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LIFESTYLE AS RISK FACTOR FOR BREAST CANCER: A CASE-CONTROL STUDY IN CHENNAI, TAMIL NADU, INDIA

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Research Paper

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ABSTRACT

AIM: The present investigation was attempted to find out the possible life style risk factors for breast cancer among the breast cancer cases, using a case-control study in Chennai, Tamil Nadu, India.

Methods: A total number of 512 breast cancer cases,from various hospitals of Chennai and 540 control women of same age groupin same geographical area,were investigated using standard questionnaire that evaluated the various lif estyle risk factors for breast cancer such as BMI, physical exercise, psychological stress, abortion, lifestyle health problems and parity.

Results: Karl Pearson's chi-square test was performed to determine the overall association between the lifestyle risk factors and breast cancer. The results revealed that all the lifestyle risk factors investigated were found to be highly significantly associated with breast cancer when compared with control women in Chennai.

Conclusion: The lifestyle changes such as overall maintenance of BMI, increasing physical exercise,decreasing psychological stress using yoga, avoiding abortion, increasing parity and eating healthy traditional foods may reduce the risk of breast cancer.

Keywords: Lifestyle risk factors-Breast cancer-BMI–Abortion-Psychological stress- physical activity-parity.

INTRODUCTION

Breast cancer has now overtaken lung cancer as the worlds most commonly diagnosed cancer. In the past two decades, the overall number of people diagnosed with cancer nearly doubled from an estimated 10million in 2000to 19.3 million in 2020. Today, one in 5 people worldwide will develop cancer during their lifetime.

Further the projections suggest that there will be 50% higher increase in breast cancer diagnosis in 2040 than in 2020 (WHO, 2021). Nutritional studies and epidemiological survey show that dietary and lifestyle factors play significant role in breast cancer risk (Afolabi, 2007).

Risk of breast cancer and its mortality rate increases with the westernization of traditional diets and life styles (Chie et al., 1995). The westernization of lifestyle include decreased parity and delayed child bearing, a diet rich in saturated fat, a sedentary lifestyle has been associated with an increased incidence of cancer in East Asian women (Shen *et al*,2005, Harashima *et al.*, 2007, Ishimo to *et al*., 1994). A number of modifiable risk factors have been associated with an increased risk of breast cancer (Heitz *et al*., 2018). There are several factors leading to the occurrence of breast cancer diseases such as unhealthy food habits, physical inactivity, disturbed biological clock, not having children, avoiding breast feeding, obesity, high fat diets, hormone replacement therapy (HRT), use of oral contraceptive, alcohol use and smoking, etc. However, by modification of

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lifestyle, these diseases can possibly be prevented. It is known that 1.67 million new breast cancer cases are diagnosed per year in worldwide, the need for the prevention is given a completely new dimension and the epidemiological studies revealed that lifestyle factors play an important role in the development of breast cancer.

In an Indian context, Gajalakshmi *et al.,* (2009), reported the decreased risk for breast cancer in pre-menopausal women with long duration of breast feeding. Further, breast cancer risk reduced with increase of the age at menarche, number of children born, and the number of children breast feeding. Similarly Akbari *et al.,* (2010) reported the parity and breast feeding are effective in reduction of breast cancer risk in Iran.

The anthropometric factors such as weight, height and mass index (BMI) have been associated with breast cancer risk (Lin *et al.,* 1971; Li *et al.,* 1997).There is strong evidence that physical activity is associated with reduced risk of colon and breast cancer (National Cancer Institute, 2009). Lahmann *et al.,* (2004) reported the breast cancer risk in post menopausal women is predicted by increased body fat and weight gain. Based on the available evidences, high body mass after menopause of women, probably increase the risk of breast cancer (WCRF, 1997). Hence, WHO (2000) has recommended the obesity prevention may be an important measure for breast cancer prevention.

There is considerable evidence that free estrogen levels are raised in obese women, especially in those with abdominal obesity (Stoll, 1996) and these estrogen may promote tumor growth, either directly or by modulating steroid activity there by implicated as a risk factor of breast cancer (Key and Pike, 1988; Schapira*et al.,* 1990; Bernstein and Ross, 1993; Ballard-Barbash, 1994; Del Giudice *et al.,* 1998; Persson, 2000 and Verkasalo *et al.,* 2001). Kuriyama (2005) reported that Japanese women are more likely to develop breast cancer due to excess weight. Therefore, weight control may be a modifiable risk factor for breast cancer prevention and thus obesity may have significant public health impact in women.

Higher consumption of red meat has been reported to be associated with increased risk of breast cancer in some epidemiologic studies (Parvathy, 2017; Boyd *et al.,* 1993) including several cohort studies (Toniolo *et al.,* 1994; Gaard *et al.,* 1995 and Vatten *et al.,* 1990). Dietary fat has long been suspected to be responsible for the meat-breast cancer association. A high intake of saturated fat was reported to increase the risk of breast cancer (NCI, 2009). Women who consumed greater amounts of trans-fatty acids significantly increased the risk of breast cancer. However, low fat consumption found to be reducing the breast cancer risk in women going through menopause. In addition, fish consumption in general has been associated with a protective effect (Omega-3-fatty acids) against breast cancer (Wakai, *et al*., 2000; Caygill, 1996; Bagga *et al*., 2002; Kuriki *et al*., 2007; Rose and Connolly *et al*., 1991 and Favero *et al*., 1998). Thus, limiting the intake of high fat diet may be a modifiable risk factor for breast cancer prevention.

Most of the studies (60 reports published in North America, Europe, Asia and Australia) indicated that physically active women have a lower risk of developing breast cancer than inactive women; however, the amount of reduction achieved through physical activity (20 to 80%) varies widely (Lee and Oguma, 2006; McTiernan, 2006). . Hirose *et al.,* (2003) demonstrated that physical exercise twice a week or more, reduces the risk of breast cancer among Japanese women.

The incidence of breast cancer is significantly lower in Japan, Thailand, Nigeria and India than in Denmark, Netherland, New Zealand, Switzerland, the United Kingdom and the United States. Women living in North America have the highest rate of breast cancer in the world. It has been suggested that these trends in breast cancer incidence may be related to dietary influences, particularly dietary fat consumption. Geographical variation in the incidence and mortality of breast cancer suggest that the known risk factors for breast may vary in different parts of the world and that environment (Jardines, 2014).

In this context, it is now noted that in Asia, Japan, Singapore and Korea have reported the doubled or tripled incidence of breast cancer over the past 40 years and China's urban registries documented a 50% increase in the years between 1972 and 1994 (Jin *et al.,* 1999). In the case of India, an increased incidence of breast cancer was reported in Bombay (Mumbai) from 1978 to 1997 (20.5 to 31.5 per 100,000) (Parkin *et al.,* 2005). Further, Murthy and Mathew (2004) listed the ranks of breast cancer incidence among major Metropolitan cities in India i.e., Mumbai (28.2); Delhi (27.6); Chennai (23.5) and Bangalore (21.3). Based on

the ICMR report (2006), the number of breast cancer cases in India to rise to 106, 124 in 2015 and to 123, 634 in 2020.

India is a developing country with one of the most diverse populations and diet in the world. Cancer rates in India are lower than those seen in Western countries, but are rising with increasing migration of rural population to the cities, increases in life expectancy and changes in lifestyles (Sinha *et al.*, 2003 and Parvathy *et al*., 2017; 2014). Presently the population of India is exceeding 1.28 billion and the population of Tamil Nadu is 7.67 Crore. Chennai, one of the major Metropolitan Cities in India, has the population of >91.27 lakhs of people and it will become 100 lakhs within 10 years (www.worldmeters.Info).

A higher risk of breast cancer among Americans and European women has been attributed to western lifestyle (Mc Tiernan, 2003; Gerber *et al.*, 2003) by combination of early menarche, decreased parity, delayed child bearing and a sedentary lifestyle, studies of migrants have confirmed the relative importance of environment and lifestyle in the etiology of breast cancer (Shimizu *et al.*, 1991; Tsugane*et al.*, 1990). The so called life style is now very common in Asian countries such as Japan, Korea, Taiwan and Hong Kong and it is spreading fast in the East Asia including Indian sub continent.

The reasons for the low incidence of breast cancer among Indian women and the increasing incidence of breast cancer now in recent years are not completely understood, although they are attributed to reproductive and lifestyle factors. . Epidemiological studies implicate change in lifestyles (Chie *et al*., 1995) and western diet as well as the westernization of diet is the probable cause of the increasing incidence of breast cancer (Wiseman, 2000).

Considering the significance of life-style as risk factors of breast cancer, while reviewing the literature, although number of researchers attempted in various regions of India about the risk factors of breast cancer (Parvathy, 2017; Parvathy *et al*., 2014; Auguestine *et al.*, 2014; Datta *et al.*, 2014; Mohite, 2014; Kamath *et al.*, 2014; Krishnatreya *et al*., 2014; Aeri, 2013; Babu *et al.*, 2013; Parvathy *et al.*, 2014; Balasubramanian *et al.*, 2013; Sharma *et al.*, 2013; Singh and Jangra 2013; Kaur *et al.*, 2011; Dhilon *et al.*, 2011; Singh *et al.*, 2011; Dey *et al.*, 2009; Datta and Biswas 2009; Murthy *et al.*, 2009; Gajalakshmi *et al.*, 2009; Pakseresht *et al.*, 2009; Jayalekshmi *et al.*, 2009; Thakur, 2008; Mathew, 2008; Puri *et al.*, 2008; Sinha *et al.*, 2003; Gajalakshmi *et al.*, 1997; Shanta *et al.*, 1995; Rao *et al.*, 2013; and Gajalakshmi and Shanta, 1991). There is no detailed study on lifestyle as riskfactor for breast cancer in Chennai. In India, breast cancer has become a major health concern across Indian cities, especially in the major metropolitan cities like Delhi, Bangalore, and Chennai as it's account for more than a fourth of all female cancers.

Hence, the present investigation has been attempted to highlight the role of lifestylerisk factors among the breast cancer cases in Chennai. In this context, a total number of 512 breast cancer patients from various hospitals of Chennai were interviewed face-to-face using standard questionnaire. Similarly, 540 control women (Non-cancer women) from general population were interviewed using the same standard questionnaire and the results are evaluated using Karl –Pearson's test to find out the major risk factors for breast cancer. The outcome of present study will guide the women to modify the lifestyle and to reduce the risk of breast cancer in future.

MATERIALS AND METHODS

The present investigation has been proposed to study the possible risk factors involved in the life style of breast cancer cases of Chennai, Metropolitan city, Tamil Nadu, India. To evaluate the lifestyle risk factors of breast cancer, a Case-Control design was proposed, involving two groups, one group of breast cancer patients and another group of age-matched women (non-breast cancer) from the same geographical area. In this context, a total number of 512 breast cancer patients (women) from different hospitals of Chennai were enrolled as case group from February 2013 to January 2015. A total of 540 age-matched, non breast cancer women in and around Chennai were enrolled as the control group. All these participants were willing to divulge their life style information.

The questionnaires were given to each patient, interacted and answers recorded in the booklet. The patients who not respond to the questions were neglected. Similarly, the same set, of questionnaires were given to each control women (non-breast cancerous women) and the answers were recorded personally with their consent.

Any absolute difference between two proportions (test statistics) that exceeds the critical value.

Preparation of questionnaire

The questionnaire was designed in such a way that covers information pertaining to the lifestyle risk factors of breast cancer cases and control women. The questionnaire used in the present study was prepared in consultation with the experienced cancer dieticians, breast cancer specialists and on the bases of information and guidelines available in the pertinent literature (Block *et al.*, 1986; Vachon*et al.*, 2000; Willet *et al.*, 2001; Sonestedt *et al.*, 2007; Hadjisavvas *et al.*, 2010; Bartlay *et al.*, 2012). The questionnaire includes BMI, physical exercise, psychological stress, type of abortion, life style health problems and parity of both cases and control women. The collected information were scrutinized, tabulated with frequencies (number of participants falling under a category of a factor) of cases and control groups and the respective percentages . (Table .1)

Table 1: Lifestyle risk factors for breast cancer: a Case –Control study in Chennai, India.

S. No.	Study groups		Cases (n=512)		Control (n=540)		χ^2	P value
			Frequency	%	Frequency	%		
1.	Body mass index (BMI)	Under weight (<18.5)	47	9.2	12	2.2	90.10734	2.08x10-^{19*}
		Normal (18.6 – 25)	174	34.0	334	61.9		
		Over weight (25.1 – 30)	210	41.0	136	25.2		
		Obesity (30.1 – 35)	81	15.8	58	10.7		
2.	Physical exercise	No exercise	256	50.0	122	22.6	91.35982	1.12x10-^{19*}
		Moderate exercise	246	48.0	383	70.9		
		Yoga	5	1.0	24	4.4		
		Tread mill	5	1.0	11	2.0		
3.	Psycho-logical stress	Life	260	50.8	65	12.0	380.036	4.67x10-^{82*}
		Job	120	23.4	77	14.3		
		No stress	77	15.0	393	72.8		
		Life and job	55	10.7	5	0.9		
4.	Type of abortion	Unmarried	14	2.7	8	1.5	180.6003	6.54x10-^{39*}
		No abortion	316	61.7	513	95.0		
		Spontaneous	96	18.8	13	2.4		
		Induced	86	16.8	6	1.1		
5.	Lifestyle health problems	No problem	236	46.1	417	77.2	133.6942	3.91x10-^{27*}
		Osteoporosis	30	5.9	16	3.0		
		T2 DM	84	16.4	67	12.4		
		BP+T2 DM	80	15.6	20	3.7		
		BP	60	11.7	20	3.7		
		Hypo-thyroidism	22	4.3	–	–		

6.	Parity	No child	33	6.4	15	2.8	13.5137	0.00902*
		One child	77	15.0	61	11.3		
		Two children	226	44.1	245	45.4		
		Three children	125	24.4	151	28.0		
		>3 children	51	10.0	68	12.6		

Note: '–' = Not applicable; '*'- Significant (P<0.05)

Statistical analysis

Data on the various risk-factors were collected from cases (breast cancer patients, n = 512) and controls (randomly selected non-breast cancerous women, n = 540) were tabulated either in 2 × 2 or 2 × k tables, depending on the number categories in each factor. Since n was sufficiently large, Karl Pearson's chi-square test was performed to determine the overall association between a risk factor and breast cancer. When there was a significant association (P < 0.05), post hoc chi-square test (2 × 2 table) was performed (1) to compare any two categories of a risk factor and (2) to compare the proportion of breast cancer patients and the proportion of non-breast cancerous subjects in a specific category of a risk factor. While comparing the two proportions of a single category, the expected frequency was arrived at with a priori hypothesis of 1:1 ratio of the row total of a category. All the 2 × 2 tests were performed with Yate's correction factor.

Post hoc multiple comparisons of proportions were made by the Marascuilo's procedure, as follows: The test-statistics are the values of the absolute differences of the proportions of the various categories of a risk-factor. These values were calculated with the assumption that all the categories under cases or controls should have equal proportions. Each of the k(k-1)/2 absolute differences was compared with its corresponding critical r_ij value, where iwas first proportion (p_i) and j the second proportion (p_j) in the pair. The critical value was calculated using table 2 value at level of significance and k-1 degrees of freedom, as follows:

$$r_{ij} = \sqrt{\aleph^2_{\alpha,k-1}}\sqrt{\frac{p_i(1-p_i)}{n_i} + \frac{p_j(1-p_j)}{n_j}}$$

Any absolute difference between two proportions (test statistics) that exceeds the critical value r was considered significant at that level of significance. All the calculations were performed either in MS Excel (Gurumani, 2005) in WinPepi 11.43.

RESULTS

Lifestyle factors of breast cancer (Table 1):

A large portion of the increase in breast cancer incidence being observed in many Asia-Pacific countries is likely due to the adoption of a more westernized lifestyle, including adverse changes to diet, physical activity and fertility (Shin *et al*., 2010, Park *et al*., 2008 Lertkhachonsuk *et al*., 2013). A higher risk of breast cancer among American and European women has been blamed for so-called "Western lifestyle" characterized (McTiernan, 2003; Gerber *et al*., 2003) by the combination of early menarche, decreased parity delayed child bearing, and a sedentary life style. Studies of migrants have confirmed the relative importance of environment and lifestyle in the etiology of breast cancer (Shimizu *et al*., 1991; Iwasaki *et al*., 2008).

Body Mass Index (BMI)

The present study revealed that there is a significant association between Body Mass Index (BMI) and risk of breast cancer (χ2: 90.10734, P=2.08-19) (Table 1). The proportion of breast cancer cases are significantly higher in underweight (χ2: 20.763, P=5.2x10-6) and overweight (χ2: 15.827, P=6.94x10-5) categories when compared with control women. In obesity group, the breast cancer cases proportion is higher but marginally not significant (χ2: 3.806, P=0.051). However, the proportion of breast cancer cases is highly significantly low in the normal weight category (χ2: 50.394, P=1.26x10-2). Further, among the cases, overweight category was (41%) which is higher than

other categories of normal (34%), obesity (16%) and underweight (9%)respectively.

Physical exercise

The results showed that there is highly significant difference between physical exercise and risk of breast cancer in cases and control group was recorded ($\chi 2$: 91.35982, P=1.12x10-19). The proportion of breast cancer cases is significantly high ($\chi 2$: 47.503, P=5.49x10-2) in the no-exercise group when compared with control women. The proportion of breast cancer cases is significantly low in the moderate exercise group ($\chi 2$: 29.839, P=4.69x10-18) and yoga group ($\chi 2$: 12.448, P=0.0004) when compared with control women. The proportion of breast cancer cases is highly significantly low ($\chi 2$: 85.756, P=2.04x10-20) in all the other exercise categories (yoga, moderate and treadmill) when put together. However, within the case group, no- physical exercise group occupied 50% and 48% were moderate exercise group.

Stress

The study revealed that there is highly significant association between stress and risk of breast cancer when compared with control groups ($\chi 2$: 380.036, P=4.67x10-82). The proportion of breast cancer cases is significantly high in stress-in life ($\chi 2$: 380.036, P= 4.67x10-82), stress-in job ($\chi 2$: 9.38, P= 0.002) and stress-in both life and job group ($\chi 2$: 41.667, P=1.08x10-10) and the proportion of breast cancer cases is highly significantly low ($\chi 2$: 212.460, P=3.99x10-48) in no stress group, Implying that stress become more risk factor for breast cancer.

Types of abortion

The study revealed that there is highly significant association ($\chi 2$:180.6003, P=6.54x10-39) between abortion and breast cancer when compared with control women. The no-abortion group has significantly low proportion ($\chi 2$: 46.814, P=7.8x10-12) in breast cancer cases. Both the spontaneous and induced abortion groups have highly significantly high proportions in breast cancer cases were recorded ($\chi 2$: 63.202, P=1.87x10-15 for spontaneous abortion and $\chi 2$: 69.565, P=7.39x10-17 for induced abortion).

Lifestyle health problems

The present study revealed that there is highly significant association between lifestyle health problems and risk of breast cancer ($\chi 2$: 133.6942, P=3.91x10-27) when compared with control women. The above referred diseases free from breast cancer cases group has significantly low proportion of breast cancer cases ($\chi 2$: 50.170, P=1.41x10-12) when compared with control. The osteoporosis with breast cancer group has marginally significant high proportion of breast cancer patients ($\chi 2$: 4.261, P=0.039) than control. In both blood pressure + T2DM and the BP group, the proportion of breast cancer patients are significantly high ($\chi 2$: 36, P=1.97x10-9) and $\chi 2$: 20, P=7.74x10-6 respectively). There is no significant difference between breast cancer patients and control women in T2DM and hypothyroidism groups. However, among the breast cancer women, T2DM and BP with T2DM group was higher than BP alone breast cancer women. BP with hyperthyroidism group of case have lesser in number in the present study.

Parity

There is significant association between parity and risk of breast cancer ($\chi 2$: 13.5137, P=0.00902) when compared with control group. The proportion of breast cancer cases in no-child group is significantly high ($\chi 2$: 6.75, P=0.009) when compared with control women. In all the other groups there is no significant difference between the risk of breast cancer cases and control women. However, among breast cancer cases, two children with breast cancer women were higher (44%) than with three children (24%), one child (15%), more than three children (10%) and no child (4%)was recorded in the present study group.

DISCUSSION

Lifestyle risk factors of breast cancer

Mostly, life style factors modify breast cancer risk through their effects on hormone metabolism (estrogen and progesterone). These factors include social changes such as physical activity, dietary habits, low parity, age at first birth, breast feeding, and avoiding oral contraceptive tablets (Magne *et al*., 2011; Parkin *et al*., 2001; Danaei *et al*., (2005). Several studies suggested that an intervention on specific factor such as dietary habits and life style modification could prevent breast cancer and its recurrence. Much of the increase of breast cancer in India has been associated with greater urbanization and changing life style (Khokhar, 2012).

The studies on major preventable risk factors among breast cancer patients in Ghana (West African country) revealed the association between breast cancer and smoking, alcohol drinking, family history of cancer, obesity, overweight, age at having first child, the use of contraceptive pills and nullparity (Kyei *et al* 2014). In Japan, the incidence and mortality rates of breast cancer have been increasing among the Japanese women due to an overall tendency to late marriage and declining birth rates and changes in the life style (Saika and Sobue, 2009).

The proportion of breast cancer death rate was higher in high-income countries (27%) and it was attributed to overweight and obesity. In low and middle income countries, the proportion of breast cancers attributed to this risk factor was 18% and physical inactivity was the most important determinant 10%. The differences in breast cancer incidence between developed and developing countries are associated with dietary effects combined with later first childbirth, lower parity, and shorter breast feeding (Peto, 2001). The increasing adoption of western lifestyle in low and middle income countries is an important determinant in the increase of breast cancer incidence in these countries.

According to Associated Chambers of Commerce (ASSOCHAM, 2009) around 68% of young workforce engaged in India`s Information Technology (IT) and IT sector are stricken with life style disorders due to factors like hectic work schedules, unhealthy eating habits, tight deadlines, day & night shift pattern of work and associated stress. Further, in view of 24x7 working environment and irregular food timings, they directly place orders to fast food outlets, street food vendors and roadside eateries operating outside their offices, serving ready to eat, high caloric and processed foods such as noodles, burgers, pizza and fried stuff like samosas along with aerated drinks and coffee etc. It is pertinent to state that considering the importance of healthy nutrition, some states in India prohibited noodles which may avoid child obesity and gastric cancers. Further, youngsters must avoid such type of varieties of fast food which may reduce the risk of breast cancer.

A striking case of life style disorders found in the India`s most developed state Kerala and this State is fast emerging as the lifestyle diseases capital of India. This transition of the state to an era of life style diseases is influenced by economic growth, urbanization and our changing foodhabits (Chie *et al*., 1995).The influence of lifestyle westernization on breast cancer risk has been observed in Japan and Korea and in urban centers in China (Yoo, 2006; Cui *et al*., 2007). Similar observations have been noted for Chinese , Japanese and Korean migrants in west (Anderson *et al*., 2007; Maskerinec, 2000). In this context, the Indian women (both working women and housewives) are no exception to the different factors which affect the life style and they are experiencing the same global phenomena. The present study also revealed that all the lifestyle factors like BMI, physical exercise, stress, abortion, chronic diseases and parity are highly statistically significant among breast cancer cases when compared with control women in Chennai (Table .1).

Body mass index

Overweight and obesity have become major public health changes throughout the world in both high and low income countries, with over one billion overweight and 315 million obese adults currently estimated worldwide (Flegal *et al*., 2010; Ogden *et al*., 2007). In USA, Over two-thirds of the adult population is overweight, with approximately one-third of adults and almost 17% children and adolescent's obese (Flegal *et al*., 2010).A high intake of red meat or processed meat and low physical activity showed increased risk of breast cancer in Polish women, Poland (Pietal *et al*., 2009). Three fold increased risk in women was reported with a BMI in the obese range of women (Montazeri *et al*., 2008). Excluding non-melanoma skin cancers, breast cancer is the most common cancer among women in the United States with a life time risk of 13.4% (Jabberi *et al*., 2010).

It is known that the BMI, >25, increases the risk of number of diseases, including heart diseases and stroke diabetes, musculo skeletal disorders, as well as cancers of the endometrial, colon and breast. The world health organization (WHO) estimated that by the year 2030, 13million people will die from cancer. It is further estimated that about 70% of cases will come from low and middle income countries.

Recently, the incidence and mortality rates have increased in low-income countries, particularly Latin America (Jemal *et al*., 2011) and Africa and especially among young women. Asian countries are also recording significant annual increase for example 2% in Japan and 3to 5% in China (Parkin, 2001). In this

context it may be inferred that India is no exception to the phenomenon.

A meta-analysis of 45 studies reported that higher total fat intake increased breast cancer risk by 13% (Boyd *et al*., 2003). Further, the excess body weight is associated with increased risk of cancer of the breast (in post-menopausal women) (Peto, 2001; Bergstrom *et al* 2001; Kaaks & Lukanova, 2002; Jonsson *et al*., 2003; Morimoto *et al*., 2002; Carmicheal and Bates., 2004;Van den Brandt *et al*., 2000; Key *et al*., 2003). A similar observation was noted in post-menopausal women in Thailand (Sangrajrang *et al*., 2013), in Sweden (Lahmann *et al*., 2004) and in Ghana women (west African country) (Kyei *et al*., 2014).

Hence it is necessary to examine whether excess weight is also a risk factors for cancer among non-western populations. In this context, our study demonstrates that there is significant association between BMI and risk of breast cancer when compared with control women in Chennai (Table .1)

A case-control study (New Delhi) among breast cancer patients revealed that there was a strong association of overweight and obesity with a breast cancer in the Indian population (Singh et al., 2011; Pakseresht, 2009). A similar observation was noted in Kolkatta (Datta and Biswas, 2009), in Haryana (Singh and Jangra, 2013), in North Iran (Naieni et al., 2007) and in Mexico women (Amadou et al., 2013) implying that weight control may be a modifiable risk factor for breast cancer prevention.

The incidence of breast carcinoma has nearly doubled over the past 25yrs among Chinese women in Singapore (ages between 45 to 69yrs) which is attributed to changes in life style (Ng *et al*., 1997). Further, the both low and high intake of omega-6 fatty acids due to fast food habit change increased breast cancer risks in Malmocity, Sweden (Sonestedt *et al*., 2007). The obesity and high consumption of animal fat are associated with breast cancer risk, particularly Kuriyama *et al*., (2005) demonstrated that excess body weight is a major risk for breast cancer among Japanese women and BMI >30 was associated with increased risk of death (Maso *et al*., 2008). While considering the above reports both in India and Western countries, our present findings are supporting the concept of increasing BMI, obesity and consumption of animal fat are the risk factors for breast cancer in south Indian women. In the present study, there is significant association between BMI and risk of breast cancer ($\chi 2$: 90.107, P=2.08x10-19) when compared to control.

According to Key *et al*., (2009), the Epic-Oxford study concluded that the self reported vegetarians have a lower prevalence of obesity. The present study supports an important role of dietary patterns on weight status. Dietary patterns characterized by greater intakes of fruits and vegetables, higher consumption of whole grains, low-fat dairy products, fish, chicken, non-dehydrogenated fats, legumes and nuts have been associated with reduced BMI (Parvathy *et. al*., 2017; Paradis *et al*., 2009; Murtaught *et al*., 2007). Therefore it is suggested that weight gain must be avoided throughout the life as a means of reducing breast cancer risk.

Physical exercise

Vigorous physical training (Warren, 1980; Frish *et al*., 1981; Bullen *et al*., 1985 and Merzenich *et al*., 1993) and even moderate exercise (Ellison and Lager, 1986; Bernstein *et al*., 1987 and Harlow and Matanoski, 1981) can interrupt the menstrual cycles, perhaps by suppressing the pulsatile release of gonadotropin releasing hormone (Zheng *et al*., 1993). The effect of physical activity may lower a woman`s cumulative exposure to estrogen and progesterone thereby inhibiting carcinogenesis in the breast.

The American cancer society recommends engaging in 45-60 minutes of physical exercise, 5 or more days a week. When breast cells are exposed to extra estrogen overtime, the risk of developing breast cancer is higher. It is established that exercise can reduce breast cancer risk. (Caan, 2006). A high level of physical activity contributes to the difference in breast cancer risk between urban and rural women in India (Mathew *et al*., 2009). More than 80 studies reported that physical activity to have a protective effect (WCRF/AICR, 2007; Friedenreich and Cust, 2008).

Physical activity may be different across levels of BMI, 30 to 60 minutes per day of moderate to high intensity physical activity is associated with a reduction in breast cancer risk (IARC, 2002, Lee *et al*., 2006; Mc Tiernan, 2006) and such reduction in the risk of breast cancer was reported in Japanese women (Tsugane, 2004; Hirose *et al*., 2003) as well as in East Indian women (Datta and Biswas, 2009). Further,

breast cancer risk could be reduced by decreasing the BMI and increasing physical activity (Friedenreich and Cust, 2008; Kawai *et al*., 2013; Parkin *et al*., 2006).

In Chandigarh, the majority of the breast cancer cases (43%) were light physical exercise, followed by moderate physical exercise (30%) and heavy physical exercise were rare (0.9%) (Puri *et al*., 2008). Highest levels of walking for shopping showed significantly protective effect for breast cancer in Thai women (Sangrajrang *et al*., 2013; Pronk *et al*., 2011) which in turn supports current health promotion and campaigns on promoting exercise. The reduction in risk of breast cancer was 40% for women who exercised for 3 to 4hrs per week at moderate to vigorous levels was reported in France (Magne *et al*., 2011) and in African-Amerian women (Rosenberg *et al*., 2014).

In young and teenage girls, physical activity affects menstrual patterns and the production of ovarian hormones which is likely to help protect against cancer (Campbell *et al*., 1999 & McTiernan, 2006). Developing opportunities for physical activity during leisure time and at work place (moderate exercise 3-4hrs per week) may help to reduce the risk of breast cancer 30-40% lower risk breast cancer than sedentary women (Mc Tiernan, 2003; Huang *et al*., 2004). In Southern Brazil, most of women diagnosed with breast cancer were sedentary (Ceccatto *et al*., 2012). According to National Cancer Registry Network (2011), one in 31 South African women will get breast cancer during her life time. Black South African women in rural areas have a low incidence of breast cancer, but in urban population, it is rising. The protective factors against carcinogenesis, such as late menarche, the early birth of a first child, prolonged lactation and high levels of physical activity, are decreased the risk in black urban population (Matatiele & Heever, 2008).

The present study on physical exercise with reference to breast cancer cases and control in Chennai women revealed that there is a highly significant association between physical exercise and breast cancer between the case and control ($\chi 2$: 91.35, P =1.12x10-19). Our findings are corroborated with the reference cited above both in the Indian and Western research reports. The present study revealed that 50% breast cancer women had no exercise and 48% women had moderate exercise ($\chi 2$: 47.50, P=5.49x10-12; $\chi 2$: 29.83, P=4.69x10-8) respectively. Hence, physical exercise is one of the major risk factor for breast cancer is identified among women of Chennai. The variety of physical exercises like walking, cycling, reducing the intake of fast food, fatty food, increased consumption of vegetables and fruits may prevents the risk of breast cancer by optimizing the BMI of women.

Stress

Breast cancer is the most common cancer affecting women patients with cancer are psychologically vulnerable for many reasons, including the stress of the diagnosis, debilitating treatments and chronic pain (Carayol *et al*., 2013). Distress can compromise compliance with treatment and negatively affect prognosis and survival rates (Ballenger *et al*., 2001). Hence, the psychological status of patient forms an essential element of oncological treatment (Lo castro & Schlebusch 2006t; Schlabuch, 1998; Schlabuch, 2012; Schlabuch and Van oers, 1999). Perceived stress, when combined with potentially risky lifestyle behaviors may be a contributing factor to breast cancer (Wang, *et al*., 2012).

Cancer can be construed as life-threatening and can result in a crisis reaction. Anxiety levels fluctuate over the cause of treatment and tend to be highest during diagnostic work-up and towards the end of treatment (Stark, 2000; Fallowfield, 1994). Extensive disease and pain are associated with a higher prevalence of anxiety (Spencer *et al*., 2010; Stark, 2000; Baqutayan 2012). Physically impaired and younger women are more likely to meet the criteria for anxiety disorder (Spencer *et al*., 2010) and patients lol from lower socioeconomic groups (Stark *et al*., 2002). Highly educated women are more likely to become anxious (Faflouti *et al*., 2010). Patients who lack social support and good family relationship which moderate the impact of stress caused by the breast cancer are also at risk (Lueboonthavatchal, 2007).

The above information's highlight that the prevalence and management of anxiety in patients with breast care in clinical practice. It may be stated that pathological anxiety is more common in women who are diagnosed with breast cancer than in those without disease (Stark *et al*., 2002; Foflouti *et al*., 2010 ; Dubashi *et al*., 2010). Therefore, it is suggested to have oncology health care professionals who can care the patient in terms of anxiety/depression along with onco-nutritionistto determine the requirement of food during treatment of cancer and for survivor.

The percentage of patients experiencing life stress including household and occupational stress was significantly high when compared to control women in Pakistan. Chronic stress has been associated with a depressed immune response that may promote cancer (Bauer *et al*., 2001). Further, it was reported that stressful events increase the level of stress hormones including estrogen levels and high level of estrogen are strongly associated with increased breast cancer risks. The breast cancer occurrence is significantly related to stress which include occupational and house hold stress(Raza *et al*., 2011).

The above referred research reports supported our present findings that there is very highly significant association between stress and breast cancer when compared control groups (P<0.001). In the present study, the proportion of cancer patients is highly significantly stress in life (χ2: 380.036; P=4.67x10-82), stress in job (χ2: 9.38; P=0.002) and stress in both life and job groups (χ2: 41.667, P=1.08x 10-10). Hence it is suggested to practice yoga everyday which may prevent the risk factor of breast cancer. It is appropriate to state that United Nation declared June 21, 2015 as International Yoga Day celebration and this program has been implemented by Government of India now. The yoga practice may relieve pain management, insomnia, depression, physical fitness, emotional -upliftment, finally make every one become normal state of mind.

Abortion

Some recent studies have suggested that there may be an increase in the risk of breast cancer associated with a history of induced abortion (Daling, 1994, Lipworth, 1995, Rookusand Leeuwen 1995, Bu *et al*., 1995). A positive history of induced abortion in a case-control study formed a risk of breast cancer in Iranian women (Naieni *et al*., 2007) and in women of Atalnta, Georgia (Daling, 1996).There is a association between abortion with breast cancer whether spontaneous or induced is associated with a 2-4 fold increase in breast cancer risk (Pike *et al*., 1981; Somervillie, 1994).

Rai *et al*., (2008) reported the significant association between the abortion and breast cancer. A past history of both natural abortion and or benign breast disease were significantly associated with the disease (Hirohata, 1985). Abortion occurrence was significantly noted in breast cancer patients of Pakistan (Raza *et al*., 2011).

In Udupi district (Karnataka), 9.6% had natural abortion in cases and 14% were in controls. The induced abortion was 15% in breast cancer cases and 4% in controls (Kamath *et al*., 2013). In Trupati (A.P), 25% of breast cancer patient had abortion and 75% were free from abortion (Kurapathey *et al*., 2007). In Chandigarh, it was observed that 25% of breast cancer patients had abortion when compared to 69% patient did not have abortion at all (Puri *et al*., 2008).

The present study revealed that there is highly significant association between abortion and risk of breast cancer (χ2: 180.6003, P=6.54x10-39). The spontaneous and induced abortion groups have highly significant high proportions of breast cancer patients (P<0.0001) when compared to control. However, the no-abortion group has significantly low proportions (P<0.0001). Therefore, it is suggested to avoid abortions to reduce the risk of breast cancer.

The other common disease such as type II diabetes, B.P. and, hypothyroidism and osteoporosis were also observed with the breast cancer cases and it was highly significant association between lifestyle health problems and risk of breast cancer (χ2: 133.6942, P=3.91x10-27).

Parity

In Iran, the parity status of women showed lower risk of breast cancer than nulliparous women (P≤0.001). Further, the number of children borne reduced the risk of breast cancer and it was significant for 1 to 3 parities (Akbari *et al*., 2010). According to Ebrahimi (2002) the never married women were at higher risk for breast cancer. According to Dey *et al.*, (2009), the number of children between 1 to 4 occupied a major group (80%) among breast cancer women in Trivandrum (Kerala) and >4 children were 12% of breast cancer women. In case-control study at Udipi district (Karnataka), among the breast cancer women, <2 children were 63% and >2 children 29%. But in control women 41.5% were <2 children and 51% were >2 children (Kamath *et al*., 2013).

In Mumbai, among breast cancer women, the increased breast cancer incidence was attributed to low parity, late at marriage and first child (Dhillon *et al*., 2011). In Nigerian women, case control study of risk factors for breast cancer revealed that high parity >4 children and long duration of breast feeding >60

months are associated with reduced risk of breast cancer (Okobia *et al*., 2005). The trend of decreasing parity and shortened duration of breast feeding increases the risk of breast cancer incidence in Iranian young women (Ghiasvand *et al*., 2011).A strong inverse association was observed between breast cancer risk and number of children among Cyprus women (Hadjisavvas, 2010). Higher parity and longer duration of breast feeding significantly decreased the breast cancer risk in Puerto Rican women (West Indies) (Morales et al., 2013). Parous women have a lower risk than nulliparous women, but the relationship between parity and breast cancer is complex (Kelsey *et al*., 1993; Colditz *et al*., 2006). The present study concluded that there is a significant association between parity and risk of breast cancer when compared to control group ($\chi 2$: 13.5137, P=0.00902). It is observed that increasing parity women with (>3 children) had lower breast cancer risk. Hence, it is suggested to have more children which may prevent the risk of breast cancer.

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