

## Review Article

### **An Integrated Approach of Yoga and Ayurveda in Cancer Rehabilitation – A Systematic Review**

#### **ABSTRACT**

**Aims:** In this comprehensive evaluation of literature, body-mind practices of Yoga and Ayurveda during cancer rehabilitation are summarized. **Methodology:** Through a methodical searching of PubMed, Embase, Scopus, Web of Science, and Allied Health Plus with a timescale of January 2008 to April 2021, appropriate research papers were identified. Data about study design, method of recruiting, subjects, interventions, and findings were taken out. Retrospective data analysis, pilot or feasibility studies were eliminated, whereas preliminary, controlled studies involving one- and multiple equipped samples, examining rehabilitating therapies for cancer patients at any phase with in-care spectrum had been included. **Results:** The study included fifteen papers as outcome of PRISM model, wherein, breast carcinoma cases are predominant. Majority of therapies involved herbal and yoga-based regimens that enhanced psycho-physiological indicators and quality of life. **Conclusion:** Preliminary research suggests that integrating Yoga and Ayurveda remedies with lifestyle-relied intervention is possible to improve self-healing capacity and sustainability in cancer patients, however methodical constraints of investigations in this growing field should be addressed. To progress the discipline, new research with robust research approaches seems to be necessary.

*Keywords: Cancer; Yoga, Ayurveda; Rehabilitation; Body-mind therapy.*

#### **1. INTRODUCTION**

The most common cause of morbidities across entire globe is carcinoma, often known as malignancy in various tumours. It is recognized as the second leading cause of mortality, in which, 70percent of deaths occur in underdeveloped and developing nations involving 25percent of hepatitis and human papillomavirus infection cases respectively as risk variables [1]. Lack of physical activity, overweight, a minimal intake of plant - based foods, overuse of tobacco, and alcoholic are the key variables that influence the development of carcinoma [2, 3]. Among these, smoking alone accounts for 22percent of deaths. Abnormal cell proliferation in addition to their capacity of expanding outside of initial position are the two key features which can cause mortality if the disease development is not halted. The presence of malignant cells as well as their invasion to surrounding healthy tissue is a contributing factor in the concern. Although some of these tumours could be relatively easily confined and sequestered, others are quite invading, that have progressed to many different regions of body, rendering the process of elimination very challenging. In essence, the purpose of anticancer therapy is to minimize or, preferably, eradicate all cancerous cells from the body. This is frequently simple than it sounds, though. Physicians, researchers, and medical associations are making numerous attempts to manage the illness, yet cancer remains continues to spread. Surgical, chemotherapeutic, and radiation are the 3 primary therapy modalities that have developed over time. The bulk of people who have malignancy and survive tend to have affected either by physical or cognitive abilities induced

by therapies and their adverse effects [4, 5]. Such functioning morbidities diminish quality of life (QL), have a detrimental influence on a person's ability to participate in personal and professional activities, and may even lessen survival rates [6, 7]. The harmful effects of therapy-linked morbidities of carcinoma are apparent over a wide range of its varieties, affecting numerous biological processes, spanning the lifespan of person both during and after intensive therapeutical interventions [8–10]. Patients often have several adverse effects from such a therapy that are even worse than the real disease complaints.

Rehabilitation using holistic healthcare approaches, such as Yoga and Ayurveda, might lessen the adverse effects of therapy-linked complaints and enhance functionality in cancer patients as well as survivors [11, 12]. Rehabilitation is a practice that is largely underused, in spite of mounting research and suggestions for inclusive approach of rehabilitation within cancer care [13, 14]. This service gap is well understood on a global scale and increases the load of morbidities as the number of cancer- survivors rises [15]. The proportion of survivors would almost quadruple globally in upcoming decades, so addressing this shortage ought to be a prime objective in treating malignancy [16]. The WHO launched Rehabilitation 2030 in 2017 as a calling to action for expanding worldwide availability of advanced rehabilitation as a crucial component for the patients suffering with non-communicable illness [17]. The goal of initiative is to develop a collection of rehabilitation strategies which will help the healthcare systems to deliver their services by increasing availability and recognition of facilities in order to enhance health outcomes. The WHO chose oncology as a strategic emphasis for this project due to the immediate, long-lasting, and delayed impacts of malignancy and therapies connected with it [17].

Alternate therapeutic modalities, like alternative and complementary therapies, that have demonstrated success in fostering good approaches against cancer and able to manage negative effects of standard therapies should be attempted among patients, since a healed person is unlikely of accepting potential adverse effects that may lessen QL [18]. In order to regain optimal well-being, the ancient traditional healthcare services like Yoga and Ayurveda primarily concentrate on the fusion of body-mind functions. Ayurvedic therapies are frequently provided to patients with the goal of either reducing tumour-related complaints or enhancing QL. The goal of Ayurveda is to safeguard healthy people from illness and to treat those who are ill [19]. Additionally, yoga as a supplemental treatment has shown to be a useful approach for cancerous patients who have overcome the disease by enabling them to deal with despair, stress, and anxiousness to enhance QL [19, 20]. It has been reported that relaxing responses obtained from combining yoga and meditation techniques have indeed been demonstrated to enhance QL, emotion regulation, as well as wellness, by controlling the levels of stress and DNA impairment [21]. This may be helpful for cancer sufferers, who frequently experience physical exhaustion, anxiety, sadness, sleeplessness, and weak muscles [22]. Numerous yoga poses, and breathing exercises combined with herbal therapies and ayurvedic health concepts may increase the psychophysiological health of such patients, along with enhanced probability of longevity [23, 24].

An initial phase of investigations to evaluate the feasibility as well as efficiency of intervention strategies for cancer- survivors during that same timeframe, is where the positive outcomes of Yoga and Ayurveda therapies originates during rehabilitation period. In order to anticipate a further wave of study in this area, it is currently crucial to pinpoint the routes and issues learnt from such investigations. As a result, this systematic review summarises the most recent research on integrated approach of Yoga and Ayurveda during cancer recovery phase with following objectives:

- To provide an overview of the studies on therapeutic benefits of Yoga and Ayurveda for carcinoma patients undergoing rehabilitation
- To discuss the efficacy of supportive care for patients with carcinoma
- To evaluate the importance of integrated cancer therapy for enhancing quality of life

## **2. RELATED WORKS**

According to Cromes, cancer rehabilitation (CAR) entails assisting a carcinoma patient in achieving their highest level of physical, societal, mental, and occupational functionalities within the constraints placed by the condition as well as its therapy. Such statement is supported by an allied health care idea as a method of CAR [25]. In their overview of literature on physical activity and cancer management, Courneya and Friedenreich, (2007) recognized the rehabilitation period as an important subject for future studies, specifically for experiments to assess the viability and effectiveness of exercise programmes. This desire in conducting exercise routines at this time is attributed to a variety of variables. Firstly, survivors often see a marked decrease in their strenuous activity as well as other physical activity involvement throughout therapy. Despite years of following with therapy sessions, individual activity levels could not restore. Given the deconditioned situation of cancer survivors and prevalence of acute adverse-effects after medication, there is significant room for enhancement in QL, physical as well as immunological functioning [26]. As per Stout et al., (2021), the suggestions for rehabilitation in oncology protocols have yet to be described, but could offer some insight to strengthen the incorporation of rehabilitation within cancer management system. The results, meanwhile, are in conflict with medical reports of reduced levels of utilization of rehabilitation, indicating that the suggestions of guidelines might indeed be disregarded. Enhancing the framework of rehabilitation therapy may have a significant influence on overall functionality and QL amongst cancer survivors, since bulk of them are adversely impacted by the functioning impairments [27]. A study by Tripathi et al., (2020) with an integrative Ayurveda and Yoga intervention as a supporting treatment in carcinoma patients who are diagnosed with osteoporosis revealed that the bone density and energy levels were enhanced after therapy [28]. The psycho-neuro-immunological approach of cancer has been modified by Amritanshuram et al. (2013) to integrate the subtler characteristics of mind (prana, mind, and self). According to authors, the therapy may be improved by utilizing yoga-relied models [29].

### **2.1. PRIMARY RISK FACTORS FOR THE DEVELOPMENT OF CANCER**

#### **2.1.1. Inflammation**

The generation of cytokines such as tumour necrosis factor (TNF), interleukin-1 (IL-1), and IL-6, as well as modified m-RNA activity by oxidative stress-induced inflammatory cells will contribute for 20percent of risk for cancer development [30, 31]. According to Ayurveda, cancer manifests as Granthi (benign) and Arbuda (malignancy), that are caused by a vata, pitta, and kapha dosha discrepancy brought on by an unsustainable lifestyle, mental stress, incompatible food-intake, sufferings, and other factors [32]. Relying on the vitiation of doshas, tumour could be inflammatory or non-inflammatory which might be managed with surgery, dietary recommendations, herbal treatment, and wellness regimes such as rasayana (restoring) and vajikarana (rejuvenating) therapy [32]. Shodhana chikitsa are the purifying detoxification techniques in carcinoma therapy that mainly includes panchakarma, which is peculiar to impaired dosha while, Shamana chikitsa (supportive care) is typically

recommended for debilitated people. In-depth study is being done on the anti-tumour effects of phytochemical components found in herbs like *curcumin*, *green tea* (epigallocatechin gallate), *grapes* (resveratrol), and *guggulsterone*, that contain anti-inflammatory and NF- $\kappa$ B-regulated genomic inhibiting action [33]. Additionally, regular exercise may be used as the main therapy for cancer and inflammation [34]. Yoga poses which have been demonstrated to modulate markers of inflammation and metabolic risks are indicated for underweight or fragile individuals to practice meditation, breathing exercises, and other relaxation techniques [35].

### **2.1.2. Oxidative stress**

Oxidative stress (OS), a predictor of cancer initiation is known to arise instable free radicals, hindered metabolic processes referred as Reactive Oxygen Species (ROS) and lack of equilibrium in antioxidants [36]. An increased ROS may result in permanent oxidative degradation of lipids, fats, carbohydrates, and nucleic acids, which further promotes cellular damage and disease manifestation [37]. ROS are essential for signalling pathways in cells wherein, their production and removal continue to manage cellular redox equilibrium. The longevity of Cancer Stem Cells (CSC) with lower intracellular ROS is facilitated by enhanced ROS formation and inadequate antioxidative defence mechanisms under more hypoxic conditions [38]. CSC seem to be more ROS responsive than healthy cells, which makes them highly susceptible to tumour growth as well as permanent cell damage and death [39]. Significant rise in ROS also promote tumorigenesis. Moreover, it is hypothesized that extrinsic ROS generating therapy by increasing OS may be used to specifically destroy cancerous cells with avoidance of damaging healthy cells [38]. From this perspective, it is possible to infer that hypoxia-induced ROS in CSC serve a crucial role in the treatment of malignancy. The notion of intracellular ROS and its regulation mechanisms in CSC meanwhile, is a relatively new field of study [38]. The stimulation of glycolysis with increased mitochondrial action and reduced O<sub>2</sub> uptake may accomplish the biological characteristics of CSC with less glycolytic pathway and energy metabolism in response to OS as contrasting to normal cells [40, 41]. This might be addressed by relaxing techniques like pranayama and meditation, which have been found to increase energy metabolism through regularized mitochondrial function and reduced O<sub>2</sub> uptake [42]. Additionally, it is known that OS-induced sperm DNA impairment is a significant contributor for the development of juvenile carcinoma and its associated mortalities, in which, yoga and meditation techniques could help to mitigate such uncertainty [43, 44]. Additionally, a number of herbs, including *Andrographis peniculata*, *Curcumin*, *Piper longum* and *Withania somnifera* have been shown to be effective against tumour development due to their anti-lipid peroxidative activity, suppression of tumour progression, antioxidant properties, and minimization of OS [45].

### **2.1.3. Metabolic syndrome**

The probability of developing cancer has indeed been linked to metabolic disorders like hyperlipidaemia, diabetes, elevated body mass index, and obese [33]. A relationship between the processes by which cholesterol affects cancer is still debatable, yet it has subsequently shown that oxidized LDL receptor 1 and cancer onset possess a close connection across a variety of paths [46]. Additionally, owing to OS-induced inflammation indicators, hyperglycaemia, overweight, and low physical activity ultimately result in carcinoma [47]. Through the improvement of body fat metabolism and inflammatory process, a mind-body approach involving yoga and meditation does have the greatest impact on metabolic syndrome [35]. Additionally, herbal remedies for metabolic illnesses like *ginseng*, *berberine*,

*bitter melon, nigella sativa, and gymnema sylvestre* are thought to be both harmless and efficient [48]. In accordance with this view, it is possible to postulate that the associated risk components for emergence of cancer could be managed by utilizing body-mind intervention program that includes Yoga and Ayurveda lifestyle-based intervention.

### 3. METHODOLOGY

#### 3.1. Search methods and screening standards

With a period ranging from January 1, 2008, until April 30, 2021, 5 databases were accessed as part of extensive searching process namely: PubMed, Web of Science, Embase, Scopus, and Allied Health Plus. Keywords for abstracts and title included cancer, rehabilitation, yoga, ayurveda, and clinical studies. Additionally, the citations of papers detailing original study and reviews of the subject that were discovered was examined. Table 1 provides a comprehensive description of inclusion and exclusion criteria. Papers were considered only if they had been published in English with peer-reviewing process. Utilizing Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISM) paradigm, finished reports are gathered initially. Four parts make up the PRISM technique for a thorough, evidence-based review process: detection, screening, qualifying, and selections. This raises the possibility of finding most published papers in systemic way [49]. Any kind of cancer sufferers who had just finished adjuvant chemo or radiation therapies, claiming of no intentions for further medication were included in the study's sample (excluding hormonal therapy for breast malignancy). Formerly, 'recent time finished' was regarded as having finished therapy not upwards of six months earlier to enrolment. But it quickly became clear during the searching phase that such a criterion seemed excessively rigid for a fresh study area. This requirement was thus modified to include finishing therapy not upwards of twelve months earlier to enrolment. Regardless of whether the inclusion criteria were specified for being less than or equal to twelve months from receiving therapy, papers have been excluded if further data concerning the recruiting procedure showed that trial failed to comply any of mentioned criteria. Yoga training programs, with or without flexibility or movement range and ayurvedic treatments like herbal and panchakarma, among other regimes, were 'interventions' which satisfied the criteria. Likewise, to learn more about the pathophysiology, development, and course of cancer therapy within traditional healthcare system, our study reviewed traditional works of Yoga and Ayurveda. For yet more discourse, a thorough summary of every characteristic and treatment options was created. All potential health-linked consequences of cancer and subsequent therapies which might become apparent during rehabilitation phase, like illnesses and healing connected complaints, QL, physically, sexually, or cognitive related skills, qualified as 'outcome' measures that satisfied the criterion. Solitude grouping pre-post testing research, controlled, and randomly selected clinical studies have been the types of papers which satisfied the 'comparative' criteria for inclusion. Single grouping investigations were crucial to incorporate because they are frequently employed in more recent scientific disciplines.

**Table 1. Selection criteria for studies**

Inclusion	Exclusion
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Published papers from January 2008 to April 2021	Papers which are not peer-reviewed publications and not in English
Studies with cancer diagnosed samples	Reported experimental protocols for existing or upcoming studies
Subjects aged 18 years or above	Case study involving below 12 participants
An approach for rehabilitation which emphasises involvement, health-associated quality of life, or physically, sexual, and cognition capacities	Feasibility or pilot experiments
Controlled intervention studies utilizing a single or a variety of methods	Intervention studies using cancer-free groups as comparative or control

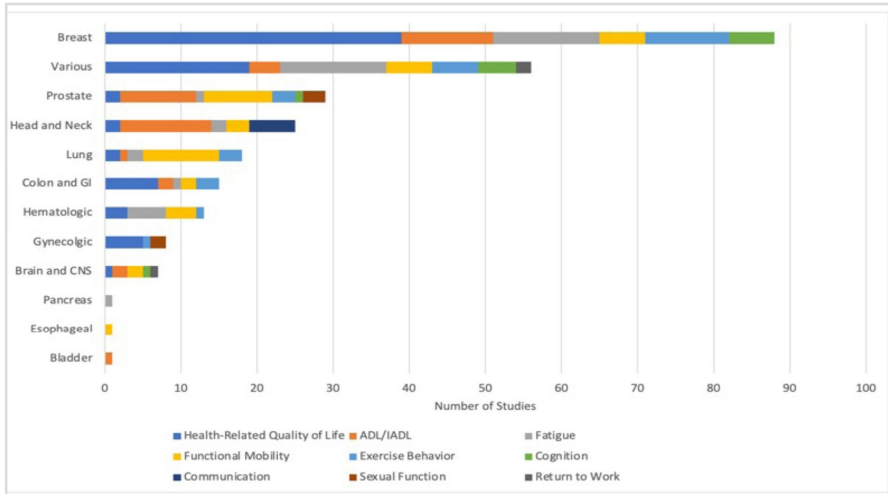
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### 3.2. Extracting data and quality evaluation

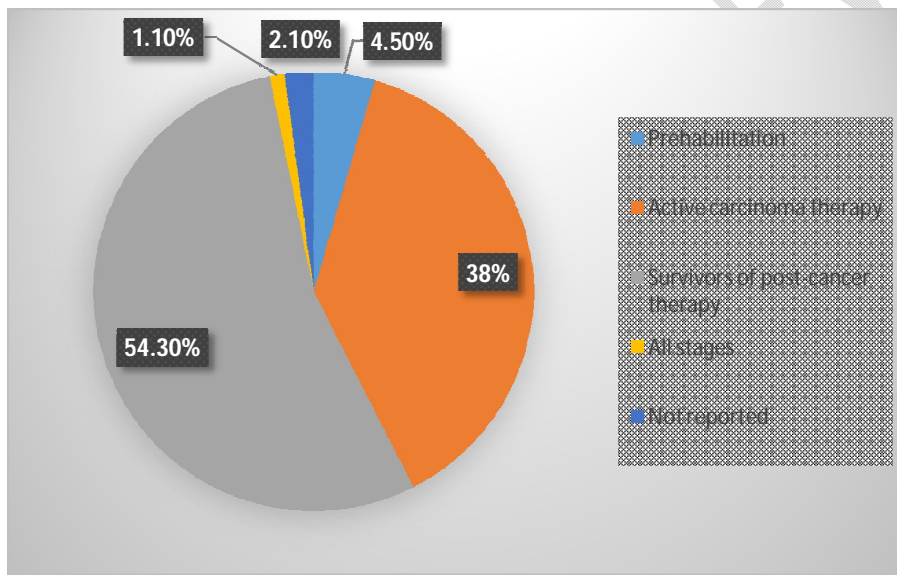
Every descriptive parameter of studies, such as the period between termination of therapy and enrolment within research, experimental design, sample features, and recruiting information, were retrieved. Descriptive information on the intervention model, such as its timeframe, intensity, and regularity, as well as its commitment or conformity, too were retrieved. The evaluation of impact of on healthcare outcomes was accomplished by extracting the findings. An approach outlined by Stevinson et al. [50] was used to evaluate the quality of selected papers for reviewing of yoga, ayurveda, and cancer all across the field. The adoption of a) randomization for group allocating, b) an efficient randomizing mechanism, c) intent-to-cure assessment, and d) blinded data feeds from group allocation were regarded as 4 crucial elements of discipline of employed methods.

## 4. RESULTS

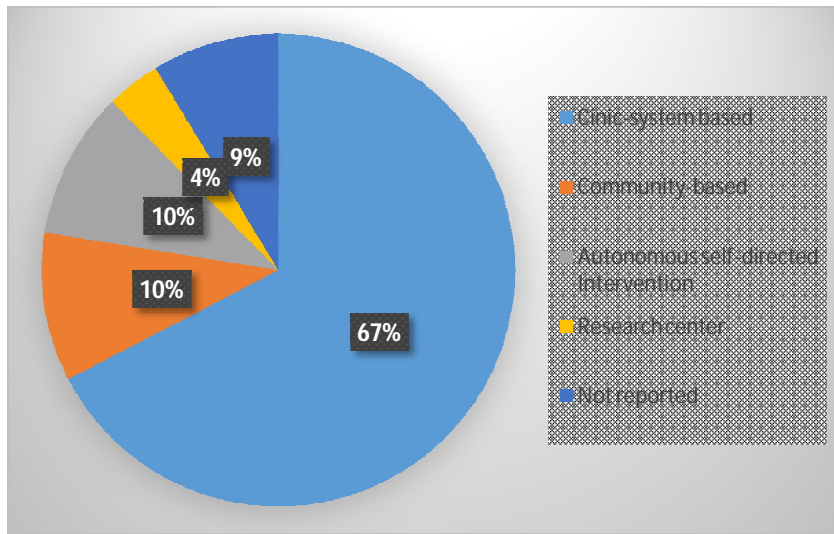
Fig. 1 displays many cancer categories researched by functional domain with interventions reaching statistically significant. Figures 2 and 3 depict the stages of therapy examined for research and their context with therapies obtaining statistically significant. 670 citations were found after search terms. Around 535 articles were found, which are not matching the criteria for inclusion after reviewing of abstracts and titles. To perform a more thorough analysis, entire contents of rest 135 papers were extracted. Using the study requirements, 120 papers were eliminated and 15 were selected to this review (Fig. 4). Majority of studies that were chosen dealt with cancer rehabilitation, impact of complementary and alternative medication, application of yoga-based intervention strategies, and ayurvedic medication. The study subjects involved survivors of various malignancies, that comprised breast cancer as a dominant finding, accompanied by lymphomas, gynaecologic, testicle, and colorectum cancer. Age group of respondents varied from 18 to 71 years, with majority of experiments encompassing a broader age group. The investigations enrolled both genders (male and female), with the exception of breast cancer survivors who were female.



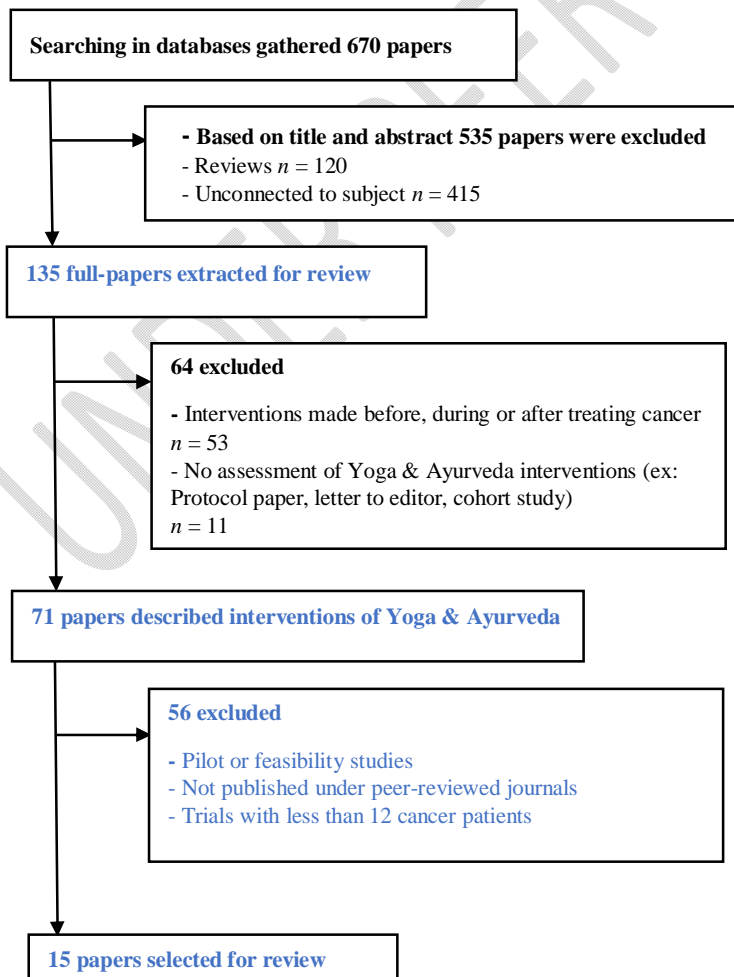
**Fig. 1. Functional analysis of cancer types using interventions attaining statistical significance**



**Fig. 2. Treatment stages investigated for trials where interventions achieved statistical significance**



**Fig. 3. Study interventions in treatment settings that are effective in terms of statistics**



#### Fig. 4. Schematic of study selection method

### 5. DISCUSSION

This systematic review examines cancer rehabilitation with an emphasis on an integral strategy combining Yoga and Ayurveda healthcare system. According to contemporary ideas, addictions like smoking and alcoholism may cause a raised chronic condition, particularly cancer, whose therapies, particularly chemo and radiotherapies, are extremely toxic and both harms nearby normal cells. A secondary effect could be immediate or delayed. Chemo adverse effects include nausea, vomiting, dysentery, baldness, oral thrush, and bowel problems while, radiation can lead to exhaustion, loss of appetite, upset stomach, vomit, disturbed sleep, skin dryness, and others. Tonsillitis, acid reflux disease, laryngitis, chronic dysphagia, tiredness, liver toxicity, and sterility are some instances of prolonged complications [51]. Death can occasionally be brought on by organ dysfunction, metastatic spread, OS, inflammatory, and haemorrhagic condition. The complementary and alternative therapies have drawn huge attention of numerous researchers and healthcare experts because of negative outcomes of standard treatment of cancer. Yoga and Ayurveda have been utilized in combination to combat the side effects of post-chemo circumstances in cancer [52]. When these adverse reactions are evaluated from an Ayurveda viewpoint, it seems that they are manifestations of an intensified Pitta dosha and Raktadusti conditions. The efficient Ayurvedic therapies including ahara, vihara, panchakarma therapy, and shaman chikitsa with beneficial herbs could enhance life span of patients by several folds through enhancing QL, and alleviating symptoms. Ashwagandha contains increased antioxidant properties, which have been demonstrated by contemporary research to improve immunological system and has proven to promote ROS in breast cancerous cells. Additionally, it is revealed that ashwagandha seems to have an anti - oxidative influence within brain and calms nervous system. The roots of this herb exhibit cytotoxic capabilities over H-460 which also promote the development of cytotoxic T lymphocytes [53]. The topmost choice for cancer treatments includes *Bacopa monniera*, *Glycyrrhiza glabra*, *Ocimum sanctum*, *Terminalia chebula*, *Elettaria cardamom*, *Hydrocotyle asiatica*, *Asparagus racemose*, *Nordostachys jatamansi*, and *Tribulus terrestris* [54].

As per yoga scriptures, human body is said to be comprised of 5 parts, or '*pancha kosha*', namely: physical existence (*Annamaya Kosha*), subtler energy or prana (*Pranamaya Kosha*), instinctive psyche (*Manomaya Kosha*), intellect or discriminatory psyche (*Vijnanamaya Kosha*), and contentment peaceful condition (*Anandamaya kosha*). According to Upanishad, whenever a person is firmly grounded in *Anandamaya kosha*, he is in great equilibrium with environment and good well-being because of everlasting feeling of self-being, as well as the causative condition of life forms from which all other Koshas arise [55]. When mankind experiences the highs and lows of living (whether via exposing of exterior assaults like damage or sickness, or emotional tough circumstances), it creates a disparity. Scripture emphasizes the fact that such disharmony results from an absence of brilliance over psyche, which is the root cause of all mind-body illnesses. A yoga Vasistha treatise by Sage Vasistha [56] outlines the development of all this disharmony which leads to cancer (likewise, other lifestyle-linked disorders). According to yoga description of stress, the character of a struggle or discomfort is portrayed as an 'unregulated reprocessing of phrases within mind' i.e., *Manomaya kosha*. If left unchecked, such disharmony resulting from unrestrained movement

(udvega) of inhibited feelings permeates into the *Pranamaya kosha*. This can be identified by a disrupted respiratory rhythm (higher pace with uneven pattern) as well as impaired metabolism. The procedure goes on and concentrates in sole area of physical body (*Annamaya kosha*), thereby leading to inconsistent biochemical reactions through an erratic flow of *prana* (life force power). This suggests that aggressiveness or conflict experienced mentally is reflected within physical confrontation (inflammatory condition). Inflammation is a characteristic of malignancy, which has become a wide-established reality. Therefore, it appears that unchecked extreme *prana* (subtler energy) movement alters the apoptotic regulation, leading to eternal cells as well as the persistence of cancerous cells at molecular scale. The narratives continue to say that origin of this illness relies on both interior (heredity) and exterior (injury by oncogenic elements, trauma, poisons, etc.) components.

Glancing across all of literature research, it could be inferred that Yoga and Ayurveda integrated strategy are clinically useful for cancer sufferers as an alternative to standard medical care. The outcomes of present review demonstrate that Yoga and Ayurveda incorporation may offer a wide range of advantages for cancer-survivors during recovery process, despite variances in subjects, experimental designs, and interventions amongst investigations. These are crucial for assessing the integrity of previous works under this topic, despite fact that it was beyond the scope of this review to address them in depth.

## **6. STUDY LIMITATIONS**

Despite an intensive literature exploration was done, it is indeed feasible that some qualified investigations were slipped. The notion that several previous investigations evaluated numerous outputs, yet only disclosed favourable results, which has raised the possibility of prejudice even when each documented study was considered. Contrarily, relying on scientific research would often lead to the selection of more robust investigations, as these trials seemed sure to have their data disclosed irrespective of output. An explanation of tendencies in results had not been considered appropriate at this moment due to the limited number of papers and variation in demography, intervention strategies, outputs, and follow-up timeframes.

## **7. FUTURE SCOPE**

In order to progress a realm, scholars examining complementary and alternative approaches during rehabilitation are urged to: establish a standard timeline for defining recovery period and assess output alterations which is more pertinent toward this moment, such as participants' functional capacity, QL, behavioural changes, as well as other mental conditions. Scholars are prompted to include following information when summing up assessments of yoga intervention strategies for cancer-survivors during rehabilitation phase namely: a) Timeframe (the number of months or weeks across post-cancer care and research enrolment; b) Conformance with implementation practices and yoga training program; c) Sample size and comparative with pre-detected medically relevant sample size; d) Achievement and flaws with recruiting and intervention.

Currently, diets with minimal fat and powerful antioxidants are being prioritized in order to increase cancer survival rates [57]. Foods, particularly of excessive fat content, like cheese, butter, palm and coconut oil, may hasten the growth of cancer, whereas foods containing higher antioxidants like fruits and vegetables, generally thought to be healthy [58]. The antioxidant contents in plant-relied foodstuffs are usually higher than that of animal-based in

which, majority will contain herbs and spices [59]. Meanwhile, it is necessary to investigate the potential health benefits of comprehensive spices and herbs in addition to nutrition-relied investigation which can clarify the complexities of dietary impact on chronic conditions, despite the fact that several experiments are performed on individual phenolic constituents of spice mixtures and herbs. Further, to connect key indicators of transdisciplinary and individualized therapy, research is still needed to link expression of genes and cancer subcategories that make it easier to tailor a patient's medication to their unique needs [60]. Even though personalized medicine is used in medical advances, Ayurveda places a greater value on individualized therapeutic intervention because it recognizes that every person has a unique body constitution, or prakriti, composed of various ratios of 3 functional units or doshas such as vata, pitta, and kapha with unique metabolic and psycho-physiological characteristics. As per body constitution, there seems to be a connection among expression of unique HLA gene that every person displays and their varying necessity of energy [61]. Hence, to achieve harmonized whole-body energy equilibrium, a lifestyle change strategy which can affect metabolic profile of an individual must be documented. According to a new analysis, practicing yoga could efficiently control the degree of metabolic functions with respect to a specified body constitution (Prakriti) [62]. With this perspective, it may be stated that constitutional medication may be more effective to treat malignancy because clinical presentation of each person is unique. Additionally, novel studies utilizing integrative approach of Yoga and Ayurveda must be performed on treating cancer, by taking into account the idea of numerous regulatory mechanisms in OS, probability of metabolic abnormalities, and inflammatory markers linked to disease onset.

## **8. CONCLUSION**

In accordance with the study, combining body-mind therapy with lifestyle interventions relying on yoga and ayurveda may help cancer patients to live better and recover their psychosocial wellbeing. In course of their rehabilitation, cancer-survivors have become the subject of certain intervention programs. Methodological flaws in these experiments are clear, as one could anticipate from growing field of investigation. Despite such drawbacks, preliminary research suggests that complementary and alternative therapies are viable, which might assist cancer patients physically and psychologically while they are undergoing rehabilitation. The discipline must now be advanced by future research with robust research approaches.

## **CONSENT**

It is not applicable.

## **ETHICAL APPROVAL**

Not applicable

## **PRIOR PUBLICATION: Nil**

## **REFERENCES**

1. Plummer M, de Martel C, Vignat J, Ferlay J, Bray F, Franceschi S. Global burden of cancers attributable to infections in 2012: a synthetic analysis. *Lancet Glob Health*. 2016;4(9):e609-16. DOI:10.1016/S2214-109X(19)30488-7. [PUBMED]
2. GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*. 2016;388(10053):1659-1724.  
Available: <https://www.sciencedirect.com/science/article/pii/S0140673616316798>
3. Global health risks: mortality and burden of disease attributable to selected major risks. Accessed 13 December 2022. Available: [https://www.who.int/healthinfo/global\\_burden\\_disease/GlobalHealthRisks\\_report\\_full.pdf](https://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf).
4. Miller KD, Siegel RL, Lin CC, Mariotto AB, Kramer JL, Rowland JH, et al. Cancer treatment and survivorship statistics, 2016. *CA: Cancer J Clin*. 2016;66(4):271-89. DOI: 10.3322/caac.21349. [PUBMED]
5. Kline RM, Arora NK, Bradley CJ, Brauer ER, Graves DL, Lunsford NB, et al. Long-Term Survivorship Care After Cancer Treatment - Summary of a 2017 National Cancer Policy Forum Workshop. *J Natl Cancer Inst*. 2018;110(12):1300-10. DOI: 10.1093/jnci/djy176. [PUBMED]
6. Effinger KE, Stratton KL, Fisher PG, Ness KK, Krull KR, Oeffinger KC, et al. Long-term health and social function in adult survivors of paediatric astrocytoma: A report from the Childhood Cancer Survivor Study. *Eur J of Cancer*. 2019;106:171-80. DOI: 10.1016/j.ejca.2018.10.016. [PUBMED]
7. Lee YH, Goo-Yoshino S, Lew HL, Chi WC, Yen CF, Liao HF, et al. Social participation in head and neck cancer survivors with swallowing disorder: World Health Organization Disability Assessment Schedule 2.0 study. *Head & Neck*. 2020;42:905-912. DOI: 10.1002/hed.26062. [PUBMED]
8. Downing A, Glaser AW, Finan PJ, Wright P, Thomas JD, Gilbert A, et al. Functional outcomes and health-related quality of life after curative treatment for rectal cancer: a population-level study in England. *Int J of Radiat Oncol Biol Phys*. 2019;103:1132-42. DOI: 10.1016/j.ijrobp.2018.12.005. [PUBMED]
9. Mohan N, Jiang J, Dokmanovic M, Wu WJ. Trastuzumab-mediated cardiotoxicity: current understanding, challenges, and frontiers. *Antib Ther*. 2018;1:13-17. DOI: 10.1093/abt/tby003. [PUBMED]
10. Lovegrove CC, Ficarra V, Montorsi F, N'Dow J, Salonia A, Minhas S. Sexual function outcomes following interventions for prostate cancer: are contemporary reports on functional outcomes misleading? *Int J Impot Res*. 2020;32(5):495-502. DOI: 10.1038/s41443-019-0220-1. [PUBMED]
11. Smith SR, Zheng JY, Silver J, Haig AJ, Cheville A. Cancer rehabilitation as an essential component of quality care and survivorship from an international perspective. *Disabil Rehabil*. 2020;42:8-13. DOI: 10.1080/09638288.2018.1514662. [PUBMED]
12. Galvao DA, Taaffe DR, Spry N, Cormie P, Joseph D, Chambers SK, et al. Exercise Preserves Physical Function in Prostate Cancer Patients with Bone Metastases. *Med Sci Sports Exerc*. 2018;50:393-99. DOI: 10.1249/MSS.0000000000001454. [PUBMED]
13. Pergolotti M, Lyons KD, Williams GR. Moving beyond symptom management towards cancer rehabilitation for older adults: Answering the 5W's. *J Geriatr Oncol*. 2018;9:543-49. DOI: 10.1016/j.jgo.2017.11.009. [PUBMED]

14. Worku T, Mengistu Z, Semahegn A, Tesfaye G. Rehabilitation for cancer patients at Black Lion hospital, Addis Ababa, Ethiopia: a cross-sectional study. *BMC Palliat Care*. 2017;16:53. DOI: 10.1186/s12904-017-0235-7. [PUBMED]
15. Anwar SL, Adistyawan G, Wulaningsih W, Gutenbrunner C, Nugraha B. Rehabilitation for Cancer Survivors: How We Can Reduce the Healthcare Service Inequality in Low-and Middle-Income Countries. *Am J Phys Med Rehabil*. 2018;97:764–71. DOI: 10.1097/PHM.0000000000000982. [PUBMED]
16. Truant TL, Fitch MI, O’Leary C, Stewart J. Global perspectives on cancer survivorship: From lost in transition to leading into the future. *Can Oncol Nurs J*. 2017;27(3):287-94. [PUBMED]
17. Gimigliano F, Negrini S. The World Health Organization “Rehabilitation 2030—a call for action”. *Eur J Phys Rehabil Med*. 2017;53:155–68.
18. Cramer H, Lauche R, Klose P, Lange S, Langhorst J, Dobos GJ. Yoga for improving health-related quality of life, mental health and cancer related symptoms in women diagnosed with breast cancer. *Cochrane Database of Systematic Reviews*. 2017;1(1):CD010802. DOI: 10.1002/14651858.CD010802.pub2. [PUBMED]
19. Agnivesha, Charaka, Dridhabala, Charak Samhita, Sutra Sthana, Dashmahamuliya adhyaya, 30/26, edited by Sharma PV, Reprint ed. Chaukhambha Orientalia, Varanasi, 2011;240.
20. Lu YH, Rosner B, Chang G, Fishman LM. Twelve-Minute Daily Yoga Regimen Reverses Osteoporotic Bone Loss. *Topics in Geriatric Rehabilitation*. 2016;32(2):81–7. DOI: 10.1097/TGR.0000000000000085. [PUBMED]
21. Banerjee B, Vadiraj HS, Ram A, Rao R, Jayapal M, Gopinath KS, et al. Effects of an integrated yoga program in modulating psychological stress and radiation-induced genotoxic stress in breast cancer patients undergoing radiotherapy. *Integr Cancer Ther*. 2007;6(3):242-50. DOI: 10.1177/1534735407306214. [PUBMED]
22. Dimeo FC, Thomas F, Raabe-Menssen C, Pröpper F, Mathias M. Effect of aerobic exercise and relaxation training on fatigue and physical performance of cancer patients after surgery. A randomised controlled trial. *Support Care Cancer*. 2004;12(11):774-9. DOI: 10.1007/s00520-004-0676-4. [PUBMED]
23. Uebelacker LA, Tremont G, Epstein-Lubow G, Gaudiano BA, Gillette T, Kalibatseva Z, et al. Open trial of Vinyasa yoga for persistently depressed individuals: Evidence of feasibility and acceptability. *Behav Modif*. 2010;34(3):247-64. DOI: 10.1177/0145445510368845. [PUBMED]
24. Dunn KD. The effectiveness of Hatha yoga on symptoms of anxiety and related vulnerabilities, mindfulness, and psychological wellbeing in female health care employees. *Diss Abstr Int*. 2010;70:2403.
25. Cromes GF Jr. Implementation of interdisciplinary cancer rehabilitation. *Rehabil Counseling Bull*. 1978;21:230–37.
26. Courneya KS, Friedenreich CM. Physical activity and cancer control. *Semin Oncol Nurs*. 2007;23(4):242–52. DOI: 10.1016/j.soncn.2007.08.002. [PUBMED]
27. Stout NL, Santa Mina D, Lyons KD, Robb K, Silver JK. A systematic review of rehabilitation and exercise recommendations in oncology guidelines. *CA Cancer J Clin*. 2021;71(2):149-75. DOI: 10.3322/caac.21639. [PUBMED]
28. Tripathi S, Panchal M, Aliyas NB. Effect of Integrated Ayurveda and Yoga Therapy (IAYT) on osteoporosis detected in breast cancer patient on remission-A single case study. *Int Med Case Rep*. 2020;1(2):23-7. DOI:10.38205/imcr.010223. [PUBMED]

29. Amritanshram R, Nagendra HR, Shastry ASN, Raghuram NV, Nagarathna R. A psycho-oncological model of cancer according to ancient texts of yoga. *J yoga phys ther.* 2013;3(1):1-6.
30. Mantovani A, Allavena P, Sica A, Balkwill F. Cancer related inflammation. *Nature.* 2008;454 (7203):436-44. DOI: 10.1038/nature07205. [PUBMED]
31. Murata M. Inflammation and cancer. *Environ Health Prev Med.* 2018;23(1):1-8. DOI: 10.1186/s12199-018-0740-1. [PUBMED]
32. Garodia P, Ichikawa H, Malani N, Sethi G, Aggarwal BB. From ancient medicine to modern medicine: ayurvedic concepts of health and their role in inflammation and cancer. *J Soc Integr Oncol.* 2007;5(1):25-37. DOI: 10.2310/7200.2006.029. [PUBMED]
33. Sumantran VN, Tillu G. Cancer, Inflammation, and Insights from Ayurveda. *Evid Based Complement Alternat Med.* 2012;2012:306346. DOI: 10.1155/2012/306346. [PUBMED]
34. Kiecolt-Glaser JK, Christian L, Preston H, Houts CR, Malarkey WB, Emery CF, et al. Stress, Inflammation, and Yoga practice. *Psychosom Med.* 2010;72(2):113-21. DOI: 10.1097/PSY.0b013e3181cb9377. [PUBMED]
35. Shete SU, Verma A, Kulkarni DD, Bhogal RS. Effect of yoga training on inflammatory cytokines and C-reactive protein in employees of small-scale industries. *J Educ Health Promot.* 2017;6:76. DOI: 10.4103/jehp.jehp\_65\_17. [PUBMED]
36. Inoue M, Sato EF, Nishikawa M, Park AM, Kira Y, Imada I, et al. Mitochondrial generation of reactive oxygen species and its role in aerobic life. *Curr Med Chem.* 2003;10(23):2495-505. DOI: 10.2174/0929867033456477. [PUBMED]
37. Raj L, Ide T, Gurkar AU, Foley M, Schenone M, Li X, et al. Selective killing of cancer cells by a small molecule targeting the stress response to ROS. *Nature.* 2011;475:231-34. DOI: 10.1038/nature10167. [PUBMED]
38. Liu J, Wang Z. Increased Oxidative Stress as a Selective Anticancer Therapy. *Oxid Med Cell Longev.* 2015(2015);12:294303. DOI: 10.1155/2015/294303. [PUBMED]
39. Trachootham D, Alexandre J, Huang P. Targeting cancer cells by ROS-mediated mechanisms: a radical therapeutic approach? *Nat Rev Drug Discov.* 2009;8:579-91. DOI: 10.1038/nrd2803. [PUBMED]
40. Sosa V, Moliné T, Somoza R, Paciucci R, Kondoh H, LLeonart ME. Oxidative stress and cancer: an overview. *Ageing Res Rev.* 2013;12(1):376-90. DOI: 10.1016/j.arr.2012.10.004. [PUBMED]
41. Ye XQ, Li Q, Wang GH, Sun FF, Huang GJ, Bian XW, et al. Mitochondrial and energy metabolism-related properties as novel indicators of lung cancer stem cells. *Int J Cancer.* 2011;129(4):820-31. DOI: 10.1002/ijc.25944. [PUBMED]
42. Bhasin MK, Dusek JA, Chang BH, Joseph MG, Denninger JW, Fricchione GL, et al. Relaxation Response Induces Temporal Transcriptome Changes in Energy Metabolism, Insulin Secretion and Inflammatory Pathways. *PLoS One.* 2013;8(5):e62817. DOI: 10.1371/journal.pone.0062817. [PUBMED]
43. Kumar SB, Chawla B, Bisht S, Yadav RK, Dada R. Tobacco use increases oxidative sperm DNA damage- Etiology in childhood cancer. *Asian Pac J Cancer Prev.* 2015;16(16):6967-72. DOI: 10.7314/apjcp.2015.16.16.6967. [PUBMED]
44. Kumar SB, Gautam S, Tolahunase M, Chawla B, Yadav RK, Kumar P, et al. Improvement in Sperm DNA Quality Following Simple Life Style Intervention: A Study in Fathers of Children with Non-Familial Sporadic Heritable Retinoblastoma. *J Clin Case Rep.* 2015;5(3):509.
45. Sharma T, Rawal G. Role of ayurveda in tumorigenesis: A brief review. *Int J Green Pharm.* 2012;6(2):93-101.

46. Osto M, Smidi SA, Alnabolsi A, Rehman R, Potts G. An evidence-based approach for malignancy-associated and paraneoplastic generalized granuloma annulare. *J Am Acad Dermatol.* 2022;87(4):876-78. DOI: 10.1016/j.jaad.2021.11.051. [PUBMED]
47. Bierhaus A, Schiekofer S, Schwaninger M, Andrassy M, Humpert PM, Chen J, et al. Diabetes associated sustained activation of the transcription factor nuclear factor-kappa B. *Diabetes.* 2001;50(12):2792-808. DOI: 10.2337/diabetes.50.12.2792. [PUBMED]
48. Jang S, Jang BH, Ko Y, Sasaki Y, Park JS, Hwang EH, et al. Herbal Medicines for Treating Metabolic Syndrome: A Systematic Review of Randomized Controlled Trials. *Evid Based Complement Alternat Med.* 2016;2016:5936402. DOI: 10.1155/2016/5936402. [PUBMED]
49. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med.* 2009;8(5):336-41. DOI: 10.1371/journal.pmed.1000097. [PUBMED]
50. Stevinson C, Lawlor DA, Fox KR. Exercise interventions for cancer patients: systematic review of controlled trials. *Cancer Causes Control* 2004;15(10):1035–56. DOI: 10.1007/s10552-004-1325-4. [PUBMED]
51. Metri K, Bhargav H, Chowdhury P, Koka PS. Ayurveda for chemo-radiotherapy induced side effects in cancer patients. *J Stem Cells* 2013;8(2):115-29. [PUBMED]
52. Gupta M, Shafiq N, Kumari S, Pandhi P. Pattern and perceptions of complementary and alternative medicine (CAM) among leukemia patients visiting haematology clinic of a north Indian tertiary care hospital. *Pharmacoepidemiol Drug Saf.* 2002;11(8):671-6. DOI: 10.1002/pds.782. [PUBMED]
53. Anticancer Herbs. Accessed 13 December 2022. Available: <http://www.aurvedindia.in/Anticancer-Herbs/951/Atharva>, Anticancer Herbs
54. Easwaran E. Three Upanishads: Isha, Mandukya, and Shvetashvatara. 1st ed. California: Nilgiri Press; 1973.
55. Gambhirananda S. Taittiriya Upanishad. 1st ed. Kolkata: Advaitashrama; 2010.
56. Venkatesananda S, Chappel C. The Concise Yoga Vasistha. 1st ed. Albany: New York State University Press; 1984.
57. Halvorsen BL, Holte K, Myhrstad MC, Barikmo I, Hvattum E, Remberg SF, et al. A systematic screening of total antioxidants in dietary plants. *J Nutr.* 2002;132(3):461-71. DOI: 10.1093/jn/132.3.461. [PUBMED]
58. Rao AV, Rao LG. Carotenoids and human health. *Pharmacol Res.* 2007;55(3):207-16. DOI: 10.1016/j.phrs.2007.01.012. [PUBMED]
59. Paur I, Carlsen MH, Halvorsen BL, Blomhoff R. Antioxidants in Herbs and Spices: Roles in Oxidative Stress and Redox Signaling. In: Benzie IFF, Wachtel-Galor S, editors. *Herbal Medicine: Biomolecular and Clinical Aspects.* 2nd ed. Boca Raton (FL): CRC Press/Taylor & Francis; 2011.
60. Potti A, Schilsky RL, Nevins JR. Refocusing the war on cancer: the critical role of personalized treatment. *Sci Transl Med.* 2010;2(28):28cm13. DOI: 10.1126/scitranslmed.3000643. [PUBMED]
61. Patwardhan B, Joshi K, Chopra A. Classification of human population based on HLA gene polymorphism and the concept of Prakriti in Ayurveda. *J Altern Complement Med.* 2005;11(2):349-53. DOI: 10.1089/acm.2005.11.349. [PUBMED]
62. Doddoli S, Shete S, Kulkarni D, Bhogal R. Effect of yoga training on lipid metabolism in industrial workers with reference to body constitution (Prakriti). *J Tradit Complement Med.* 2017;7(3):322-6. DOI: 10.1016/j.jtcme.2016.08.001. [PUBMED]

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