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Mexican Journal of Medical Research ICSa

Biannual Publication Vol. 14 No. 27 (2026) I-II

Editorial

Traditional, complementary and alternative medicine (TCAM) in cancer chemoprevention: Advances and promises

Medicina tradicional, complementaria y alternativa (MTCA) en la quimioprevención del cáncer: Avances y promesas

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The World Health Organization (WHO) defines Traditional, Complementary, and Alternative Medicine (TCAM) as the body of knowledge and skills rooted in the traditional theories, beliefs, and experiences of diverse cultures that preserve health. In other words, TCAM includes any medical system or practice, knowledge, and belief based on plants, animals, and/or mineral, spiritual therapies, manual techniques, and exercises applied individually or in combination to improve human health. Currently, the number of individuals using TCAM has grown significantly, as it presents favorable factors that contribute to its growing global acceptance. Among its main advantages are its high diversity, relatively low cost, and most importantly, a lower incidence of adverse and/or toxic effects compared to conventional biomedicine (allopathic medicine), where these effects are often attributed to synthetic drugs. At present, TCAM is used by different populations to diagnose, improve, treat, and/or prevent the appearance and progression of infectious and chronic diseases (such as obesity, diabetes, hypertension, asthma, atherosclerosis, Alzheimer's, Parkinson's, and, indisputably, cancer).[1-3]

Over the past few decades, there has been an exponential increase in its use among cancer patients. The main reasons for this are: a) the high incidence of ineffective results of conventional treatments, b) the presence of associated complications that increase the number of dissatisfied patients, and c) the rising costs of them.[1-3]

Despite numerous advances in cancer treatment, this disease continues to generate a significant health and economic burden for the healthcare sector of every country and is one of the leading causes of death worldwide. Therefore, cancer patients use TCAM as an alternative strategy to control the disease, improve their quality of life, and, above all, find a possible cure. [1-4]

Perhaps this ideology and/or belief is not entirely wrong if we consider the following aspects:

1. Deoxyribonucleic acid (DNA) is the molecule most closely linked to cancer; therefore, when it undergoes alterations (mutations); cell growth and/or division can become uncontrolled, inducing the development of the disease. These mutations accumulate over time and can activate oncogenes (those that promote cell growth) or deactivate tumor suppressor genes (those that control the growth of tumors), leading to uncontrolled cell proliferation and tumor formation.[4-6]
2. Genotoxicity is the ability of different agents to damage genetic material; however, it does not only include DNA, but also cellular components related to the functionality and behavior of chromosomes within a cell.[5,6]
3. Genotoxic agents, depending on their origin, are classified into three categories: physical, chemical, and biological. Temperature, ionizing and electromagnetic radiation, as well as ultraviolet light, are considered in the first group. The second category includes aromatic hydrocarbons, alkylating agents, acrylamide, heavy metals, pesticides, aliphatic epoxides, food additives, organic solvents, and xenobiotics derived from certain lifestyles, such as alcoholism or smoking. Finally, some bacteria, parasites, fungi, and viruses are in the last category. Therefore, many genotoxins can have mutagenic and carcinogenic effects.[5,6]
4. In the case of mutagenesis, there are two types of alterations: micromutations, which occur at the level of a minimal unit of information (gen), and/or macromutations, which can affect chromosomes. Mutations can also occur in germ and/or somatic cells. In the first case, they are heritable if they are passed on to progeny. On the other hand, the majority of scientific evidence agrees that mutations in somatic cells are not only involved in carcinogenesis but can also cause genetic disorders such as atherosclerosis, heart diseases, and other chronic degenerative diseases. It is important to remember that the toxicity of genotoxic agents is influenced by the dose, time, or means of exposure, along with the genetic makeup of the individual, which can determine susceptibility.[5,6]
5. Throughout history, TCAM has been based primarily on the use of plants and their bioactive compounds (also called "phytochemicals"), which together have played an important role in improving human health. Bioactive compounds have

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Received: 09/05/2025, Accepted: 13/05/2025, Published: 05/01/2026

DOI: https://doi.org/10.29057/mjmr.v14i27.16107

demonstrated the ability to counteract mutagenic and carcinogenic effects; that is, antigenotoxic agents that can intervene in the initiation, promotion, and progression of cellular transformation (carcinogenesis).[5,6]

6. In recent decades, numerous studies have been conducted to identify compounds that can protect DNA. This field of research is gaining relevance worldwide to explore the rich biodiversity of edible plants (fruits, vegetables) and medicinal plants in search of more effective phytoantimutagens. Therefore, the cultivation and use of medicinal herbs and fruits significantly contribute to promoting sustainable agricultural development due to the growing demand for organic agricultural production in different countries (including Mexico). These bioactive compounds belong to various chemical groups, such as flavonoids (flavanols, flavones, flavonols, isoflavones, chalcones, anthocyanins), phenolic acids (hydroxycinnamic acids, hydroxybenzoic acids), phytosterols, phytoestrogens, terpenes (triterpenes, tetraterpenes, diterpenes, sesquiterpenes, monoterpenes), coumarins, hydroxybenzoates, phenylpropanoids, chlorins, tannins, pheophytins, megastigmas, chitinases, organic acids, fatty acids, amino acids, alkaloids, glycosides and protease inhibitors. Besides their antimutagenic and anticancer properties, many of these substances have demonstrated other beneficial effects on health, such as immunomodulatory, hepatoprotective, antihyperglycemic, antihyperlipidemic, cardioprotective, anti-inflammatory, and antirheumatic actions resulting from their excellent antioxidant and detoxifying properties.[5,6]

7. In general, antimutagenic agents are organized into desmutagens and bioantimutagens. Desmutagens are substances that promote the elimination of genotoxins from the organism and/or partially or completely inactivate their action through enzymatic or chemical interactions before genes are altered. On the other hand, bioantimutagens or true antimutagens activate repair and replication processes of damaged DNA, generating a decrease in the frequency of mutations.[5,6]

8. Antimutagenic agents can be classified according to their specific mechanism of action or site of action. An obvious strategy would be to avoid exposure to recognized risk factors. However, complementary actions (levels of prevention) include increasing the body's resistance to genotoxins or slowing the progression of chronic diseases through the administration of chemopreventive agents. In primary prevention (used in apparently healthy individuals), mutations and cancer initiation can be inhibited by activating mechanisms in the extracellular and/or intracellular environment; for example, by modulating metabolism, blocking reactive oxygen and/or nitrogen species, inhibiting cell replication, modifying membrane transport, modulating metabolism, maintaining DNA structure, and controlling gene expression. Therefore, tumor promotion can be decreased by stimulating antioxidant and anti-inflammatory activities, inhibiting cell proliferation, inducing cell differentiation, and modulating apoptosis and signal transduction pathways. Secondary prevention begins when a premalignant lesion is detected. Tumor progression can be controlled using the same mechanisms previously mentioned. It can also be controlled by altering hormonal status and the immune system, and suppressing tumor angiogenesis. Finally, in tertiary prevention aimed to cancer patients after therapy, similar mechanisms are being explored, highlighting the possibility of affecting cell adhesion molecules and activating anti-metastasis genes.[4-6]

In conclusion, TCAM is a different strategy from radiotherapy and chemotherapy, and there is still a long way to go in scientific research to better understand its effects in cancer chemoprevention. It has shown substantial progress, yet there is still much promise to be fulfilled in the future.

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