Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 02, 2024

ASSESMENT OF BODY MASS INDEX, WAIST HIP RATIO AND ESTROGEN RECEPTOR AND PROGESTERONE RECEPTOR STATUS IN PATIENT'S WITH BREAST CARCINOMA: CROSS SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL

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INTRODUCTION

Breast cancer is a most common malignant condition of the mammary gland, affecting both males and females, with increased risk after the third decade and increasing its incidence with patient age, highest peak in fourth and fifth decade. worldwide it is one of the most commonly diagnosed malignant disease and cancer related deaths affecting women1,2 . Despite the decreased mortality rates attributable to breast cancer in women, the number of cases diagnosed has steadily increased over the past 30 years. This is believed to be due, at least in part, to an increased prevalence of obesity not only in the Western world, but also in other parts of the world where obesity has only recently reached epidemic proportions3 .

The risk of breast cancer increases with age and a strong correlation between obesity and the risk of breast cancer in postmenopausal women is well established. The majority of postmenopausal breast cancers are hormone receptor positive and rely heavily on estrogens produced from the adipose tissue for growth. The enzyme responsible for the final and key step in estrogen biosynthesis, aromatase, is increased in the adipose tissue in response to factors produced in obesity, including adipokines, inflammatory cytokines, and prostaglandins, as well as insulin.

Novel therapies are now being considered in light of evidence suggesting that obesity may affect current endocrine therapy, as well as the identification of novel pathways involved in estrogen regulation, including metabolic pathways that can be targeted by drugs currently used for the treatment of other obesity-related diseases.

Breast cancer is the most common cancer among women contributing to 25.4% of overall cancers. The incidence of breast cancer has increased over the previous two decades resulting in social and economic burdens. This ever increasing trend highlights the need for and potential impact of effective breast cancer risk reduction strategies, such as dietary modifications and weight control1,2,10 .

The association between obesity and breast cancer defined by Estrogen and progesterone receptor status among women remains poorly characterized. The current work aims to provide a comprehensive view of the relationship between obesity and breast cancer with particular emphasis on the role of dysregulated Estrogen metabolism and to know the possible associations

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between both general and central obesity and breast cancer risk according to joint Estrogen receptor and Progesterone receptor status

METHODOLOGY

SOURCE OF DATA:

Inpatients with histologically confirmed primary breast cancer presented during the study period at KARNATAKA INSTITUTE OF MEDICAL SCIENCES, HUBLI, DEPARTMENT OF GENERAL SURGERY, would be taken as subjects for this study

METHOD OF COLLECTION OF DATA:

STUDY DESIGN: Cross sectional study.

STUDY PERIOD: 1 stDecember 2019 to 31st November 2021.

STUDY DURATION: 24 months.

PLACE OF STUDY: Department of General surgery, KIMS Hubballi.

INCLUSION CRITERIA: • Females aged 25–70 years who are newly diagnosed with histopathologically confirmed primary breast cancer.

EXCLUSION CRITERIA

: • Diagnosed with recurrent or metastatic breast cancer

• Diagnosed with other concurrent malignancies 81

• Prior history of cancer

STUDY METHODOLOGY: All participants will be asked questions to gather information on the following factors: female physiological and reproductive factors, medical and family history, dietary habits, lifestyle habits, and breast cancer related knowledge. Current weight, standing height, waist circumference (WC), and hip circumference (HC) will be measured, and BMI (weight [kg]/height [m]2) and WHR (WC/HC) will be computed from the obtained measurements. Elements of protocol used in this study during measurement of waist and hip circumference are as follows,

• The **anatomical placement** of the measuring tape: waist circumference is measured at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest.

Hip circumference measurement should be taken around the widest portion of the buttocks at the level of greater trochanter of femur.

• **Tightness of the tape**: both waist and hip circumference is measured with the tape snuging around the body, but not pulled so tight that it is constricting, parallel to the floor at the level at which the measurement is made.

• **Type of tape** used: stretch- resistant tape 82

• **Subject's posture**: subject stands with arms at the sides, feet positioned close together, and weight evenly distributed across the feet.

• **Phase of respiration**: the waist circumference is measured at the end of a normal expiration, when the lungs are at their functional residual capacity There is no difference in hip circumference with phase of respiration.

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• **Abdominal tension**: the patient is asked to relax and take a few deep, natural breaths before the actual measurement is made, to minimize the inward pull of the abdominal contents during the waist measurement

• **Stomach contents**: Waist and Hip circumference are preferably made in empty stomach early in the morning.

The results of clinical examinations including visual examination, palpation, and related diagnostic tests such as breast ultrasound, mammography, and blood tests, will also be collected. Medical and pathology records from the hospital where the patient was originally diagnosed will be reviewed to obtain information on ER and PR statuses and other pathological results.

OBSERVATION AND RESULTS

86 patients admitted with newly diagnosed histologically confirmed primary breast cancer during the study period were considered for the study after taking proper consent.

Table 10: Age distribution of the participants in the study.

Sl.no	Age Groups (in years)	Female = n	Percentage (%)
1	≤ 30	3	3.5%
2	31 – 40	16	18.6%
3	41 – 50	30	34.9%
4	51 – 60	28	32.55%
5	61 – 70	9	10.45%
6	Total	86	100.0%

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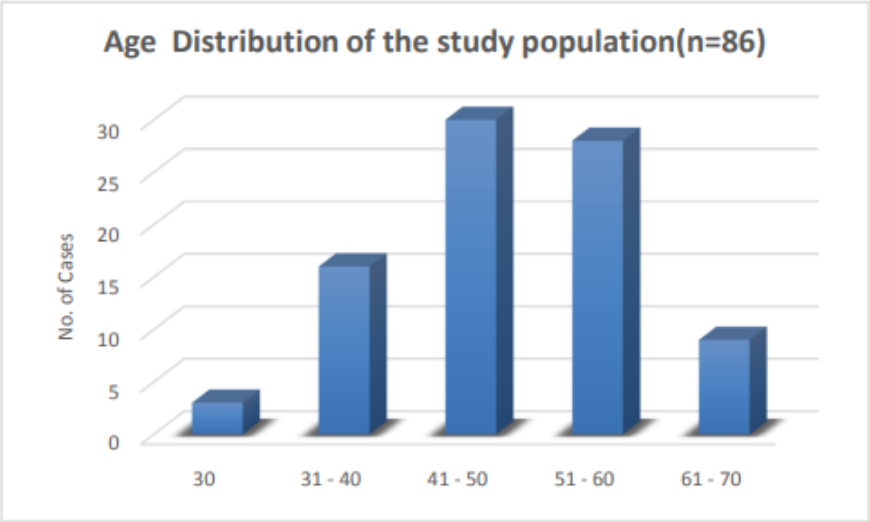
Graph 1: Age distribution of the participants in study.



Mean Age (SD) = 50.29 (10.79)

Median Age (IQR) = 50 (42 – 59)

In our study, among 86 patients the incidence of breast cancer was highest i.e, 58 patients(67.4%) in the age group of 40-60 years, and the incidence of breast cancer is highest in peri menopausal(40-50years) and postmenopausal(50-60years) group with mean age of 50.29 among the study population.

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Table 11: Distribution of the side of the breast lump involved (n=86)

S.no	Side	Frequency = n (%)
1	Right	41 (47.67%)
2	Left	45 (52.32%)
3	Total	86(100%)

In our study, 41 patients had right sided carcinoma breast and 45 patients had left sided carcinoma breast.

Table 12: Duration of breast lump in months (n=86)

S.no	Duration (in months)	n	Percentage (%)
1	≤ 2	28	32.6%
2	3 – 4	15	17.4%
3	5 – 6	24	27.9%
4	7 – 8	2	2.3%
5	9	1	1.16%
6	>1 year	16	18.6%
7	Total	86	100.0%

Mean Duration (SD) = 7.23 (12.41), Median Duration (IQR) = 4.5 (2 – 6)

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Table 14:Age of attaining menopause among the participants in the study.

Data Statistics of Postmenopausal women (n=55)
Mean Age (SD) = 45 (2.502)
Median Age (IQR) = 45 (44 – 46)

In our study among 86 participants, 55 had attained menopause and the mean age of menopause is 45 years among those who had attained menopause.

Remaining 31 patients were premenopausal.

Table 15: Family history of breast cancer among the study population(n=86).

S.NO	Family History	No of Patients	Percentage
1	Present	3	3.48%
2	Absent	83	96.5%

Among 86 patients only 3 patients had family history of breast cancer, and other 83 patients had no history of breast cancer among the family members.

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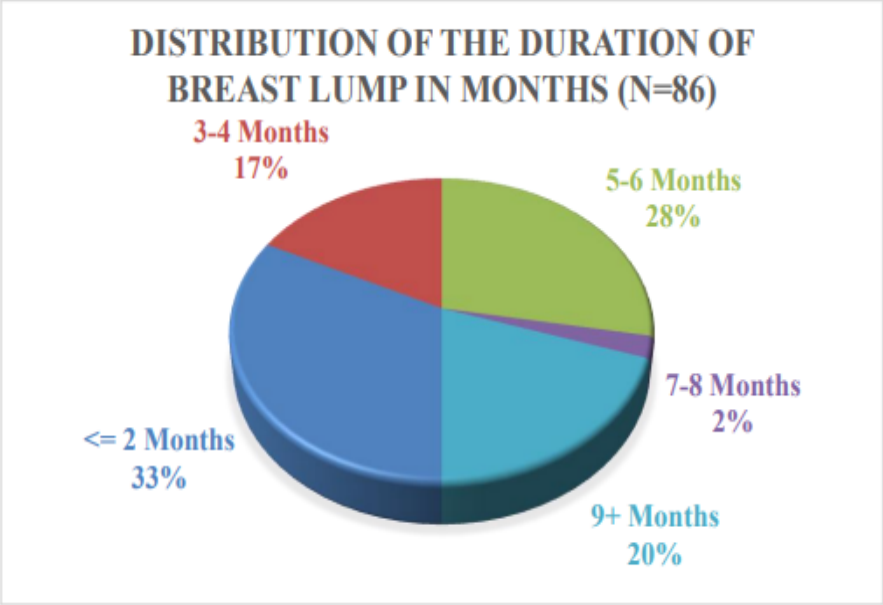
Graph 2: Distribution of the duration of breast lump in months (n=86)



In our study, most of the patients (33%) had presented with breast lump less than 2 months.

Table 13:Age of menarche among the participants in the study.

Data Statistics of Menarche (n=86)
Mean Age (SD) = 12.59 (1.2)
Median Age (IQR) = 12.5 (12 – 14)

In our study mean age of menarche among the participants is 12.59 with standard deviation of 1.2 years.

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Table 16: Tobacco History of the Study Population (n=86).

S.NO	Tobacco History	No of Patients	Percentage
1	Present	12	13.9%
2	Absent	74	86.04%

In our study 12 patients had history of tobacco consumption.

Table 17: PARITY among study population(n=86)

S.NO	Parity	No of Patients	Percentage
1	Nulliparous	8	9.3%
2	Parous	78	90.7%

In our study 8 patients were nulliparous, remaining 78 patients were parous.

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Table 18:Mean(SD) of various anthropometric parametersinthestudy population(n=86).

Sr. No	Parameters	Mean (SD)
1	Weight	59.87(6.14)
2	Height	1.53(0.4)
3	BMI	25.49(2.656)
4	Waist Circumference	82.93(5.7)
5	Waist Hip Ratio	0.84(0.04)

Mean weight among study population in our study is 59.87 kg.

Mean height among study population in our study is 153cms.

Mean BMI among study population in our study is 25.49kg/$m^{2.}$

Mean waist circumference among study population in our study is 82.9cms.

Mean WHR among study population in our study is 0.84.

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Table 19: BMI Grading of the Study Population (n=86).

S.no	BMI Grading	n	Percentage (%)
1	Normal Range (18.5-22.9)	16	18.6%
2	Overweight (22.9-24.9)	9	10.46%
3	Obese I (25-30)	56	65.11%
4	Obese II (>30)	5	5.81%
5	Total	86	100.0%

Among 86 patients of carcinoma breast in the study 61 patients were obese and 56 among them were Obese I category, 5 patients were obese category 2, 16 patients were of normal BMI and 9 patients were overweight.

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Table 20: WHR Classification of the Study Population (n=86).

S.no	WHR	n (%)
1	≤ 0.81	22 (25.58%)
2	0.81 – 0.85	28 (32.55%)
3	>0.85	36 (41.86%)
4	Total	86 (100%)

Waist hip ratio was classified into 3 categories based on the health risk associated with it.

22 patients had WHR of <0.81 and remaining 64 patients had WHR >0.81.

Table 21: Obesity classified as present/absent (n=86) with respect to BMI

Sr. No	Obesity	n	Percenatge
1	Present (>25)	61	70.9%
2	Absent (<25)	25	29.1%
3	Total	86	100.0%

In our study, 61 patients were obese and remaining 25 patients were non obese.

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Table 22: BIRADS Score of the study population (n=86)

S.no	BIRADS Score	n	Percentage (%)
1	**3**	11	12.8%
2	**4**	30	34.9%
3	**5**	37	43.0%
4	**6**	8	9.3%
5	**Total**	**86**	**100.0%**

In our study, 67 patients were having BIRADS score of 4 and 5(77.9%). 11 patients were of BIRADS 3(12.8%), 8 patients were of BIRADS 6(9.3%) category.

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Table 23:WHR and BIRADS cross tabulation.

Sr. No	WHR Category	BIRADs Score				
		3	4	5	6	Grand Total
1	≤ 0.81	3(13.6%)	10(45.45%)	8(36.36%)	1(4.5%)	22(100%)
2	0.81 – 0.85	5(17.85%)	7(25%)	14(50%)	2(7.14%)	28(100%)
3	>0.85	5(13.88%)	13(36.11%)	15(41.67%)	5(13.8%)	36(100%)
4	Total	11(12.8%)	30(34.9%)	37(43%)	8(9.3%)	86(100%)

Among the study population in our study, 22 patients had WHR of <0.81, 28 patients had WHR of 0.81-0.85 and 36 patients had WHR of > 0.85.WHR was cross tabulated with BIRADS score, but there was no significant association between WHR and BIRADS score.

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Table 24: BMI and BIRADS cross tabulation.

Sr. No	BMI Category	BIRADs Score				
		3	4	5	6	Grand Total
1	Normal Range (18.5-22.9)	2(12.5%)	6(37.5%)	6(37.5%)	2(12.5%)	16(100%)
2	Overweight (22.9-24.9)	4(44.45%)	2(22.22%)	0	3(33.3%)	9(100%)
3	Obese I (25-30)	5(8.9%)	19(33.92%)	29(51.78%)	3(5.3%)	56(100%)
4	Obese II (>30)	0	3(60%)	2(40%)	0	5(100%)
5	Total	11(12.8%)	30(34.9%)	37(43%)	8(9.3%)	86(100%)

In our study, among obese(obese type 1 and obese type 2) patients, 22 had BIRADS 4 score, 31 patients had BIRADS 5 score, 3 patients had BIRADS 6 score and 5 patients were BIRADS 3 score.

Among nonobese patients(normal BMI and overweight), 8 patients had BIRADS 4 score, 6 had BIRADS 5 score, 5 patients had BIRADS 6 score and 6 patients had BIRADS 3 score.

There is no statistically significant association between BMI and BIRADS score

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Table 25: ER Status of the Study Population (n=86).

S.NO	ER Status	No of Patients	Percentage
1	Positive	41	57.67%
2	Negative	45	52.32%
3	Total	86	100%

In our study, 41 patients had positive estrogen receptor status and remaining 45 patients were negative for estrogen receptor.

Table 26: PR Status of the Study Population (n=86).

S.NO	PR Status	No of Patients	Percentage
1	Positive	29	33.7%
2	Negative	57	66.27%
3	Total	86	100%

In our study, 29 patients had positive progesterone receptor status and remaining 57 were negative for progesterone receptor.

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Table 27: Her2neu Status of the Study Population (n=86).

S.NO	Her2/neu Status	No of Patients	Percentage
1	Positive	23	26.7%
2	Negative	63	73.25%
3	Total	86	100%

In our study, 23 patients had positive Her2 neu receptor status and remaining 63 were negative for Her2 neu receptor.

Table 28: ER/PR status combined of the Study Population (n=86).

S.NO	ER/PR status	No of Patients	Percentage
1	**ER-/PR-**	45	52.3%
2	**ER+/PR+**	29	33.7%
3	**ER+/PR-**	12	14.0%
4	**Total**	**86**	**100.0%**

Both estrogen and progesterone receptor status were combined and study population was divided into 4 categories in our study,

1.ER +/ PR +: 29 patients had both hormonal receptor status positive

2.ER +/ PR -: 12 patients had positive estrogen receptor and negative progesterone receptor

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3.ER-/ PR+: 45 patients had both hormonal receptors negative

4.ER-/ PR-: none of the patients in the study had estrogen receptor negative and progesterone receptor positive status

In our study majority of the patients were negative for both hormone receptor status.

Table 29: Distribution of the Stages of Breast Cancer (n=86).

S.no	Stage	n	Percentage (%)
1	**IIA**	18	20.9%
2	**IIB**	24	27.9%
3	**IIIA**	28	32.6%
4	**IIIB**	16	18.6%
6	**Total**	**86**	**100.0%**

In our study, 42 patients had early breast carcinoma (18- stage IIA, 24- IIB) and 44 patients had locally advanced breast cancer(28- stage IIIA, 16- stage IIIB).

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Table 30: BMI Category and Stages of Breast cancer cross tabulation (n=86).

Sr. No	BMI Category	IIA	IIB	IIIA	IIIB	Grand Total
1	Normal	4(25%)	5(31.25%)	6(37.5%)	1(6.25%)	16(100%)
2	Overweight	3(33.3%)	2(22.2%)	1(11.11%)	3(33.3%)	9(100%)
3	Obese I	9(16.1%)	16(28.57%)	19(33.9%)	12(21.43%)	56(100%)
4	Obese II	2(40%)	1(20%)	2(40%)	0	5(100%)
5	Total	18(20.9%)	24(27.9%)	28(32.6%)	16(18.6%)	86(100%)

Table 31: Obesity and Stages of Breast cancer cross tabulation (n=86).

Sr. No	Obesity	Stages of Breast Cancer		Grand Total
		<IIIA	>IIIA	
1	**Present (>25)**	28(45.9%)	33(54.1%)	61(100%)
2	**Absent (<25)**	14(56%)	11(44%)	25(100%)
3	**Total**	**42(48.8%)**	**44(51.2%)**	**86(100%)**

Chi Square test: Pearson Chi Square Value- 0.723; df – 1; p value- 0.3949 (Not Significant)

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In our study, among 61 obese patients, 28 patients were having early breast cancer and 33 patients were having locally advanced breast cancer.

Among 25 non obese patients, 14 patients were having early breast cancer and 11 patients were having locally advanced breast cancer. There is no statistically significant association between stage of breast cancer and obesity.

Table 32:BMI Category and Hormonal receptor Status of Breast cancer cross tabulation (n=86).

Sr. No	BMI Category	Hormonal Status of Breast Cancer			Grand Total
		ER+/PR+	ER+/PR-	ER-/PR-	
1	Normal	1(6.25%)	1(6.25%)	14(87.5%)	16(100%)
2	Overweight	2(22.2%)	1(11.1%)	6(66.7%)	9(100%)
3	Obese I	23(41.07%)	10(17.85%)	23(41.07%)	56(100%)
4	Obese II	3(60%)	0	2(40%)	5(100%)
5	Total	**29(33.7%)**	**12(14%)**	**45(52.3%)**	**86(100%)**

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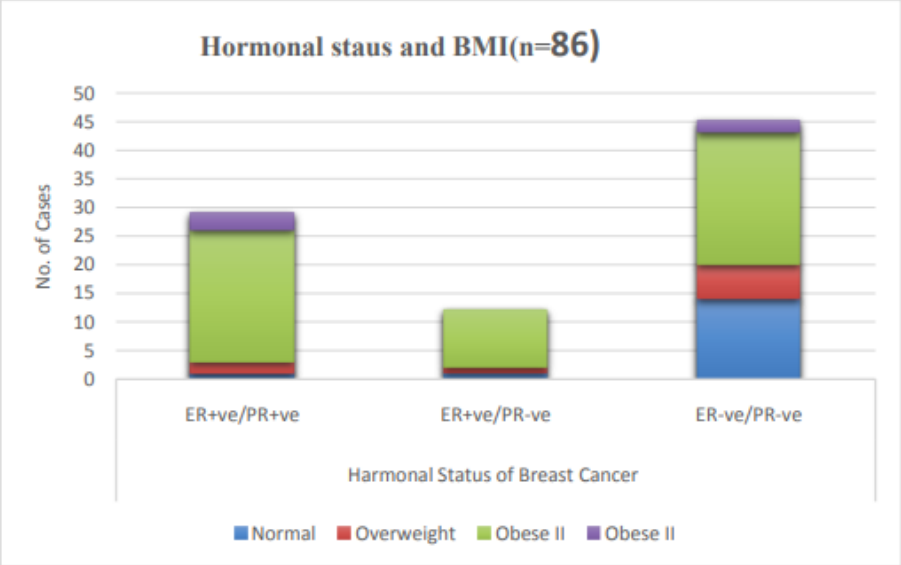
Table 33: Obesity and Hormonal receptor Status of Breast cancer cross tabulation (n=86).

Sr. No	Obesity	Hormonal receptor Status of Breast Cancer			Grand Total
		ER+/PR+	ER+/PR-	ER-/PR-	
1	Present (>25)	26(42.6%)	10(16.4%)	25(41%)	61(100%)
2	Absent (<25)	3(12%)	2(8%)	20(80%)	25(100%)
3	Total	**29(33.7%)**	**12(14%)**	**45(52.3%)**	**86(100%)**

Chi Square test: Pearson Chi Square Value- 10.99; df – 2; p value- 0.0041 (Significant)

Graph 3: Obesity and Hormonal Status of Breast cancer (n=86)



In our study, among 29 patients with ER + / PR + status – 26 were obese and 3 patients were non obese.

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Among 12 patients with ER +/ PR - status – 10 patients were obese and 2 patients were non obese.

Among 45 patients with ER - / PR - status – 25 patients were obese and 20 patients were non obese.

With increasing BMI there is more of ER+/PR+ subtype of breast cancer, with decreasing BMI there is more chances of ER-/PR- subtype of breast cancer, which is statistically significant.

Table 34: WHR Category and Stages of Breast cancer cross tabulation (n=86).

Sr. No	WHR Category	Stages of Breast Cancer					Grand Total
		IIA	IIB	IIIA	IIIB	IIIC	
1	(≤0.81)	6(27.27%)	3(13.63%)	9(40.9%)	4(18.18%)	0	22(100%)
2	(>0.81-85)	8(28.57%)	7(25%)	6(21.42%)	6(21.42%)	1(3.57)	28(100%)
3	(>0.85)	4(11.11%)	14(38.8%)	13(36.11)	5(13.8)	0	36(100%)
4	Total	**18(20.9%)**	**24(27.9%)**	**28(32.6%)**	**15(17.4%)**	**1(1.2%)**	**86(100%)**

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Table 35: WHR Category and Stages of Breast cancer cross tabulation (n=86).

Sr. No	WHR Category	Stages of Breast Cancer		Grand Total
		<IIIA	>IIIA	
1	(≤0.81)	9(40.9%)	13(59.1%)	22(100%)
2	(>0.81- 85)	15(53.57%)	13(46.43%)	28(100%)
3	(>85)	18(50%)	18(50%)	36(100%)
4	Total	**42(48.8%)**	**44(51.2%)**	**86(100%)**

Chi Square test: Pearson Chi Square Value- 0.8241; df – 2; p value- 0.75 (Not Significant)

Waist hip ratio has been classified into 3 categories, <0.81, 0.81-0.85, >0.85 based on the health risk associated with it(among women).

WHR is classified into 2 categories,<0.81 and >0.81 according to the Indian standards to stratify into obese and nonobese women.

In our study, among 42 patients of early breast cancer, 9 patients had WHR <0.81, 15 patients had WHR of 0.81-0.85, 18 patients had WHR >0.85.

Among 44 patients of locally advanced breast cancer, 13 patients had WHR <0.81, 13 patients had WHR of 0.81-0.85, 18 patients had WHR >0.85.

There is no statistically significant association between waist hip ratio and stages of breast cancer.

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Table 36: WHR Category and Hormonal receptor Status of Breast cancer cross tabulation (n=86).

Sr. No	WHR Category	Hormonal receptor Status of Breast Cancer			Grand Total
		ER+/PR+	ER+/PR-	ER-/PR-	
1	(≤0.81)	16(72.72%)	4(18.18%)	2(9.09%)	22(100%)
2	(0.81- 85)	10(35.7%)	2(7.14%)	16(57.14%)	28(100%)
3	(>0.85)	3(8.33%)	6(16.7%)	27(75%)	36(100%)
4	Total	**29(33.7%)**	**12(14%)**	**45(52.3%)**	**86(100%)**

Chi Square test: Pearson Chi Square Value- 29.76.25; df – 4;p value- 0.0001 (Significant)

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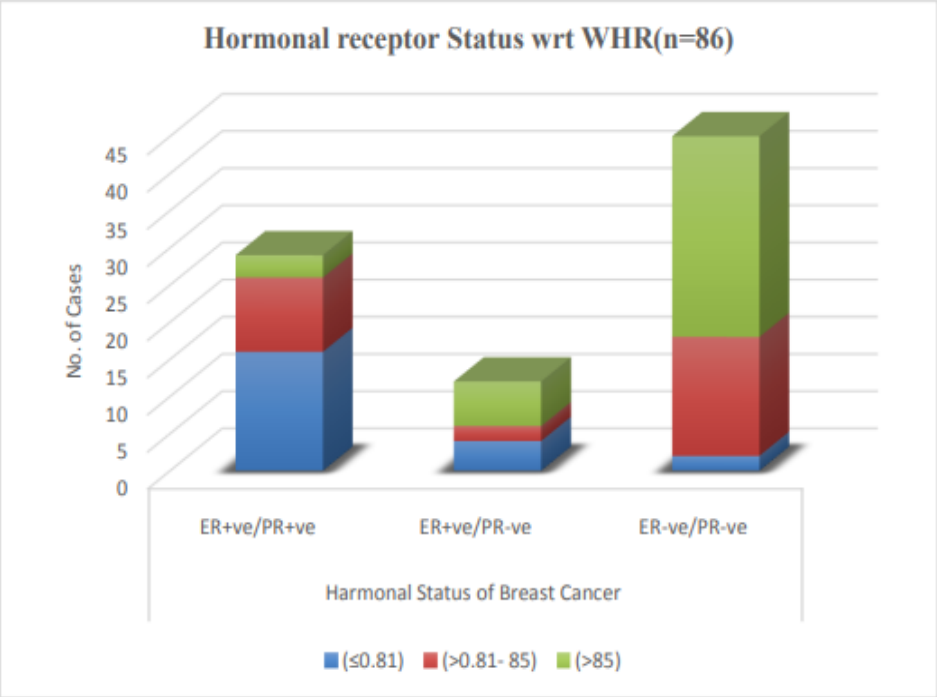
Graph 4: WHR Category and Hormonal receptor Status of Breast cancer (n=86).



In our study, among 29 patients with ER + / PR +status – 16 patients had WHR<0.81, 10 patients had WHR 0.81-0.85, 3 patients had WHR of >0.85.

Among 12 patients with ER +/ PR - status – 4 patients had WHR<0.81, 2 patients had WHR 0.81-0.85, 6 patients had WHR of >0.85.

Among 45 patients with ER -/ PR - status – 2 patients had WHR<0.81, 16 patients had WHR 0.81-0.85, 27 patients had WHR of >0.85.

With increasing WHR there ismore of ER-/PR- subtype of breast cancer, with decreasing WHR there is more chances of ER+/PR+ subtype of breast cancer, which is statistically significant.

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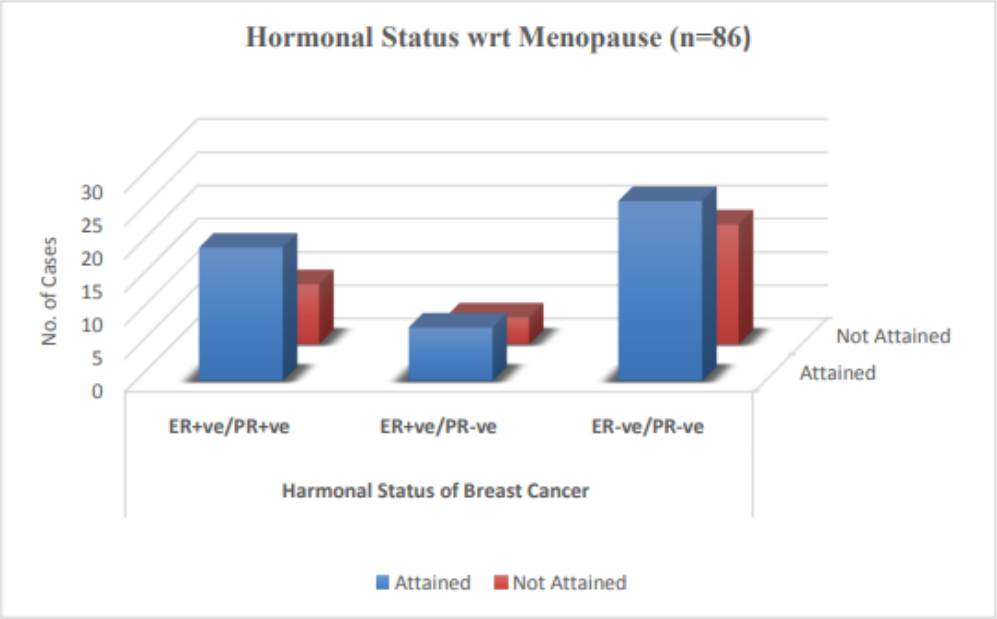
Table 37: Menopausal status and Hormonal receptor Status of Breast cancer cross tabulation (n=86).

Sr. No	Menopause	Hormonal receptor Status of Breast Cancer			Grand Total
		ER+/PR+	ER+/PR-	ER-/PR-	
1	Attained	20(36.4%)	8(14.5%)	27(49.1%)	55(100%)
2	Not Attained	9(29%)	4(12.9%)	18(58.1%)	31(100%)
3	Total	**29(33.7%)**	**12(14%)**	**45(52.3%)**	**86(100%)**

Chi Square test: Pearson Chi Square Value- 0.6594; df – 2; p value- 0.719 (Not Significant)

Graph 5: Menopausal status and Hormonal Status of Breast cancer (n=86).



In our study, among 55 postmenopausal patients, 20 patients were ER +/ PR+, 27 patients were ER-/ PR-, 8 patients were ER +/ PR-.

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Among 31 premenopausal patients, 9 patients were ER +/ PR+, 18 patients were ER-/ PR-, 4 patients were ER +/ PR-.

Table 38: Post-Menopausal

Sr. No	Obesity	Hormonal receptor Status			Grand Total
		ER+/PR+	ER+/PR-	ER-/PR-	
1	Absent	1(5.55%)	2(11.11%)	15(83.33%)	18(100%)
2	Present	17(45.9%)	7(18.91%)	13(35.13%)	37
3	**Grand Total**	**18**	**9**	**28**	**55**

X^2 – 12.01, df – 2, p value – 0.0025

In our study, 37 postmenopausal patients were obese, among them 17 patients were ER +/ PR+, 13 patients were ER-/ PR-, 7 patient had ER +/ PR- receptor status.

18 postmenopausal patients were non obese, among them 1 patient had ER +/ PR+, 15 patients were ER-/ PR-, 2 patients had ER +/ PR- receptor status.

Among postmenopausal women who are nonobese there are more chances of ER-/ PR- subtype of breast cancer and among postmenopausal obese patients there are more chances of ER +/ PR+ subtype of breast cancer which is statistically significant.

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Table 39:Premenopausal

Sr. No	Obesity	Hormonal receptor Status			Grand Total
		ER+/PR+	ER+/PR-	ER-/PR-	
1	Absent	2(28.57%)	0	5(71.42%)	7
2	Present	9(37.5%)	3(12.5%)	12(50%)	24
3	**Grand Total**	**11**	**3**	**17**	**31**

In our study, 24 premenopausal patients were obese, among them 9 patients were ER +/ PR+, 12 patients were ER-/ PR-, 3 patient had ER +/ PR- receptor status.

7 premenopausal patients were non obese, among them 2 patients had ER +/ PR+, 5 patients were ER-/ PR-, no patients had ER +/ PR- receptor status.

statistical significance couldnot me assessed as the sample size is low and one of the parameters is zero in the sample.

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Nominal regression testamong study population.

Nominal regression test is used to assess the association between WHR, BMI and specific subtypes of breast cancer.

It is done using one of the subtypes as reference and one more as redundant

Table 40: Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	72.155			
Final	27.656	44.499	6	.000

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Table 41: Pseudo RSquare

Cox and Snell	.404
Nagelkerke	.470
McFadden	.264

Table 42:Parameter Estimates

ER/PR status[a]		B	Std. Error	Wald	Df	Sig.
ER-/PR-	Intercept	1.837	.621	8.747	1	.003
	[Obesity=Absent]	2.233	.799	7.813	1	.005
	[Obesity=Present]	0[b]	.	.	0	.
	[WHRCategory=A(<81)]	-4.450	1.025	18.861	1	.000
	[WHRCategory=B(81-85)]	-2.174	.782	7.718	1	.005
	[WHRCategory=C(>85)]	0[b]	.	.	0	.

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ER+/PR-	Intercept	.624	.714	.764	1	.382
	[Obesity=Absent]	.865	1.015	.726	1	.394
	[Obesity=Present]	0[b]	.	.	0	.
	[WHRCategory=A(<81)]	-2.120	.906	5.473	1	.019
	[WHRCategory=B(81-85)]	-2.420	1.063	5.183	1	.023
	[WHRCategory=C(>85)]	0[b]	.	.	0	.

a. The reference category is: ER+/PR+.

b. This parameter is set to zero because it is redundant.

A logistic regression was performed to ascertain the effects of body mass index and waist hip ratio on the hormonal receptor status. The logistic regression model was statistically significant, $\chi^2(4) = 44.499, p < .0001$. The model explained 47% (Nagelkerke R^2) of the variance in ER+/PR+ and correctly classified 73.3% of cases. Considering the ER+/PR+ as the reference category non obese (BMI<25) patients have 7.8 times likelihood of having ER-/PR- when compared to obese patients(BMI>25).

DISCUSSION

The incidence of breast cancer in both urban and rural areas of india has increased over the previous 2 decades, resulting in great social and economic burdens. Thiseverincreasing trend highlights the need for and potential impact of effective breast cancer risk reduction strategies,

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such as dietary modifications and weight control.

The association between breast cancer and obesity defined by estrogen and progesterone receptor status among women remains poorly characterized, this study was conducted to know the possible association between breast cancer and obesity, subtypes of breast cancer depending on hormonal receptor status and its association with obesity.

In our study among patients of breast carcinoma, maximum number of patients were in the age group of 40-60 years accounting for 65.3% of total cases taken. This is in accordance with various studies conducted in the past which shows carcinoma breast being common in 4th and 5th decade of life. Mean age of study population in our study is 50.29 years.

A cross sectional study was conducted among 86 patients of carcinoma breast with known ER/PR status, and assessed for association between factors indicating different body size like BMI, WHR with breast cancer.

In our study among 86 patients of breast cancer, 61 patients(70.9%) had BMI >25 and 64 patients(74.4%) had WHR >0.81, thus indicating both BMI and WHR are positively associated with breast cancer, with WHR being slightly more sensitive than BMI, while considering obesity related to breast cancer.

In our study, among 86 patients, 41 patients were positive for estrogen receptor and 29 patients were positive for progesterone receptor, among them 36 patients(87%) with estrogen receptor status positive and 26 patients(89%) with progesterone receptor status positive respectively had

BMI >25, indicating obesity is related with hormone receptor positive status, slightly more with progesterone receptor with respect to BMI (general obesity).

In our study, patients were grouped into 4 subtypes based on hormone receptor status as, ER+/PR+, ER+/PR-, ER-/PR+ and ER-/PR- subtypes, among 61 patients with BMI>25, 26 patients were ER+/PR+(42%), 25 patients were ER-/PR-(40%), 10 patients were ER+/PR-(16%), among 25 patients with BMI<25, 3 patients were ER+/PR+(12%),20 patients were ER-/PR-(80%), 2 patients with ER+/PR-(8%). High BMI is associated more with ER+/PR+ breast cancer and low BMI is associated more with ER-/PR- breast cancer.

In our study, high waist hip ratio was associated with more chances of ER-/PR- breast cancer and low waist hip ratio with more chances with ER+/PR+ breast cancer.

On further stratification into premenopausal and postmenopausal categories,Obese postmenopausal women have more chances of developing ER+/PR+ breast cancer and nonobese postmenopausal patients have more chances of developing ER-/PR- breast cancer.

Among premenopausal women who are obese are likely to develop ER+/PR+ breast cancer but less compared with postmenopausal obese patients, and premenopausal non obese patients have more chances of developing ER-/PR- breast cancer.

On nominal regression analysis, considering the ER+/PR+ as the reference category non obese(BMI<25) patients have 7.8 times likelihood of having ER-/PR- when compared to obese patients(BMI>25).

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TABLE 43: Comparison of various studies.

Study	Overall risk of breast cancer	BMI with hormone receptor status	WHR with hormone receptor status
Present study	Increased	High BMI associated with hormone receptor positive(ER+/PR+)subtype of breast cancer	High WHR associated with hormone receptor negative(ER-/PR-)subtype of breast cancer.
Nehad M. Ayoub et al[4]	Increased	Not associated	Not compared
Shieh, Y., Scott, C.G., Jensen, M.R. et al[5]	Increased	High BMI associated with hormone(estrogen) receptor negative status	Not compared
Cina J. Nattenmülle and team[6]	Increased	High BMI associated with hormone receptor positive status	Not compared
Renata pacholczak and team[7]	BMI was negatively associated with breast cancer, WHR was positively	Not compared	Not compared

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	associated with breast cancer		
A Amadou et al.[8]	BMI was negatively associated with breast cancer in premenopausal women and positively associated with postmenopausal women. WHR was positively associated in both the groups.	Not compared	Not compared
FEI WANG et al[91]	Increased	High BMI associated with hormone receptor positive status	High WHR associated with hormone receptor negative status

SUMMARY

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The dissertation titled “ASSESMENT OF BODY MASS INDEX, WAIST HIP RATIO AND ESTROGEN RECEPTOR AND PROGESTERONE RECEPTOR STATUS IN PATIENT'S WITH BREAST CARCINOMA:CROSS SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL”is done in two parts.

In the part-1, review of literature,anatomy,physiology,pathology, investigations and management of different conditions were discussed.

In the part-2, materials and methods followed in the study, proforma of study, master chart, analysis of data regarding various etiologies incidence, symptoms and signs, investigations, BMI, WHR and its association with subtypes of hormone receptor status were discussed.

The study group consisted of 86 cases of carcinoma breast admitted in Department of general surgery, Karnataka Institute of Medical Sciences, Hubli during 1st December 2019 to 31st November 2021.

Among the study group, 61 patients had high BMI and 64 patients had high WHR, indicating both BMI and WHR are positively associated with risk of breast cancer, more so with WHR.

In our study,obesity had no correlation with stage of the disease and prognosis of the disease and BIRADS score.

In our study both BMI and WHR had distinct effect on specific subtype of breast cancer with high BMI having more hormone receptor positive breast cancer and high WHR having more hormone receptor negative breast cancer.

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