

Assessing the contribution of dietary factors in breast cancer

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ABSTRACT

The worldwide estimates suggest that in the year 2012 almost 14.1 million new cases and 8.2 million cancers associated mortality has been reported. Incidence-wise, breast cancer (11.7 million) is the leading malignancy reported in women in the same year. The present systematic review is carried out to explore the magnitude and contribution of dietary constituents in the development of breast cancer, and to recommend community-based strategies to counter the menace of breast cancer on a global scale. A thorough search for all published matter pertaining to the topic was made in multiple search engines, including PubMed, World Health Organization website and Google scholar for almost 35 days. Keywords used in the search include breast cancer and dietary constituents. Owing to the multi-factorial etiology and lack of clarity regarding share of each potential risk factor, early detection of the disease and implementation of a multi-pronged strategy remains crucial in ensuring adequate control. To conclude, the review clearly establishes the role of dietary constituents in the onset/prevention of breast cancer. However, most of the available evidence cannot be generalized in multiple settings and requires further research to eventually formulate a cost-effective approach for the early detection and treatment of breast cancer.

Key words: Breast cancer, diet, dietary constituents, screening

INTRODUCTION

The worldwide estimates suggest that in the year 2012 almost 14.1 million new cases and 8.2 million cancer associated mortality has been reported.^[1] Incidence-wise, breast cancer (11.7 million) is the leading malignancy reported in women in the same year.^[1] Similar trends have been observed pertaining to cancer associated deaths among women and a definite hike has been reported in comparison to the 2008 estimates.^[2] In fact, the recent estimation reveals that among every four women diagnosed with any form of cancer, one is a case of breast cancer.^[1] Owing to these enormous estimates, impairment in the quality of life, and involved financial expenditure, implementation of appropriate measures to ensure prevention of breast cancer deserves global attention.^[3,4]

However, as a major proportion of breast cancer associated death are happening in low/middle-income countries (because of the weak public health care delivery system and the absence of a comprehensive screening programs and treatment facilities), it is a daunting task for the program managers to combat the situation effectively.^[5-7] In fact documented evidence is available to suggest that effective screening programs will not only increase the chances of a healthy outcome, but even decrease the need of invasive approach in management, and minimize the suffering/deaths.^[8-11]

The present systematic review is carried out to explore the magnitude and contribution of dietary constituents in the development of breast cancer, and to recommend community-based strategies to counter the menace of breast cancer on a global scale.

MATERIALS AND METHODS

A thorough search for all published matter pertaining to the topic was made in multiple search engines, including PubMed, World Health Organization website and Google scholar for almost 35 days. All the relevant documents,

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systematic reviews, technical publication series, research articles, and books, published in the time frame of 1998-2014 was incorporated in the review. A total of 107 studies were identified initially, of which, 17 were excluded on account of irrelevance to the present study and because of the unavailability of the complete version of the articles. Overall 90 articles were selected based upon the suitability with the current review objectives and analyzed. Keywords used in the search include breast cancer and dietary constituents.

Risk factors in the causation of breast cancer

Findings of multiple small scale and large scale studies have confirmed that etiology of breast cancer is multi-factorial, involving a significant interaction between the environmental and genetic attributes.^[12,13] All the identified factors have been mentioned in a systematic manner in Table 1.^[13-39]

Dietary constituents: Augmenting the risk of breast cancers

Despite presence of enough evidence regarding the association of a particular class of nutrient with the development of breast cancer, the association of the same with the overall diet is still variable.^[40] Dietary constituents are acknowledged as an environmental

factor which has a tremendous potential to affect the onset of breast cancer by altering the epigenome.^[41] Findings of multiple studies have revealed association between different dietary constituents and augmented risk of breast cancer [Table 2].^[28,42-54]

Dietary constituents: Reducing the risk of breast cancers

This topic is worth mentioning as in comparison with most of the nonmodifiable risk factors, diet and nutrition related attributes can be easily altered to ensure massive reduction in the magnitude of breast cancer.^[55] A wide range of specific food components has been identified which are considered beneficial in mitigating the risk of breast cancer subtypes [Table 3].^[40,56-80] In addition, adherence to the Mediterranean diet has also shown positive results in decreasing the overall risk of onset of the malignancy.^[81,82] In a study performed in a developed nation, improvement in survival rate was observed in response to intake of Vitamin-C on a prophylactic basis.^[83,84] Furthermore, in case of postmenopausal women, dietary factors are not only associated with the development of the disease but also with a reduction in breast cancer relapse, survival rates, and associated mortality.^[85-91]

Suggested interventions

In contrast to some other malignancies, breast cancer occurs in an easily accessible site and thus facilitates prompt detection and treatment.^[92] However, owing to the multi-factorial etiology and lack of clarity regarding share of each potential risk factor, early detection of the disease and implementation of a multi-pronged strategy remains crucial in ensuring adequate control.^[8,93]

In fact, the international welfare agencies have proposed multiple strategies like ensuring sustained support from program managers in different aspects of the cancer; developing targeted strategies based on the prevalence of

Environment ^[13-31]	Genetic ^[31-39]
Age; parity; residential geographical setting; lack of exercise; practice of late initiation of breastfeeding; oral contraceptives and hormone replacement therapy; disturbances in the circadian rhythm; high percentage of total body fat and tall height in adulthood; benign breast disease; and positive history of breast cancer on one side	Positive family history; race; role of FOXA1 in anti-estrogen resistance; Her2 positive breast cancer; presence of long Intergenic noncoding RNAs; programmed cell death ligand 1 expression and elevated tumor-infiltrating lymphocytes; and methylenetetrahydrofolate reductase C677T polymorphism

RNAs: Ribose-nucleic acids, FOXA1: Forkhead box transcription factor 1

Dietary constituent	Study related parameters
High consumption of animal-source foods ^[30,42]	Case-control study in China; case control study in Thai women
Intake of synthetic folate ^[43]	Case-control study-The Women's Circle of Health Study (European American women vs. African American women)
Excess of calorie intake ^[44]	Systematic reviews performed by nine independent academic centers
Alcohol intake ^[12]	In the Women's Health Initiative observational study prospective cohort
Carbohydrates ^[45-49]	Population based case-control study among women in Malaysia; among premenopausal women in the Nurses' Health Study II aged 26-46 years; a population-based cohort study-Shanghai Women's Health Study; a prospective cohort analysis from E3N French study; a cross-sectional study among Mexican women admitted in six hospitals
Eicosanoids and adipokines ^[50]	Systematic review
Saturated, monounsaturated, polyunsaturated, and trans-fatty acids ^[51,28]	Prospective observational study among premenopausal women in the Nurses' Health Study; case control study among Polish women
Foods with high glycaemic index and glycaemic load ^[46,47,49,52-54]	Among premenopausal women in the Nurses' Health Study II aged 26-46 years; a population-based cohort study-Shanghai Women's Health Study; a prospective cohort analysis from E3N French study; prospective cohort of Swedish women; cohort study among Women's Health Initiative cohort participants; case-control study using a validated food-frequency questionnaire method

Table 3: Dietary constituents: Reducing the risk of breast cancers

Plant-origin dietary constituents ^[28,30,40,43,45,56-74]	Animal-origin dietary constituents ^[42,65,75-77]	Others ^[78-80]
Miso-soup and isoflavone consumption; high soy intake; green tea; natural food folate intake; linoleic acid; citrus fruits; diet rich in fruit and vegetables; plant fat and sterols; Vitamin-B, carotenoids, and phytoestrogens; dietary fiber; and dietary lignans, phytoestrogen-rich foods (viz., sunflower and pumpkin seeds)	Milk and egg; omega-3 fatty acids; and Vitamin-D	Beverages containing <i>Lactobacillus casei</i> Shirota; and quality of diet

risk factors in the local settings; promoting research work in the grey areas of the malignancy; sensitizing health personnel about recent developments; fostering association with nongovernmental and international agencies to increase the coverage of services in remote areas; strengthening of the existing infrastructure; increasing awareness among community regarding modifiable etiological factors; implementing uniform screening services; expanding interventions towards high-risk patients; and advocating lifestyle modification.^[1,4,5,7,8,81,89,94]

Implications for practice

The present review broadly reflects the immense need to develop a comprehensive national program, well supported with community awareness activities to augment their knowledge about risk factors, breast self-examination, and treatment modalities. The policy makers can ensure successful implementation of the strategies provided all stakeholders (especially, physicians from the public and private sector) are involved. Furthermore, the outreach workers should be strategically involved to cover the remote areas and remove the prevalent myths among the members of society. Finally, presence of a strong political-will can ensure accomplishment of multiple goals, within the available resources.

Implications for research

As already discussed, there is an immense need to plan and organize population-based large-scale studies to assess the role of dietary nutrients in both causation or prevention of the malignancy. However, studies to assess the level of awareness among the community about potential risk factors and breast cancer screening services can also help the program managers. In-fact, there is a definite scope for randomized controlled trials to establish the cut-off range of multiple dietary constituents so that onset of breast cancer can be averted.

CONCLUSION

To conclude, the review clearly establishes the role of dietary constituents in the onset/prevention of breast cancer. However, most of the available evidence cannot be generalized in multiple settings and requires further research eventually to formulate a cost-effective approach for the early detection and treatment of breast cancer.

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