Original Article

A study on Anthropometric Factors and Breast Cancer Risk

Jahangeer Aslam Makhdoomi, Misba Hamid Baba, Riffat Anjum Fatima, Sumera Saba

Abstract:

Background and Purpose: Breast cancer is the most common cancer in women worldwide, which poses a health concern throughout the world. Therefore it necessitates ruling out the factors that increase the risk of breast cancer. Body mass index an index of adiposity is considered to be one of the risk factors for the development of breast cancers in postmenopausal women. Waist to hip ratio which corresponds to the central obesity is another factor associated with an increased risk of breast cancer in both pre and postmenopausal women. This study aims to examine the relationship between obesity and breast cancer.

Materials and Methods: This study was conducted between January 2017 and December 2019 in a tertiary care hospital. 150 patients who qualified our set criterion of all the diagnosed clinical stages of breast cancer, aged between 24 to 80 years. All the patients were subjected to nine anthropomorphic body measurements i.e. height, weight, chest circumference, waist circumference, thigh girth, arm span, BMI, abdomen, and thigh skinfold thickness. These factors were compared with Histopathological examination values using a t-test. The analysis was done using the data editor of SPSS V20. The p-value <0.05 was considered significant.

Results: On comparing the selected anthropometric factors six out of nine selected factors risk i.e. height, weight, chest circumference, waist circumference, thigh girth, arm span, BMI, abdomen, and thigh skinfold thickness showed a significant relationship between the factor and the breast cancer risk. The p-value ($p<0.05$) was quite significant which clearly shows that there is a direct relationship between adiposity and breast cancer. The remaining three factors i.e. height, arm span, and thigh skinfold thickness were found to be insignificant in comparison with HPE ($p>0.05$).

Conclusions: We observed that weight, adiposity, and chest circumference increase the risk of breast cancer in women. We also observed that higher waist and chest circumference were associated with an increased risk of premenopausal and postmenopausal breast cancer with increased luminal types and triple-negative breast tumors in our subset of the population.

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INTRODUCTION

The breast or mammary gland is a distinguishing feature of class Mammalia. From puberty to death, the breast is subjected to constant physical and physiological alterations that are related to menses, pregnancy, gestation, and menopause. The impact of breast disease in societies assumes greater importance as the incidence of breast cancer continues to increase steadily. One of every two women will consult her physician for breast disease; approximately one of every four women will undergo breast biopsy, and one of every nine American women will develop some variant of breast cancer.[1] Carcinoma of the breast is the most common site-specific cancer in women and is the leading cause of death from cancer for females 40 to 44 years of age. Breast cancer is a major health problem for women throughout the world. In 2020, there were 2.3 million women diagnosed with breast cancer and 685 000 deaths globally. As of the end of 2020, there were 7.8 million women alive who were diagnosed with breast cancer in the past 5 years; making it the world's most prevalent.[2] Worldwide breast cancer is the

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Keywords

Obesity, Body Mass Index, Breast Cancer, Waist circumference

most frequently diagnosed cancer and the leading cause of cancer death among females, accounting for 23% of the total cancer cases and 14% of the cancer deaths although there is five-fold variation in incidence between high incidence areas such as the United States and Western Europe, and low incidence areas such as Africa and Asia.[3] Since 1990, the death rate from breast cancer has decreased in the United States by 24%, and similar reductions have been observed in other countries.[4,5] The adoption of screening mammography, and the use of adjuvant therapy, have contributed approximately equally to this improvement. Although breast cancer has traditionally been less common in no developing nations, its incidence in these areas is increasing. Body size is one of the few breast cancer risk factors that can be modified throughout life and therefore should be considered in research on breast cancer prevention. The contrasting effects of body size on premenopausal breast cancer compared with postmenopausal breast cancer and the lack of strong association between body mass and postmenopausal breast cancer in some cohort studies have led to a view that obesity has some influence on breast cancer risk. These conclusions are based on analyses that consider relative weight at one point in time as an adequate measure of lifelong weight patterns and their metabolic consequences.[5] Recent research suggests that, compared to body mass indices, adult weight gain and increased central body fat may be more specific markers of the metabolic consequences of obesity and therefore may predict health outcomes more consistent with an increased risk of postmenopausal breast cancer. The timing of weight gain also appears to influence breast cancer risk; increased relative weight and weight gain after menopause have been associated with the largest increases in relative risks. Overall levels of adiposity, increased central fat deposition, and weight gain is associated with alterations in ovarian hormone and glucose metabolism and in growth factors that may promote breast cancer cell growth. Data on lifelong weight changes and the location of fat depots may more precisely identify women with high-risk patterns of sex steroid and glucose metabolism. Similarly, research is needed to determine if weight gain during periods of hormone change, such as menarche, pregnancy, and menopause, have different biologic effects, perhaps because of differences in the location of fat deposition during these periods. Research is also needed on whether there are critical times relative to breast cancer promotion when excessive weight gain should be avoided. Data are lacking on the influence of weight gain on breast cancer risk or prognosis. Relatively consistent findings on the relationships between body size and shape and breast cancer risk have been emerging in recent years. Adult height is predictive of breast cancer risk, even in populations with no evidence of energy or nutrient deficiency. A complex relationship with adiposity has been observed. The dominant pattern is increased risk with increasing adiposity except in younger, premenopausal women from countries with high breast cancer rates, in whom an inverse association is noted. When adult weight is evaluated as a dynamic measurement rather than a constant one, excess weight in the years preceding breast cancer diagnosis seems especially critical, consistent with the substantial evidence that adiposity at the time of breast cancer diagnosis is associated with an increased probability of recurrence and a decreased survival time.[6,7] Epidemiological evidence implicating anthropometric risk factors in breast cancer etiology is accumulating. For premenopausal women, breast cancer risk increases with increasing height but decreases with higher weight or body mass index, and no association with increased central adiposity exists. For postmenopausal women, an increased risk of breast cancer is found with increasing levels of all the anthropometric variables including height, weight, body mass index, waist-hip ratio, waist circumference, and weight gain. Weight loss appears to decrease risk, particularly if it occurs later in life. Breast size may be a risk factor for breast cancer; however, the current evidence is inconclusive. A study from Nigeria showed that waist to hip ratio (WHR) is a significant predictor of breast cancer risk in Nigerian women and measures to sustain increased physical activity and ensure healthy dietary practices were recommended to reduce the burden of obesity in the population.[6–11] Breast Cancer is a major killer disease in females globally and in developing regions, where the early cancer detection facilities remain unavailable. A study in Kashmir conducted on the analysis of breast cancer in Kashmiri women has shown that Breast Cancer is the second most common cancer in the valley after esophageal cancer.[12] In another study from the same region it was found that the majority of patients with breast cancer were married, postmenopausal, came from rural settings and the commonest tumor at presentation was T2 followed by T3.[12] Besides in India too breast cancer is the second most common cancer among women however the first being Cervical cancer. Although various studies have focussed on obesity and the association with breast carcinoma very few studies have been conducted on breast cancer and its link with various anthropometric measures. Since breast cancer remains one of the most common cancers in the Kashmir valley and as people are getting more aware of the disease we intend to find an association between this malignancy and various anthropometric parameters through this research.

MATERIALS AND METHODS

This study was conducted between January 2017 and December 2019 in a tertiary care hospital. 150 patients who qualified our set criterion of all the diagnosed clinical stages of breast cancer, aged between 24 to 80 years were enrolled. Only patients

who gave consent were enrolled while patients with deformity and reluctance were excluded. A complete history and examination with risk factor assessment, baseline investigations complete blood count, liver function tests, kidney function tests, chest X-rays, and electrocardiogram were evaluated in all the patients. In addition, Performance Status (The Eastern Cooperative Oncology Group -ECOG) was incorporated. Risk factor assessment such as smoking (duration, type, pack-years), alcohol consumption, socioeconomic status (Kupposwamy scale), marital status, place of residence, age at pregnancy, menarche, menopause, history of benign proliferative lesion, any first degree relative with a history of breast cancer, history of cancer in ovary/endometrium, radiation to the chest was also reported in patients. All the patients were subjected to nine anthropomorphic body measurements i.e. height, weight, BMI, arm span, chest circumference, waist circumference, abdomen and thigh skinfold thickness, and waist to hip circumference.

Measured Anthropometric Parameters

1. **Height**

Height or standing height is the maximum distance from the floor to the highest point on the head when the subject is facing directly ahead. Shoes were taken off, feet together and arms by the sides. Heels, buttocks, and upper back were in contact with the wall when the measurement was made.

2. **Weight**
3. **Chest Circumference**

The subject was made to stand or sit while the chest circumference measurement was taken at the level just at the nipples.

4. **Abdominal circumference/Girth**

The girth was taken at the narrowest waist level or if it was not apparent at the midpoint between the lowest rib and the top of the hip bone (Iliac crest).

5. **Thigh girth**

The subject was standing erect with their weight evenly distributed on both feet and legs slightly parted. The circumference measured was taken at the level of mid-point on the lateral surface of the thigh, midway between trochanterion and tibial laterale.

6. **Arm Span**

With the subject facing away from the wall with her back and buttocks touching the wall the arms were stretched out horizontally. Measurement was taken from one farthermost fingertip to other.

7. **BMI**

The body mass index (BMI), calculated as weight(kg)/height(m)^2, or weight (lbs)/height(inches)^2 x 703, was used to classify weight status and risk of disease.

8. **Abdominal and**
9. **Thigh Skinfold Thickness**

The mark was made 5cm adjacent to the umbilicus to the right side. The vertical pinch was made at the marked site and the calipers were placed just below the pinch and the measurement was taken.

With the subject sitting and the knee bent at right angles, the measurement was taken at the midpoint of the anterior surface of the thigh midway between the patella and inguinal fold.

Statistical Analysis

All the continuous variables were reported in terms of Mean ±S.D, and the categorical variables in terms of frequency and percentages. The student's independent t-test was used to analyze the data. All the results were discussed on a 5% level of significance i.e., a p-value < 0.05 was considered significant. The data was analyzed with the help of the statistical software SPSS V 20.

RESULTS

The mean age of the patients was 44.53years (Fig 1). The highest number of cases was found in the urban population than in rural areas. The major complaints by the patients were through the lump in the Breasts and the frequency was 145 followed by the Discharge nipple (Fig 2)**.** Stage III A was predominant, followed by III C, IIA, and II B stages with 20%, 18.7%, 17.3%, and 16.7 % respectively (Fig 3). 140 patients were having Infiltrating Duct Cell followed by Duct CA in Situ followed by other types (Fig 4). Left-sided laterality dominated the right-sided one, left side (n=83) followed by the right side (n=66) (Fig 5). Majority of the patients were ER/PR+ (n=65), followed by TNBC (n=34), HER+ (n=22) and ER+ (n=13) respectively (Fig 6)**.** The mean height of the patients was 153±5.43cm (Fig 7)**.** The mean weight of the patients was 61.53±11.3kg (Fig 8). Mean BMI was 26.23 with class I obesity in 63 patients followed by class II obesity in 30 patients (Fig 9). The mean ARMS SPAN, of the patients, was 157.5±7 (Fig 10). The mean Chest Circumference of patients was 97.24±10.6cm (Fig 11). The mean abdomen circumference was 98.39± 12.26cm (Fig 12). The mean abdominal skinfold thickness was 23.45±7cm (Fig 13). Mean thigh skinfold thickness was 24.58±9.12cm (Fig 14). 98cm Mean thigh girth was 44.05 ±4.31cm (Fig 15)

Paired t-test was performed to find the association between the various physical parameters and the incidence of breast cancer. There were no significant differences in HPE of the patients when compared with Height (P=0.435). A significant difference was found (p=0.000) in comparing weight with HPE. A significant difference was found (p=0.00) in comparing HPE with CHEST

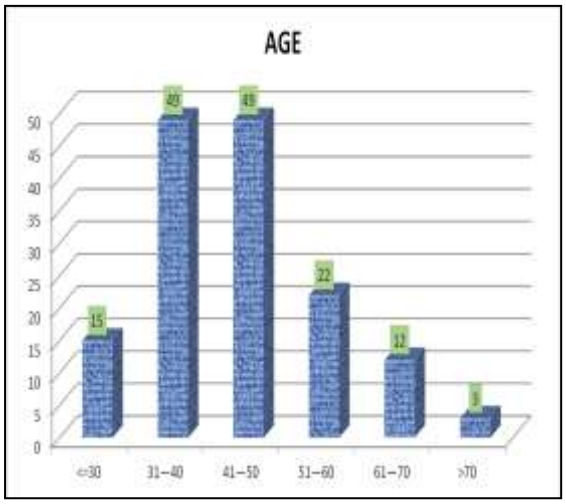

Fig 1 Mean age of 150 patients

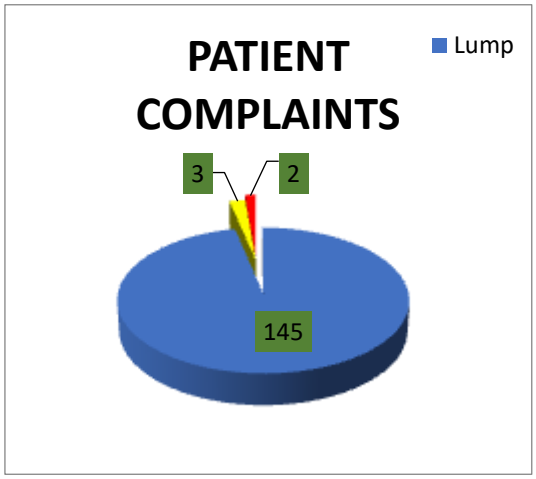

Fig 2 Main patient complaints at the time of diagnosis

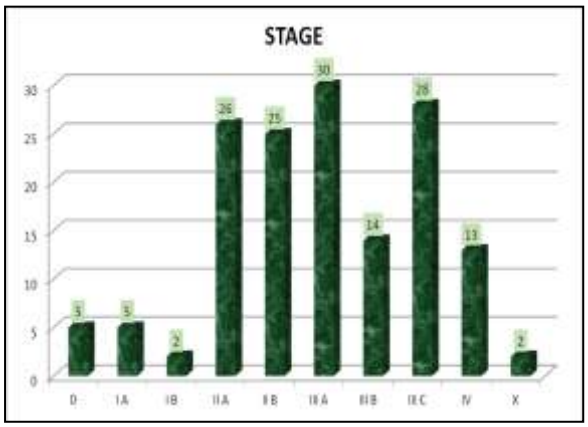

Fig 3 Stage-wise distribution of the patients

Fig 4 Histopathology of the patients

Circumference. A significant difference was found (p=0.00) in comparing HPE with Abdomen Circumference. A significant difference was found in comparing HPE with Thigh girth (p=0.00) and abdominal skinfold thickness (p=0.046). A significant difference was found (p=0.022) in comparing HPE with BMI. No significant association was found when HPE was compared with arm span (p=0.990), and thigh skin thickness (p=0.566)

DISCUSSION

Obesity has become a crucial public health problem worldwide, especially for breast cancer development and survival. Most studies have shown that body mass index which reflects general obesity is associated with a decrease in the risk of developing breast cancer before menopause and an increase after menopause in most of the studies, while waist to hip ratio which reflects central obesity is associated with an increased risk of both pre and postmenopausal breast cancer. Results are variable with differences in metabolic risk and definitions of obesity according to ethnicity. Findings suggest that anthropometric factors may have different associations with breast cancer risk in Kashmiri women than in Western women. Our study showed that weight, chest circumference, abdominal and thigh girth, BMI, and abdominal skin thickness are a few important anthropometric factors that were associated with increased breast cancer risk in our set of samples. Many studies have evaluated various anthropometric factors and found that either these factors were positively affecting or showed a negative correlation of these physical parameters with the breast cancer risk. Tehard B and Clavel-Chapelon F et al did a cohort study with several anthropometric measurements and breast cancer risk.[13] A slight increase in risk with increasing height was found. Weight, BMI, thorax and waist circumferences, and WHR were negatively related to breast cancer risk

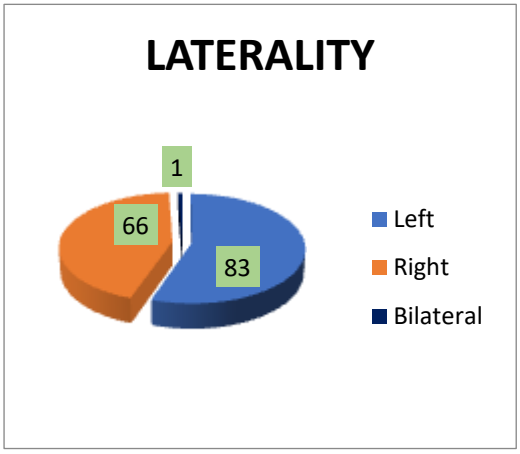

Fig 5 Disease laterality

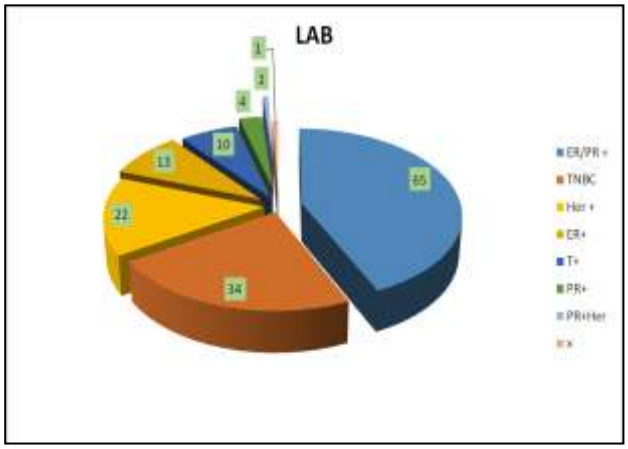

Fig 6Lab Parameters at disease diagnosis

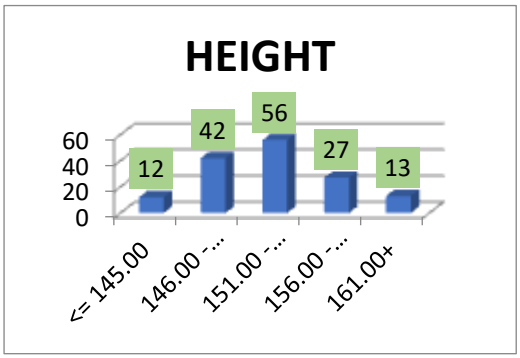

Fig 7 Height of the patients

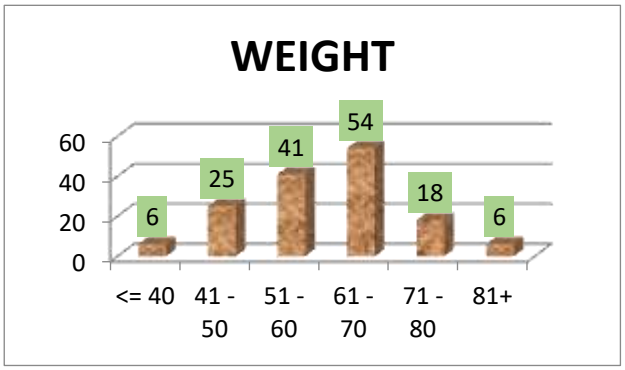

Fig 8 Weight of the patients

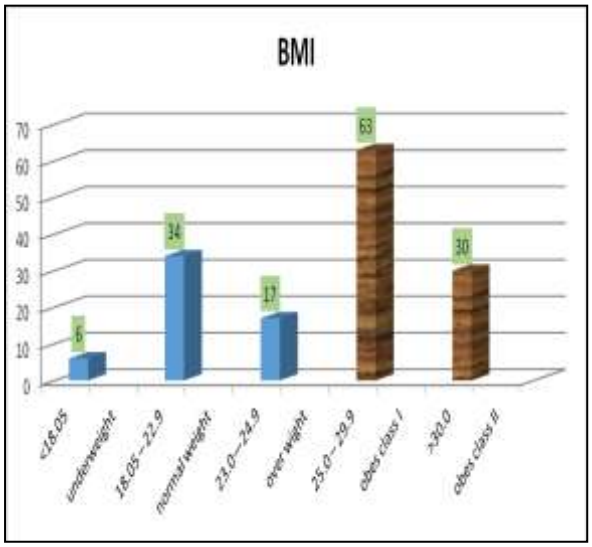

Fig 9 Basic Metabolic Index

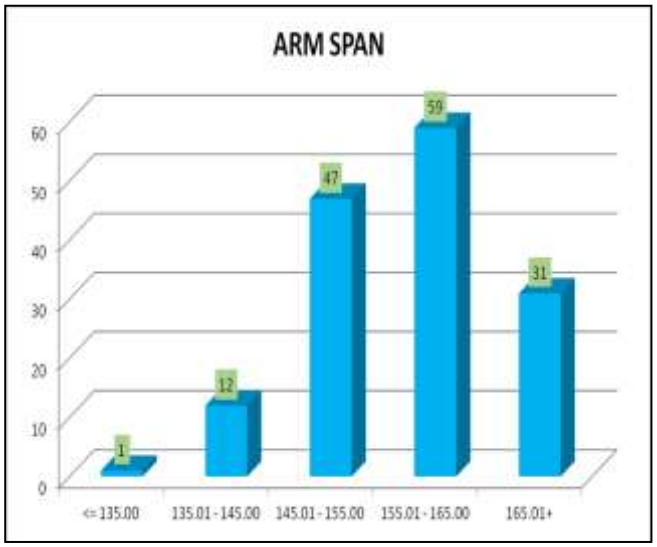

Fig 10Measured Arm Span

among premenopausal women. The relationships became non-significant after additional adjustment for BMI. An increased risk of premenopausal breast cancer with an android body shape (WHR>0.87) might be confined to obese women. Among postmenopausal women, all anthropometric measurements of corpulence were positively associated with breast cancer risk but became non-significant after additional adjustment for BMI. No difference in risk of postmenopausal breast cancer according to HRT use was observed. The study confirmed that adiposity was negatively associated with premenopausal breast cancer risk and positively associated with postmenopausal breast cancer

risk.[14] Suleyman S, Gokmen U et al did a retrospective and explorative analysis of the 3767 female BC patients from a single center. All patients' BMI at the time of initial diagnosis and tumor demographics were recorded. Their data indicated that

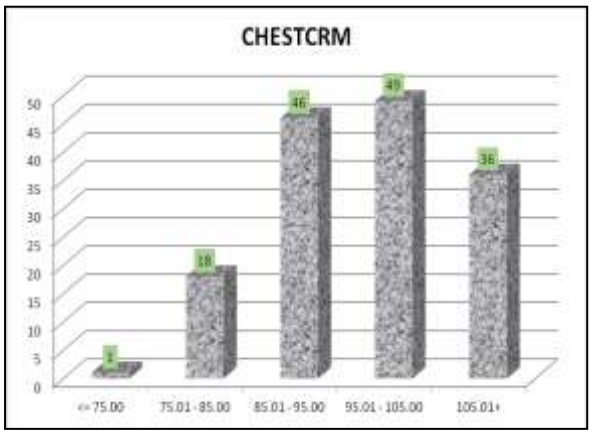

Fig 11 Measured Chest girth

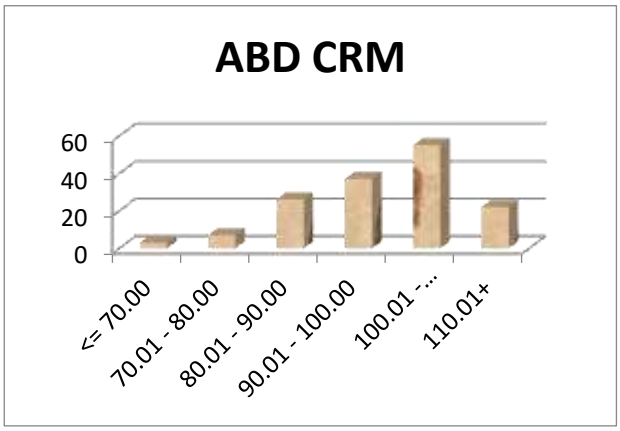

Fig 12 Measured Waist girth

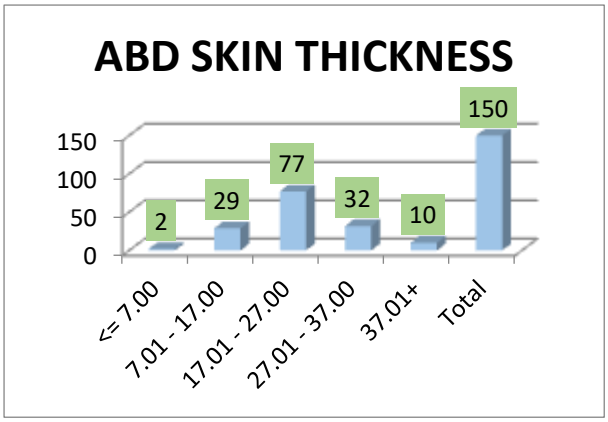

Fig 13 Measured abdominal skin thickness

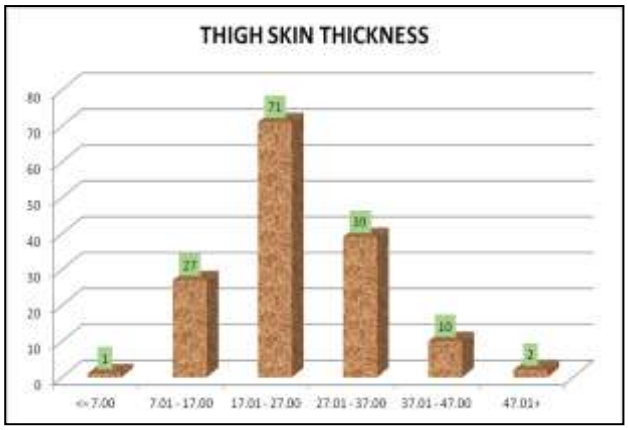

Fig 14 Measured thigh skin thickness

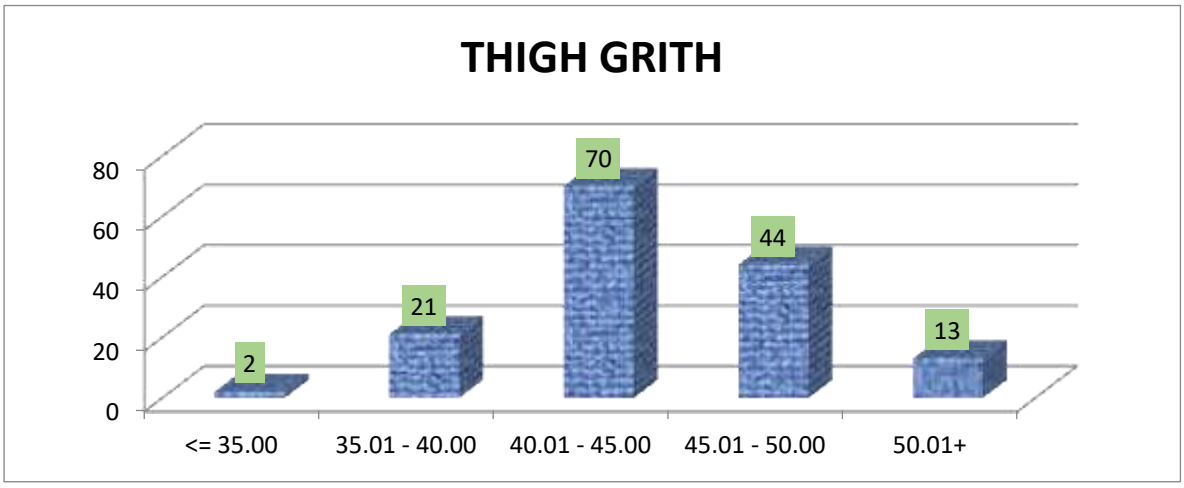

Fig 15 Measured thigh girth

BMI was an independent factor in patients with BC, with an association indicating a decreased incidence for luminal-like subtype and increased incidence for triple-negative subtype among premenopausal patients. However, this significance was not found in postmenopausal patients.[15] Samira EZ, Nahid G, Fatemah HS et al studied the relationship between body size and body shape and with risk of breast cancer. Their study revealed that the risk of breast cancer increased with increased hip circumference. In addition, the results indicated that body shape might be a useful predictor in determining the risk of breast cancer.[15] Amina A, Gabriela T, et al studied the association between anthropometry, body shape evolution across a lifetime, and the risk of breast cancer using a multi-center population-based case-control study in Mexico. Analysis of body shape evolution throughout life showed a strong and significant increase in the risk of breast cancer among women with increasing silhouette size over time compared to women with no or limited increase. Their findings suggested that anthropometric factors had different associations with breast cancer risk in Hispanic women than in Caucasian women. This study also showed the importance of considering the evolution of body shape throughout life.[4,16,17]

Our study adds to the literature on weight, adiposity, chest circumference, and risk of breast cancer in Kashmiri women in the Asian subcontinent. We observed that higher abdomen circumference and chest circumference were associated with an increased risk of premenopausal and postmenopausal breast cancer with increased luminal types and triple-negative breast tumors in our subset of the population. This in addition to dietary habits may contribute further to the risk of breast cancer.

Future studies of breast cancer should include more accurate measurements of various parameters of anthropometry and incorporate inflammatory markers and focus on the role of nutrition. Evaluation of an individual woman's risk of breast cancer has become much more important because this risk can now be modified. Until recently, risk has been primarily based on the evaluation of family and reproductive history and history of benign breast disease. New information on risk based on genotype, detailed histologic characteristics of benign breast disease, and hormone levels now allows a much more powerful prediction of risk for an individual woman.

CONCLUSIONS

We observed that weight, adiposity, and chest circumference increase the risk of breast cancer in women. We also observed that higher waist and chest circumference were associated with an increased risk of premenopausal and postmenopausal breast cancer with increased luminal types and triple-negative breast tumors in our subset of the population.

Available evidence provides a basis for strategies that can reduce the risk of breast cancer, although some of these represent complex decision-making. Attainable objectives can make an important impact on individual risk of cancer. However, even the collective implementation of all lifestyle strategies will not reduce population rates of breast cancer to the very low levels of traditional agrarian societies because the magnitude of the necessary changes is unrealistic or undesirable. Thus, a role will exist for hormonal and other chemopreventive interventions that may be appropriate for women at particularly high risk and, potentially, for wide segments of the population because few women can be considered to have very low risk. Together, the modification of nutritional and lifestyle risk factors and the judicious use of chemopreventive agents can have an impact on the incidence of this important disease.

Obesity has reached a level where it has to be considered a concern due to negative health complications it is associated with, such as increased cancer rates. Our study revealed that women with breast cancer present with typical body silhouette and visceral obesity, along with altered body proportions. Simple anthropometric characteristics such as height, weight, body mass index, waist and chest circumference, and skin fold thicknesses may be valuable tools for the assessment of the population to disclose subjects at greater risk of developing breast cancer.

Avoiding weight gain during adult life can importantly reduce the risk of breast cancer, as well as cardiovascular disease, and many other conditions. Individual women can reduce weight gain by exercising regularly and moderately restraining caloric intake, which is facilitated by the overall quality of diet. Healthcare providers play an important role in counseling patients throughout adult life about the importance of weight control. However, the incorporation of greater physical activity into daily life will be difficult for many persons. Physicians can assess dietary habits and provide guidance and policies influencing diet in many ways. Providing the best current information on the diet is an important role.

CONFLICTS OF INTEREST

None

Ethics

As the study did not involve any invasive procedure or any departure from the routine standard evaluation and treatment, no significant ethical considerations arose. Patients were enrolled only after informed consent. The study was undertaken only after clearance by the 'Institutional Ethical Committee' that looks into routine ethical aspects of studies at our institution.

Funding

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