REVIEW ARTICLE

A bird's-eyeview on the classical and current perspective of Ayurveda Cancer care

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ABSTRACT:

The classical literature of *Ayurveda* explains the clinical entities of *Arbuda* and *Granthi* mentioned in *Sushruta Samhita* that resemble Cancer. Anticancer activities of various herbs are known. Effective integrative treatment modality in Cancer still exists as a research question. The multidimensional *Ayurvedic* approach can be effective in cancer care which includes preventive, curative, and restorative aspects. This article is a review regarding the potential of Ayurvedic aspects of Cancer management.

Keywords; *Ayurveda*, Cancer, Holistic Approach, Integrative management

INTRODUCTION

Ayurveda is a holistic science of healing that originated from the traditional knowledge treasure of the Indian subcontinent. The word consists of two parts, Ayu and Veda. Ayu is life, and Veda means science or knowledge. Thus, Ayurveda's literal definition is the science of life. Ayurveda is a science that treats diseases and helps preserve the health and well-being of individuals. It's an entire lifestyle. Life is an association of senses, mind, body, and soul. It is also evident from this concept that Ayurveda comprehends the body, but this also involves spiritual, physical, mental, and

social health. The Indigenous traditional system advocates lifestyles and natural therapies to balance the body, mind, soul, and environment. Here arises the equilibrium between the microcosm and macrocosm.

Cancer is a broad term and defines the disease that results when cellular changes ground the uncontrolled growth and division of cells. Cancer is one of the significant causes of death around the globe.^[1] It is one of the critical issues causing a physical, mental, economic, and financial burden. Seventy percent of cancer death occur in low- and middle-income countries. 1.16 trillion dollars is the total annual

Access the article online

Quick Response Code

www.thehealerjournal.org

DOI: 10.51649/healer.69

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Submitted: 08.06.2021

Received: 12.06.2021

Revised: 16.06.2021

Accepted: 21.06.2021

economic cost of Cancer per year.^[2] It indicates the need for cost-effective management as well as preventive measures. Cancer is a disease that occurs not only physically but also psychologically. Stress is a primary cause and a significant symptom after this terrible sickness has occurred. Previous studies have shown that stress can cause Cancer through genetic changes in expression.^[3] Progressive stress increases inflammation, and lower immunity also prevents immune cells from efficiently managing cancer cells. In addition, tumor and stromal cells in the tumor microenvironment can be influenced to promote tumor growth, invasion, and metastasis. Considering stress as one of the most important causes and symptoms, non-pharmacological therapies to heal the subtle body are highly recommended.

A rich history of the traditional system of medicine available worldwide upon different countries, out of which Indian system of medicine stands to be the most ancient, widely accepted, practiced, and flourished indigenous system of medicine. In *Ayurvedic* literature, diseases having signs and symptoms similar to those of Cancer are described under the heading of *Arbuda/Granthi*.^[4] According to the classical literature of Ayurveda, it is evident to note that *Kapha* is said to be the dominant *Dosha* involved along with others. *Acharya Sushruta* opines that due to excess *Kapha* *Dosha* *Arbuda* does not suppurate. *Arbuda* appears at the pre-existing site or nearby primary growth; it is called *Adhyarbuda* (recurrence). When a couple of similar types of change occurring at different places, following one after another, it is called "*Dwairbuda*" that can be correlated with metastasis.

METHODOLOGY

Ayurvedic perspective of cancer care collected from classical *Ayurvedic* literature, scientific articles, and practical experiences. Data mining was carried out from various Ayurvedic texts, peer-reviewed journals indexed on MEDLINE, EMBASE, and EBSCO medical databases, and websites (world health organization, press information bureau of India, etc.) of the concerned subjects. Evaluated them using scientific basis and practical aspects. Classical references are taken from *Sushruta Samhita* and available commentaries.

Discussion

A) Classical *Arbuda* And Cancer At a glance from *Sushruta Samhita*

	Ayurvedic Aspect	Current understandings
01	<i>Gatrapradeshekavachita</i>	It can occur anywhere in the body under five main types, 1) Carcinoma, 2) Sarcoma, 3) Lymphoma and Myeloma, 4) Leukaemia, 5) Brain and Spinal cord cancer
02	<i>Mamsamabhipradushyam</i>	Predominantly involves the damage of the muscular connective and epithelial tissues.
03	<i>Vrutamsthiram</i>	The growth may be round and stony hard
04	<i>Manda rujam</i>	Pain is not present except in the final stage
05	<i>Mahantam</i>	Spreads with a deep route
06	<i>Chiravrudhi</i>	Chronic in nature and gradual in progress.
07	<i>Apakam</i>	It is non-suppurative
08	<i>Mamshrochhayam</i>	Tumour is formed by unnecessary and uncontrolled abnormal proliferation of tissue
09	<i>Adhyarbuda or Dwirarbuda</i>	Recurrence and metastasis
10	<i>Vranarbuda</i>	Ulcerative tumors
11	<i>Karkatarbuda</i>	Malignant/ hard tumors

Understanding Cancer in terms of *Shadkriyakala* (Six stages)

B) Benefits of Ayurveda as an Adjunct Therapy in Cancer

It is pretty interesting to think that a 5000-year-old healing science is capable of addressing current disease spectrums. Humans had undergone multidimensional evolution, and why the science of life still relevant in health care?? The answer is whether the changes happening in the system of health the eternal principles or the fundamental of Ayurveda remains the same. This fundamental is comprising *Panchabhuta* (five essential components), three *Doshas* (life forces), *Dhatus* (seven tissue types), three *Malas* (waste types), and many other unique concepts.^[5] The variation of these principles determines both wellness and illness. Ayurvedic approach to cancer management also follows the same principles. Different neoplastic variants do not deviate from the purview of *DoshaDushya* and *Mala*. In the standard integrative approach Ayurvedic approach may be helpful to prevent further deterioration of the body and bring back to *Swasthya* (wellness).^[6]

Ayurveda advises the way to a healthy lifestyle through *Dinacharya*, *Ritucharya*, and *Achara rasayana*.^[7] The practice of lifestyle modifications through *Ayurveda* itself is capable of preventing modifiable risk factors of Cancer. *Rasayana Chikitsa* in *Ayurveda* needs particular exploration specific to Cancer care. The word "*Rasayana*" implies the way for attaining superior *Rasadi Dhatus*. The improved nutritional status and the better qualities of *Dhatus* lead to a series of secondary attributes of *Rasayana*, which bestow longevity, impart strength, *Ojo-bala*.^[8] Oxidative stress is thought to contribute to the development of Cancer and another disease. Many Ayurvedic formulations help to prevent oxidative stress and premature aging of cells. Numerous cells and tissues of the body are subject to early changes in the present age due to variables of the biological age and their current living style. Employing *Rasayana*

therapy is needed to rejuvenate or detoxify body systems to balance body, mind, and soul better. *Rasayana* therapy has been essentially used to maintain health. Still, it may also be utilized to treat different disease conditions, as *Rasayana* is nutritional science that gives nutrients for all seven *Dhatus*. *Rasayana* therapy strengthens the immune system and the vital life force called *Ojus*. This helps slow down all tissues breakdown and boost the system.

Rasayana drugs act as an antioxidant. Antioxidants are chemicals, such as free radicals, which minimize oxidative damage. Free radicals are highly reactive substances that attack molecules by collecting and changing electrons. Well recognized antioxidants are many enzymes and can counter the harmful effect of oxidation, such as vitamin C, vitamin E, and beta carotene (which is transformed to vitamin A).

Apart from *Rasayanachikitsa* Ayurveda is effective in various symptoms related to specific Cancers. Judicious administrations can be done. According to *Rogabala*, *Rogibala*, *Prakriti*, *Koshta*. Along with pharmacological interventions, other interventions are also available in Ayurveda. *Satvavajaya* and *Daivavyapashrayachikitsa* can improve psychological health status. It seems that this method can be used as a safe method in the management of the physical function, pain, anxiety, depression, and nausea in cancer survivors and increase a sense of well-being and improve quality of life.^[9]

C) Some major Plants used for cancer treatment in Ayurveda.

Approximately 35,000 plant species have been evaluated by National Cancer Institute (NCI) for possible anticancer properties. Of these, over 3,000 plant species indicated reproductive anticancer activity.^[10]

	Plant	Research outcome
01	<i>Abrus precatorius</i>	Anticarcinogenic properties on Yoshida sarcoma in rats, fibrosarcoma in mice and ascites tumor cells. ^[11]
02	<i>Albizia lebeck</i>	Anticancer properties on sarcoma in mice ^[12]
03	<i>Alstonia scholaris</i>	Benzo[a]pyrene-induced forestomach carcinoma in humans ^[12]
04	<i>Asparagus racemosa</i>	Human epidermoid carcinoma
05	<i>Boswellia serrata</i>	Human epidermal carcinoma of the nasopharynx
06	<i>Erythrina suberosa</i>	Sarcoma
07	<i>Euphorbia hirta</i>	Freund virus leukemia,
08	<i>Gynandropsis pentaphylla</i>	Hepatoma,
09	<i>Nigella sativa</i> in Lewis	Lung carcinoma
10	<i>Pedicularia foetida</i>	Human epidermoid carcinoma of the nasopharynx
11	<i>Picrorrhiza kurroa</i>	Hepatic cancers
12	<i>Withania somnifera</i>	various tumors ^[13]

Research on plant based chemical constituents in Cancer

No.	Study title	Type/ methods	Result/conclusion	Journal/yr of publicn
1	Chemical Composition and Cytotoxic Activity of Methanol Extract and its Fractions of <i>Streblus asper</i> Leaves on Human Cancer Cell Lines	methanol extract (SAM) and its fractions of S. asper leave tested for in vitro anticancer activity against cancer cell lines. Shade dried plant material was extracted with methanol and fractionated sequentially with hexane, chloroform, and butanol.	All tested extracts found highly effective against human lung cancer cell line (A-549) with IC ₅₀ <10 µg/mL. On Hep-G2 cancer cell line, only chloroform fraction are highly active with IC ₅₀ <10 µg/mL. Methanol and hexane fraction showed potent anticancer activity on K-562 cancer cell line with IC ₅₀ <10 µg/mL.	Pharmacogn Mag. 2018
5.	Cytotoxicity of withasteroids: withametelin induces cell cycle arrest at G2/M phase and mitochondria-mediated apoptosis in non-small cell lung ca A549 cells.	To test the cytotoxicity of six withasteroids viz., withametelin (WM), withaphysalin D, withaphysalin E, 12-deoxywithastramonolide, Withaperuvine B, and physalolactone against A549, HT-29, and MDA-MB-231 cancer cell lines	Significant cytotoxic effect of WM against A549 cells (IC ₅₀ value of 6.0 µM), MDA-MB-231 cells (IC ₅₀ value of 7.6 µM), and HT-29 cells (IC ₅₀ value of 8.2 µM) was observed	Tumour Biol. 2016
6.	The enriched fraction of <i>Vernonia cinerea</i> L. induces apoptosis and inhibits multi-drug resistance transporters in human epithelial cancer cells.	<i>Vernonia cinerea</i> Less. (VC) of the family Asteraceae. Cytotoxicity of the ethanolic extract of VC (VC-ET), petroleum ether fraction (VC-PET), dichloromethane fraction (VC-DCM), n-butyl alcohol fraction (VC-BT), and rest fraction (VC-R) was evaluated in cervical carcinoma (HeLa), lung adenocarcinoma (A549), breast cancer (MCF-7), and colon carcinoma (Caco-2) cells using Sulforhodamine B (SRB) assay	enriched fraction of VC (VC-DCM) possessed cytotoxic effects, triggered apoptosis, inhibited MDR transporters, enhanced drug uptake, and sensitized cancer cells towards anticancer drug-mediated cytotoxicity in human epithelial cancer cells.	J Ethnopharmacol. 2014
7.	Biological and therapeutic activities, and anticancer properties of curcumin	The present study reviewed previous studies in the literature, which support the therapeutic activity of curcumin in Cancer.	Curcumin is able to exert anti-inflammatory, antiplatelet, antioxidative, hepatoprotective and antitumor activities, particularly against cancers of the liver, skin, pancreas, prostate, ovary, lung and head neck, as well as having a positive effect in the treatment of arthritis	Exp Ther Med. 2015
9.	Effect of Puta on in vitro anticancer activity of Shataputi AbhrakBhasma on lung, leukemia and prostate cancer cell lines.	To screen in vitro anticancer activity of AbhrakBhasma at various stages of Putas (20, 50, 100)- cell line	AbhrakBhasma shows concentration dependent positive in vitro anticancer activity on all three cell lines with highly significant activity on prostate cancer cell lines. . Anticancer activity of AbhrakBhasma is in the order 100 Puti > 50 Puti > 20 Puti	J Ayurveda Integr Med. 2018

13.	An Overview on Genistein and its Various Formulations.	an overview on genistein, the various analytical methods and drug delivery approaches to determine genistein in the formulations are discussed.		Drug Res (Stuttg). 2019
14.	From ancient medicine to modern medicine: ayurvedic concepts of health and their role in inflammation and Cancer.	How ayurvedic medicine can be integrated with allopathic medicine is also discussed in this review		J Soc Integr Oncol. 2007
15.	Inhibition of pulmonary metastasis by Emilia sonchifolia (L.) DC: An in vivo experimental study	Whole plant genuine extract of E. sonchifolia (25 mg/kg body-weight) was administered intraperitoneally to C57BL/6 mice	sonchifolia significantly inhibited pulmonary tumour formation and increased the life span of animals. Lung collagen hydroxyproline, uronic acid, hexosamine, serum sialic acid, γ -glutamyl transpeptidase, vascular endothelial growth factor (VEGF), granulocyte monocyte colony-stimulating factor and other cytokine levels were significantly lowered in the treated group of animals	Phytomedicine. 2016
16.	Metabolic alterations in mammary cancer prevention by withaferin A in a clinically relevant mouse model.	Invivo	WA administration resulted in a statistically significant decrease in macroscopic mammary tumor size, microscopic mammary tumor area, and the incidence of pulmonary metastasis	J Natl Cancer Inst. 2013
17.	Enhancement of antitumor effect of paclitaxel in combination with immunomodulatory Withaniasomnifera on benzo(a)pyrene induced experimental lung cancer.	Paclitaxel: chemotherapy-induced immune dysfunction- Aswagandha along with paclitaxel- 400mg/kg in albino rats- induced lung ca by benzo-pyrene.	Benzo(a)pyrene induced cancer animals were treated with 400mg/kg bodyweight of W. somnifera (L.) Dunal extract for 30 days significantly alters the levels of immunocompetent cells, immune complexes and immunoglobulins	Chem Biol Interact. 2006
18.	Anticancer activity of green synthesised AgNPs from Cymbopogon citratus (LG) against lung carcinoma cell line A549	To analyse the antibacterial and anticancer effects of silver nanoparticles (AgNPs) synthesised from the Cymbopogon citratus, (lemongrass) (LG-AgNPs), which is widely used in ayurvedic drugs for treating various diseases. the cytotoxicity and anticancer activity of the LG-AgNPs were assessed with lung alveolar carcinoma cell line A549	Results show the cytotoxicity effect of LG-AgNPs in lung cancer cells. It also inhibited the cell migration and invasion at the dose of 25 μ g ml ⁻¹ by increasing the apoptotic gene expression	IET Nanobiotechnol. 2019

20.	Anticancer Studies of Aqueous Extract of Roots and Leaves of Pandanus Odoratissimus f. ferreus (Y. Kimura) Hatus: An In Vitro Approach.	To explore the dose-dependent in vitro anticancer effects of the extracts of Pandanus odoratissimus. In vitro cytotoxic and antimitotic screening by brine shrimp lethality assay and onion root tip method. The behavior of the extracts on calu-6 (non-small cell lung cancer cell lines), PBMC (peripheral blood mononuclear cells) and WI (lung fibroblast cell lines) was studied using 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium (MTT) assay followed by flow cytometric analysis on calu-6 cell lines.	AEPO showed significant cytotoxic and antimitotic activities. AEPO at 10 mg/ml concentration showed significant antimitotic activity by showing 3% mitotic index. There was a significant reduction in cell proliferation of calu-6 cells, ranging from 56 to 35%, after 24-48 h of treatment with 200 µg/ml ($P < 0.001$) of AEPO, while AEPO remained unaffected on PBMC and WI-38 cell lines.	J Tradit Complement Med. 2014
22.	Cytotoxic and anti-tumour properties of certain taxa of Umbelliferae with special reference to Centella asiatica (L.) Urban.	Study examines the anti-tumour effect of the crude extract (CE) of Centella asiatica as well as its partially purified fractions (AF) from chromatographic procedures by both in vitro short and long term chemosensitivity and in vivo tumour model test systems.	AF dose dependently inhibited the proliferation of the transformed cell lines significantly more than did the CE and other solvent fractions. No toxic effects were detected in normal human lymphocytes. Significantly suppressed the multiplication of mouse lung fibroblast (L-929) cells . Oral administration of the extracts (CE and AF) retarded the development of solid and ascites tumours and increased the life span of these tumour bearing mice. Tritiated thymidine, uridine and leucine incorporation assay suggest that the fraction acts directly on DNA synthesis.	J Ethnopharmacol. 1995
23.	Amelioration of cisplatin induced nephrotoxicity in Swiss albino mice by Rubia cordifolia extract	Hydro-alcoholic extract of Rubia cordifolia at different doses along with cisplatin treatment-swiss albino mice. Other group-cisplatin alone.	The extract could significantly decrease the cisplatin induced nephrotoxicity as inferred from the tissue antioxidant status in the drug administered animals. Remarkable change was observed in serum creatinine and urea levels. Lipid peroxidation in the kidney and liver tissues was also considerably reduced in Rubia cordifolia extract treated animals	J Cancer Res Ther. 2008

Integrative treatment efforts in Ayurveda

As a joint venture of All India Institute of Ayurveda (AIIA) and National Institute of Cancer Prevention and Research (NICPR), the Center of Integrative Oncology (CIO) has been established with the intention of integrative practice in the field of cancer prevention and management. MoU has been signed between AIIA & NICPR in the year 2016. During the celebration of the "Cancer

Awareness Week", the website link of the CIO was launched by Director, AIIA in Feb, 2018 .

D) Challenges in the Current *Ayurvedic* Approach towards Integrative Cancer care

Lack of proper evidence in synergistic and antagonistic drug interaction

Each herb contains multiple active principles that often operate synergistically or antagonistically to produce action along with conventional care. The exact action of most of the drugs are not known. Preclinical safety studies should be necessary in this scenario.

Challenges in the pain management and critical care of Cancer

There is a critical need for new analgesic and anti-inflammatory drugs having the efficacy of conventional NSAIDs while minimizing their associated adverse events. Nanomedicine is a novel and rapidly evolving, highly technical approach to optimize the delivery and control of medicines. *Ayurveda bhasmam* may provide a safe, effective, and fast-acting treatment option in pain conditions.

CONCLUSION

Research on the majority of *Ayurveda* drugs is in the preclinical phase or is not being actively explored. Future research on this topic would help to identify safe and effective anticancer drugs and will further the exploration of their mechanism of action are the need of the hour. Promising results are getting from current *Ayurvedic* practices, but unfortunately, the documentation for future research scope is poor. Due to these limitations, *Ayurveda* is often administered as an integrative or adjunct therapy. There is enough scope to explore the role of *Ayurveda* in the management of Cancer by analyzing and comparing various concepts mentioned in ancient texts with current information available in practices. Attention should be given not only to the evaluation of safety and examination of effectiveness in treatment strategy but also to consider community practice settings, patient expectations, compliance, and cost-effectiveness.

ACKNOWLEDGEMENTS: Not Applicable

CONFLICT OF INTEREST: Author declares that there is no conflict of interest.

SOURCE OF SUPPORT: None

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How to cite this article:

Arshathjyothi P.S., Yadava R.K., A bird's-eye view on the classical and current perspective of *Ayurveda* Cancer care, *The Healer Journal*, 2021;2(2):62-68.