Pathology	
Metastatic	52	74,29
Local	18	25,71
Breast	41	58,58
Gastrointestinal	19	27,15
Brain	2	2,86
Ovarian	6	8,58
Liver	2	2,86

variables), and daily disturbances (using sleep disturbances and daytime dysfunctions variables) [40].

The Brief Fatigue Inventory is a measure implemented in clinical settings to assess the severity of fatigue and the impact it has on the quality of life. Lower scores reflect less fatigue [41]. The one-page BFI has only nine items, with the items measured on 0-10 numeric rating scales. Three items ask patients to rate the severity of their fatigue at its "worst," "usual," and "now" during normal waking hours, with 0 being "no fatigue" and 10 being "fatigue as bad as you can imagine." Six items assess the amount that fatigue has interfered with different aspects of the patient's life during the past 24 hours. The interference items include general activity, mood, walking ability, normal work, relationships with other people, and enjoyment of life, with 0 being "does not interfere" and 10 being "completely interferes."

2.2. Data Analysis

To perform a preliminary analysis of the data, a descriptive statistical evaluation of each of the variables and a calculation of the frequency of the answers for each implemented psychometric scale were carried out. Afterward, a comparative analysis of the responses obtained at baseline (T0) with those related to the after treatment (T1) was performed by implementing an associated example t-test assuming a significant value of $p < 0.05$ in the 2-queues tests [42].

3. RESULTS

All data analyses were performed using the Statistical Package for Social Science (SPSS), version 15.0, for Apple. The characteristics of the sample recruited for this study are listed in Table **1**. There were 70 patients, 20% males and 80% females, with a mean age of 54.9 years, a standard deviation of 10.68 years and an age range of 32-75 years. Participants presented mainly with breast cancer (58.5%), gastrointestinal cancer (27.1%), ovarian cancer (8.5%), brain cancer (2.8%) and liver cancer (28.8%). The majority of patients were metastatic (74.2%), and the remaining patients were in a localized stage (25.7%).

3.1. HADS

To conduct statistical analyses, the variables of anxiety and depression were considered separately. The results showed that the average level of anxiety at T0 was 7.4 (from 0 to 18), and the average level of anxiety at T1 was 6.5 (from 1 to 15). For depression, the mean depression level at T0 was 6.1 (between 1 and 16), and the average depression level at T1 was 5.1 (between 0 and 14). In both cases, it was possible to detect a statistically significant differentiation of scores (tail t-2 test, $p < 0.05$): a difference of 0.891 for anxiety and 0.945 for depression. All test results are summarized in Tables **2** and **3**.

3.2. PSQI

The results concerning the sleep quality measurements carried out with the Pittsburgh Sleep Quality Index (PSQI) showed that the intervals between T0 and T1 were 7.24 and 6.5, respectively, with a difference of 0.673.

3.3. BFI

Finally, the results concerning the acquisitions with the Brief Fatigue Inventory battery (BFI) [43] showed that the difference between T0 and T1 was 3.418, while the scores were 31.65 at T0 and 28.24 at T1. After the adjustment, the mean fatigue score was not significantly lower.

Table 2. Descriptive statistics.

	N	Minimum	Maximum	Average	Std. Deviation
Age	56	32,00000000	75,00000000	59,94545455	10,68289743
HADS Anxiety T0	55	0	18	7,47	3,686
HADS Anxiety T1	55	1	15	6,58	3,409
HADS Depression T0	55	1	16	6,13	4,078
HADS Depression T1	55	0	14	5,18	3,549
PSQI T0	55	2	16	7,24	3,766
PSQI T1	55	0	16	6,56	3,711
BFI T0	55	0	72	31,65	21,465
BFI T1	55	0	72	28,24	20,343

Table 3. Coupled test sample.

		Coupled Differences					t	gl	Sign. (Two Lines)
		Average	Standard Deviation	Average Error Standard	Confidence Range of Difference of 95%				
					Lower	Higher			
Couple 1	**HADS anxiety T0 -HADS anxiety T1**	**,891**	**1,941**	**,262**	**,366**	**1,416**	**3,405**	**54**	**,001**
Couple 2	**HADS depression T0- HADS depression T1**	**,945**	**2,129**	**,287**	**,370**	**1,521**	**3,293**	**54**	**,002**
Couple 3	**PSQI T0 - PSQI T1**	**,673**	**2,913**	**,393**	**-,115**	**1,460**	**1,713**	**54**	**,092**
Couple 4	**BFI T0 - BFI T1**	**3,418**	**14,598**	**1,968**	**-,528**	**7,365**	**1,737**	**54**	**,088**

4. DISCUSSION

This study aimed to explore various psychophysiological benefits stressed by the practice of Yoga in patients diagnosed with cancer. It is essential to understand whether this practice can be considered an effective therapy for the reduction of psychological (anxiety and depression) and physiological (perception of fatigue and sleep disorders) symptoms. First, the analysis of the acquired data made it possible to highlight a significant difference between the scores (T0 and T1) for the acquisitions related to the (HADS) Hospital Anxiety and Depression Scale. Numerous studies correlate cancer with increases in the symptoms of depression and anxiety in patients during the different treatments and after overcoming the disease [44-48]. It could be considered that the psychological variables related to the perception of depression and anxiety investigated in this study with the HADS have shown that the practice of Yoga could slightly decrease the symptoms of depression and anxiety of oncological patients. In this regard, however, it should be noted that one of the various limitations of this study is related not only to the small number of the sample but also to the fact that the sample consists, for the most part, of women with breast metastases; it follows that it is not possible to extend these results to the general population of cancer patients because the distribution of the sample is not equal between males and females.

A second consideration must be made with respect to the variables of physiological perception of fatigue and sleep disorders investigated with the (BFI) Brief Fatigue Inventory and (PSQI) Pittsburgh Sleep Quality. In the literature, patients diagnosed with cancer report severe distress due to a combination of fatigue-related symptoms [49-52] and sleep disorders [53-55] regardless of the type of cancer from which they suffer and from the treatment they follow. Sleep disorders can be recognized using two main classification systems: the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) [56, 57] and the International Classification of Sleep Disorders (ICSD) [58]. Sleep disorders can occur individually or in combination. They include insomnia, sleep-related breathing disorders, hypersomnia, circadian rhythm disorders, parasomnia, sleep-related movement disorders, isolated symptoms and other unspecified disorders [59]. The results obtained in this study from the scores on the (BFI) Brief Fatigue Inventory and (PSQI) Pittsburgh Sleep Quality scales relative to the physiological perception of fatigue and sleep disorders did not show significant differ-

ences between the scores (T0 and T1); therefore, it would seem that Yoga does not prove to be a therapy that significantly reduces these symptoms; however, it could favor a decrease in the symptomatic perception of anxiety and depression, positively affecting the quality of life and the psychological health of cancer patients.

CONCLUSION

This study has identified the discipline of Yoga a potential tool for moderately decreasing depressive and anxiety symptomatology. It would, therefore, be plausible to think that the practice of this discipline allows the prevention of acute states of depression and anxiety in cancer patients, decreasing the risk of developing a further perception of worsening of the quality of life in the patient who has to face the laborious treatment process. The scientific literature has documented that depression and anxiety may be potential precursors for a cancer diagnosis; it has been indicated that psychological distress could have a predictive function for some types of tumors [60-62]; in this sense, it is plausible that the practice of Yoga can be a preventive measure of cancer disease.

Carrying out studies to understand the psychophysiological mechanism involved in when the oncological disease occurs could allow a medical team to identify the symptomatic variables, in which it is possible to intervene by promoting their decrease and urging an improvement in the (QoL) of the cancer patient. For the disorders of physiological perception, such as sleep disturbances and the perception of fatigue, in this work, no statistically significant results were obtained, leading us to think that the practice of Yoga is not effective for the reduction of this symptomatology. However, in the literature, sleep and fatigue disorders are considered with particular attention to the underlying biological mechanisms, such as the role of cytokines [63-74]. This highlights the functional complexity of these disorders and, most likely, their treatment. It follows that it is necessary to promote more studies that take into account both physiological and psychological variables that correspond to the mechanism of fatigue and sleep disorders. Ultimately, the National Comprehensive Cancer Network (NCCN) Fatigue Practice Guidelines clearly describe cancer-related fatigue (CRF) as the subjective, stressful and persistent feeling of fatigue or exhaustion related to cancer or its treatment [75, 76], and it is easy to understand how this symptom negatively affects the quality of life of cancer patients. This exploratory study, despite having numerous limitations due to the small sample size, the nonhomogeneity with respect to gender, the type of tumor and the stage of the disease, allows us to highlight that disciplines such as Yoga are still useful as an accompaniment for the treatment of cancer patients. In fact, being able to reduce symptoms such as depression and anxiety through the practice of Yoga has in itself great value for the patient who sees his life overwhelmed by the trauma of cancer disease; among other things, it is a noninvasive technique free from adverse side effects that helps to promote human relationships.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The ethics committee was not consulted for this study because it did not foresee any specific experimentation.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2008 (http://www.wma.net/en/20activities/10ethics/10helsinki/).

CONSENT FOR PUBLICATION

The written informed consent was obtained from all participants.

AVAILABILITY OF DATA AND MATERIALS

The author confirms that all data explained can be found within the paper.

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CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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