



Body Mass Index and Risk of Breast Cancer

Authors

Dr Alex Oommen.MS Mch¹, Dr Sumin.V.S¹

¹Additional Professor, Department of General Surgery, Govt. Medical College, Kozhikode – 673008

Email: dralexoommen64@yahoo.co.in, Ph: 9447057725

²Junior Resident, Department of General Surgery, Govt. Medical College, Kozhikode – 673008

Email: sumintmc@gmail.com, Ph: 9496346404

Abstract

Breast cancer is the most common cancer diagnosed in women worldwide with over 1.3 million new cases per year. There is a wide variation in the geographical distribution of the disease with highest incidence seen in the more developed areas of the world and the lowest incidences seen in the least developed regions. Breast cancer is one of the most common cancer diagnosed among Indian women. One important factor proposed to contribute to the rising incidence is explained by 'westernisation' of lifestyles and changes in reproductive behaviour. Body mass index (BMI) has emerged as an important metameter for the association between adiposity and many obesity related diseases. The WHO Western Pacific Regional Office has defined obesity in Asian populations as $BMI \geq 25\text{kg/m}^2$. This study aims to investigate the association between body mass index and breast cancer. This is a case control study conducted at Government Medical College, Kozhikode with 100 cases of female patients (30-60 years) with cytology proven Stage I/II/III breast cancer and with 100 age matched controls. On evaluation it was found that BMI was significantly associated with female breast cancer. When the results were stratified by different menopausal status of the women, higher BMI is associated with increased risk of breast cancer in premenopausal patients whereas statically no association between higher BMI and breast cancer was found in postmenopausal. To conclude high BMI is significantly associated with breast cancer in the pre-menopausal group whereas no significant association was found in the post menopausal group.

Keywords: *Body mass index, breast cancer, Premenopause, Postmenopause.*

Introduction

Breast cancer ranks second in global cancer incidence and is one of the most common cancer diagnosed among Indian women^{1,2}. While breast cancer incidence has been shown to have stabilized or to be decreasing in some Western countries, the breast cancer burden has steadily increased in many developing countries with traditionally low incidence rates³. Among factors proposed to contribute to the rising incidence in these societies are secular changes in lifestyle and

reproductive factors. The influence of anthropometric measures on breast cancer risk has been the subject of many studies⁴⁻⁶. The relation between body weight and breast cancer risk is modified by menopausal status, with higher weight or body mass index (BMI) associated with increased risk for post-menopausal women. However, these findings were derived from studies conducted mainly in Western countries, where the prevalence of obesity is relatively high and attained height is not limited by nutritional status in childhood. The

influence of body size on breast cancer risk in developing countries remains unclear.

Body mass index (BMI) has a multifaceted relation with the risk of breast cancer that varies with menopausal status. Higher BMI is positively associated with risk of pre-menopausal breast cancer in Asian women^{7,8} and association is less clear for post menopausal group. The underlying mechanisms for the inverse association are poorly understood. The question of whether body fat distribution contributes further to the risk of breast cancer is of considerable interest. Greater upper or central body fat distribution, perhaps because of its relation with visceral adiposity, is associated with multiple hormonal and metabolic changes, including insulin resistance and hyperinsulinemia, increased levels of free fatty acids, decrease in sex hormone-binding globulin levels, increases in androgen levels and the conversion of androgen to estrogen in adipose tissue, increased bioavailability of estradiol and each of these changes have been associated with an increased risk of premenopausal breast cancer.

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health⁹. There are different ways to measure obesity; BMI is the most commonly used and is calculated as weight (kg) divided by height (m²). The WHO Western Pacific Regional Office (WPRO) has proposed a definition of obesity in Asian populations with overweight defined as BMI 23.0–24.9kg/m² and obesity defined as BMI \geq 25kg/m².

The aim of this study is to study the association of Body Mass Index with risk of breast cancer.

Materials and Methods

This is a Case control study conducted in Government medical college, Kozhikode. Hundred female patients with cytology proven breast cancer in age group 30-60 years attending OP of Department of Surgery, Government Medical College, Calicut was taken as cases and equal number of age matched individuals were

taken as control. The study period was one year from March 2014 to March 2015.

In this study, all cases of breast cancer, regardless of previous history, seen at presentation and later confirmed histologically from Govt. Medical College, Calicut was selected after taking informed consent. BMI (weight in kilogram/height in meter²) of all cases was recorded as per the guidelines set by WHO expert meeting 2008.

Height was measured with a stretch resistant tape. The measurement was taken with subject standing with arms relaxed at the side, feet evenly spread apart and body weight evenly distributed. Weight was measured using electronic weighing machine. Same was done in controls as well.

A woman was considered as postmenopausal if she had experienced a final menstrual period more than 12 months before the reference date (and had not used hormonal therapy (HT) before or during the 12 month interval after last menstrual period.

Results

Body Mass Index in Cases And Control

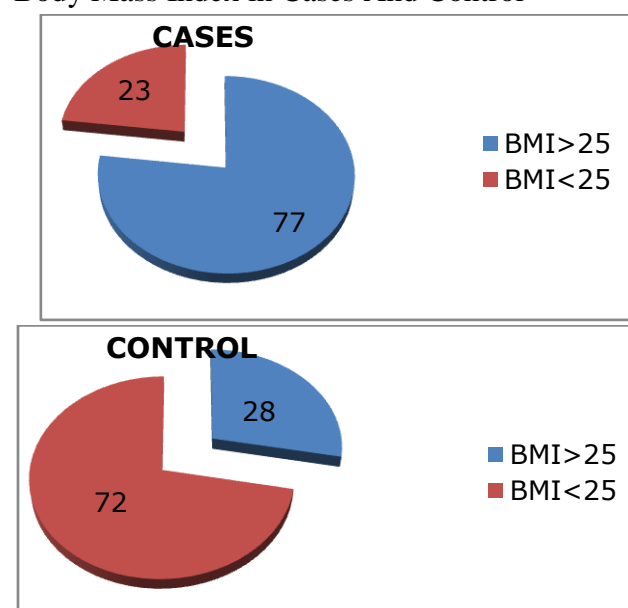


Fig 1: Body Mass Index in Cases and Controls
Body mass index was compared between the two groups. Chisquare value came as 48.14 and p value was 0.00. There was significant association between elevated Body mass index and carcinoma breast.

Premenopause and BMI

Table 1 BMI in Premenopausal Cases and Controls

	Cases	Controls
BMI>25	39	7
BMI<25	15	61
	54	68

There were 54 premenopausal patients among cases and 68 premenopausal patients among control. BMI was evaluated among these groups. Chisquare value came as 49.14 and p value came as 0.00. There was significant association between higher BMI and breast cancer among premenopausal age group

Post Menopause and BMI

Table 2: BMI in Postmenopausal Cases and Controls

	Cases	Controls
BMI>25	38	21
BMI<25	8	11
	46	32

There were 46 postmenopausal patients among cases and 32 postmenopausal patients among control. BMI was evaluated among these groups. Chisquare value came as 2.95 and p value came as 0.08. There was no significant association between higher BMI and breast cancer among postmenopausal age group.

Discussion

As economies have developed, living conditions have improved. However the structure of the diet has also changed, with more high fat food being eaten while at the same time the need for physical strength in work has diminished and these factors have resulted in a rising level of obesity with consequent morbidity and mortality. Usually BMI is used to evaluate generalized obesity. In this study 200 patients were included, 100 cases of breast cancer and 100 age matched control groups. The data were collected and analysed using SPSS software.

Many studies have indicated that BMI is an important index for evaluating the degree of obesity, and the association between obesity and breast cancer¹⁰, but confirmatory studies performed in Asian populations are lacking. In our study it was found that BMI was significantly associated with female breast cancer (p value came as 0.00).

When the results were stratified by different menopausal status of the women in the breast-cancer case and control groups, there were significant differences in BMI in the premenopausal group. There were 54 premenopausal patients among cases and 68 premenopausal patients among control. Comparing the BMI among these, 39 out of 54 cases have higher BMI and only 7 out of 68 controls have higher BMI. On computing p value came as 0.00. Thus higher BMI is associated with breast cancer among premenopausal patients. The results of a census carried out on women in a community in Shanghai indicated that a BMI of ≥ 25 is a risk factor for breast cancer in pre-menopausal women¹¹. Several studies among Asian women suggest that higher BMI may be associated with an increased risk for premenopausal breast cancer¹²⁻¹⁵. A prospective study including 11,889 women from Taiwan reported that higher BMI was moderately associated with an increased risk of premenopausal BC¹⁶, with an OR of 1.90 (1.00–3.4) for BMI > 26.2kg/m² versus 21.6kg/m². Similarly a multicentric case control study conducted among urban and rural women and including 898 cases and 1,182 controls reported an increased risk of 33–56% when comparing premenopausal women above 25kg/m² with those with than less 25kg/m²(OR = 1.33; 95 % CI:1.50–1.62 for BMI 25–29.9kg/m² and1.56;95 % CI:1.03,2.35 for BMI greater than 30kg/m²)¹⁷. One recent cohort study conducted in Japan reported a high increased risk of 2.54; 95% CI (1.16–5.55) when comparing women of BMI>25kg/m² to those of <20kg/m²¹⁸.

BMI among postmenopausal cases and controls was evaluated. There were 46 postmenopausal

patients among the cases and 32 postmenopausal patients among the control. Comparing the BMI among these, 38 out of 46 cases have higher BMI and 21 out of 32 among controls have higher BMI. P value came as 0.08. There was statistically no association between higher BMI and breast cancer in postmenopausal patients. Comparing with other studies, high BMI being associated with an increased risk of postmenopausal breast cancer in 2 studies^{19,20}, reduced risk in 2 studies²¹, and no association in 3 studies²²⁻²⁴. Also the association between BMI and risk of breast cancer in postmenopausal women was weak even for studies that showed a positive association; for example, one pooled analysis found that the relative risk was only 1.0725.

In our study obesity definitely carries risk for breast cancer among premenopause but no association was found among postmenopausal patients. These results indicate that increased BMI is a risk factor for pre-menopausal women and thus should receive more attention in breast-cancer prevention.

Conclusion

Many factors which are known to increase the risk of breast cancer are not modifiable such as age, family history, early menarche and late menopause. But obesity is one important factor that is modifiable. Body mass index, the index of obesity is found to be significantly associated with female breast cancer. High Body mass index is significantly associated with breast cancer in the pre-menopausal group where as no significant association was found in the post menopausal group. Thus for both public health and clinical practice, obesity should be considered as important modifiable risk and as the prevalence of obesity in developing and developed countries remains high and continues to increase, more research into understanding the underlying biological mechanisms and on improving the treatment of obese breast cancer patients diagnosed at any age is warranted.

Conflicts of Interest: None declared

References

1. Ries L, Melbert D, Krapcho M, et al. SEER Cancer Statistics Review, 1975–2005. Bethesda, MD: National Cancer Institute; 2008.
2. Parkin DM, Whelan SL, Ferlay J, et al. Cancer Incidence in Five Continents. Lyon, France: IARC CancerBase no. 7; 2005.
3. Jemal A, Ward E, Thun MJ. Recent trends in breast cancer incidence rates by age and tumor characteristics among U.S. women. *Breast Cancer Res.* 2007;9(3):R28. (doi:10.1186/bcr1672).
4. Ursin G, Longnecker MP, Haile RW, et al. A meta-analysis of body mass index and risk of premenopausal breast cancer. *Epidemiology* 1995; 6(2):137–141.
5. Van den Brandt PA, Spiegelman D, Yaun SS, et al. Pooled analysis of prospective cohort studies on height, weight, and breast cancer risk. *Am J Epidemiol.* 2000;152(6):514–527.
6. Hunter DJ, Willett WC. Diet, body size, and breast cancer. *Epidemiol Rev.* 1993;15(1):110–132.
7. S. Kuriyama, Y. Tsubono, A. Hozawa et al., “Obesity and risk of cancer in Japan,” *International Journal of Cancer*, vol. 113, no. 1, pp. 148–157, 2005.
8. M.H.Wu, Y.C.Chou, J.C. Yu et al., “Hormonal and body-size factors in relation to breast cancer risk: a prospective study of 11,889 women in a low-incidence area,” *Annals of Epidemiology*. Friedenreich CM: Review of anthropometric factors and breast cancer risk. *Eur J Cancer Prev* 2001, 10:15-32.
9. Den Tonkelaar I, Seidell JC, Collette HJ, et al. A prospective study on obesity and subcutaneous fat patterning in relation to breast cancer in post-menopausal women

- participating in the DOM project. *Br J Cancer* 1994;69:352-7.
10. Yu ZG, Jia CX, Liu LY, Geng CZ, Tang JH, Zhang J, Zhang Q, Li YY, Ma ZB: The prevalence and correlates of breast cancer among women in Eastern China. *PLoS One* 2012,7: e37784.
 11. Tang YQ, Zhu L, Shen KW, et al : A study on the breast cancer on the community women group. *J Surge Concepts Prat* 2011,16:19 –22.
 12. Hartmann LC, Sellers TA, Frost MH, et al : Benign breast disease, parity and the risk of breast cancer. *N Engl J Med*2005,353: 229– 237.
 13. Lahmann PH, Hoffmann K, Allen N,et al : Body size and breast cancer risk: findings from the European Prospective Investigation into Cancer And Nutrition (EPIC). *Int J Cancer* 2004,111: 762– 771.
 14. S. Kuriyama, Y. Tsubono, A. Hozawa et al., “Obesity and risk of cancer in Japan,” *InternationalJournalofCancer*, vol. 113, no. 1,pp. 148–157, 2005.
 15. M.H.Wu,Y.C.Chou, J.C. Yu et al., “Hormonal and body-size factors in relation to breast cancer risk: a prospective study of 11,889 women in a low-incidence area,” *Annals of Epidemiology*.
 16. A.Mathew, V.Gajalakshmi, B.Rajan etal., “Anthropometric factors and breast cancer risk among urban and rural women in South India: a multi centric case-control study,” *British Journal of Cancer* ,vol.99,no.1,pp.207–213,2008.vol. 16, no. 3, pp. 223–229, 2006.
 17. M. Kawai, Y. Minami, S. Kuriyama et al., “Adiposity, adult weight change and breast cancer risk in postmenopausal Japanese women: the miyagi cohort study,” *British Journal of Cancer* ,vol.103,no.9,pp.1443–1447,2010.
 18. Schatzkin A, Palmer JR, Rosenberg L, et al. Risk factors for breast cancer in black women.*J Natl Cancer Inst.* 1987;78 (2):213–217.
 19. Zhu K, Caulfield J, Hunter S, et al. Body mass index and breast cancer risk in African American women. *Ann Epidemiol.* 2005;15(2):123–128.
 20. Adams-Campbell LL, Kim KS, Dunston G, et al. The relationship of body mass index to reproductive factors in pre- and postmenopausal African-American women with and without breast cancer. *Obes Res.*1996;4(5):451–456.
 21. Hall IJ, Newman B, Millikan RC, et al. Body size and breast cancer risk in black women and white women: the Carolina Breast Cancer Study. *Am J Epidemiol.* 2000;151(8):754–764.
 22. Austin H, Cole P, Wynder E. Breast cancer in black American women.*Int J Cancer.* 1979;24(5):541–544.
 23. McCullough ML, Feigelson HS, Diver WR, et al. Risk factors for fatal breast cancer in African-American women and White women in a large US prospective cohort. *Am J Epidemiol.* 2005;162 (8):734–742.
 24. Palmer JR, Adams-Campbell LL, Boggs DA, et al. A prospective study of body size and breast cancer in black women. *Cancer Epidemiol Biomarkers Prev .* 2007;16(9): 1795 1802.
 25. Van den Brandt PA, Spiegelman D, Yaun SS, et al. Pooled analysis of prospective cohort studies on height, weight, and breast cancer risk. *Am J Epidemiol.* 2000;152(6):514–527.