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Evaluation of weight change in women undergoing hormonal therapy for breast cancer

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Abstract
Background: Hormonal therapy is a cornerstone in the management of hormone receptor-positive breast cancer. While its efficacy in reducing recurrence and improving survival is well established, therapy is often accompanied by metabolic alterations, particularly weight gain, which may influence prognosis and quality of life.
Objective: This study aimed to evaluate changes in weight and body mass index (BMI) among women with breast cancer receiving hormonal therapy and to explore the influence of dietary index and demographic factors on these outcomes.
Methods: A prospective observational cohort study was conducted at Baqubah Teaching Hospital, Diyala, Iraq, from January to September 2025. A total of 346 women with breast cancer undergoing hormonal therapy were enrolled. Baseline demographic data, dietary index, and physical activity were recorded. Weight and BMI were measured before therapy initiation and reassessed after 16 weeks. Statistical analyses included paired t-tests, ANOVA, and chi-square tests, with significance set at $p<0.05$.
Results: Participants had a mean age of 44.2±8.7 years, with the majority in the 40-49 age group (34.7%). Significant increases were observed in weight (78.72 → 79.98 kg; p=0.0001) and BMI (31.25 → 31.81 kg/m²; p=0.0001) after therapy. At baseline, women with low dietary index had higher mean weight (86.39±17.76 kg) and BMI (33.42±6.27 kg/m²) compared to medium and high index groups. Post-therapy, these differences were no longer statistically significant, suggesting hormonal therapy as the dominant factor influencing weight gain.
Conclusion: Hormonal therapy in breast cancer patients leads to significant weight and BMI increases within a short treatment period, overshadowing the effects of dietary and demographic factors. These findings highlight the importance of weight monitoring and supportive interventions during treatment to mitigate adverse metabolic outcomes.

Keywords: Weight, change, women, hormonal, therapy, breast, cancer

Introduction

Breast cancer is the most commonly diagnosed cancer among women globally, and hormone receptor-positive (HR+) subtypes comprise a substantial proportion of cases. Hormonal or endocrine therapy-such as selective estrogen receptor modulators (e.g., tamoxifen) or aromatase inhibitors-is a mainstay of treatment, particularly for HR+ cancers. These therapies aim to limit estrogen stimulation of tumor growth, thereby reducing recurrence risk and improving survival. However, while endocrine therapy has significant oncologic benefits, it may also lead to side effects, including metabolic changes and alterations in body weight and composition [1, 1]. Weight change during hormonal therapy is of clinical and public health importance. Studies have shown that patients with breast cancer often experience weight gain after diagnosis and during treatment. Among women treated for early stage breast cancer, many experienced weight increases that continued beyond treatment, with younger age and lower baseline body mass index (BMI) being associated with greater gain [3]. Endocrine therapy-though generally considered less disruptive metabolically than chemotherapy-may still contribute to weight gain or unfavorable shifts in fat-to-lean body mass, especially in postmenopausal women or those who experience treatment-induced suppression of estrogen [4]. Weight gain during and after treatment has implications beyond physical appearance. Increased adiposity is associated with worse prognosis, higher risk of recurrence, poorer overall survival, and a higher incidence of comorbid conditions such as diabetes, cardiovascular disease, and metabolic syndrome. BMI trajectories over time in HR+ breast cancer patients and found that increasing BMI post-diagnosis was associated

with poorer outcomes [5]. Moreover, excessive weight gain can negatively affect quality of life, lead to reduced physical functioning, and complicate survivorship care [6]. The mechanisms by which hormonal therapy might induce weight change are multifactorial. Loss of estrogen (via ovarian suppression or natural menopause) tends to reduce basal metabolic rate and may promote fat accumulation; hormonal therapy may also lead to changes in appetite, energy expenditure, fat distribution (especially increase in central adiposity), and reductions in lean muscle mass. Hormonal therapy can also interact with age and menopausal status: for example, postmenopausal women on aromatase inhibitors may experience more pronounced alterations in body composition [4, 7]. Despite its importance, many existing studies on weight change during hormonal therapy are limited by relatively short follow-up duration, small sample sizes, or lack of measurement of body composition beyond simple weight or BMI. There is a need for prospective, sufficiently powered studies that track weight and body composition over time, investigate relevant predictors (age, baseline BMI, menopausal status, type of endocrine agent), and evaluate the clinical implications of such changes. This study aims to evaluate weight change over a 16-week period among women undergoing hormonal therapy for breast cancer in Diyala, Iraq.

Method

This study was designed as a prospective observational cohort to evaluate weight change among women with breast cancer undergoing hormonal therapy. The research was carried out at Baqubah Teaching Hospital, Oncology Center, in Diyala city, Iraq, between January and September 2025. A total of 346 women who had a confirmed diagnosis of breast cancer and were eligible for hormonal therapy were enrolled. Patients with advanced disease requiring immediate surgical intervention, those with severe hepatic, renal, cardiovascular, or endocrine disorders, and pregnant or lactating women were excluded to reduce potential confounders.

- **Study Design and Sampling:** Patients were recruited consecutively from the oncology outpatient clinics. Informed consent was obtained prior to participation. Demographic data, socioeconomic characteristics, menstrual history, and physical activity levels were collected using a structured questionnaire. Baseline anthropometric measures, including body weight and height, were recorded to calculate BMI. Weight and BMI were reassessed after 16 weeks of continuous hormonal therapy, enabling longitudinal evaluation of treatment-associated changes.
- **Hormonal Therapy Protocol:** Participants received standard hormonal therapy as clinically indicated. Premenopausal women were commonly prescribed tamoxifen, while postmenopausal women were treated with aromatase inhibitors such as anastrozole or letrozole. All treatments were administered under supervision by oncology specialists in accordance with international guidelines. Medication adherence was monitored through patient interviews and prescription refill records [8].
- **Dietary and Lifestyle Assessment:** Nutritional status was evaluated using a validated dietary index questionnaire that classified participants into low, medium, or high dietary quality categories. Physical activity was assessed through self-reported frequency and intensity of exercise, categorized as sedentary or active. These parameters were included to identify potential modifiers of weight and BMI changes during therapy [9].
- **Data Collection and Measurements:** Weight was measured using a calibrated digital scale, and height was recorded with a stadiometer. BMI was calculated as weight (kg)/height (m^2). Repeated measures allowed comparison of pre- and post-treatment values. Quality control procedures ensured standardized measurements across all participants [10].
- **Statistical Analysis:** Data were analyzed using SPSS version 25. Continuous variables were expressed as mean±standard deviation (SD), while categorical variables were presented as frequencies and percentages. Paired t-tests were used to compare pre- and post-treatment weight and BMI. One-way ANOVA assessed differences according to dietary index and demographic characteristics. Associations between categorical variables were tested using Chi-square. A p-value <0.05 was considered statistically significant.

Results

The sample included 346 patients, with the majority belonging to the 40-49 years age group (34.7%), followed by 30-39 years (30.9%). Younger participants aged 20-29 accounted for 14.2%, while those aged ≥50 years represented 20.2%. This shows that most patients were in middle adulthood, an age group often associated with hormonal, metabolic, and lifestyle-related health changes. Educational distribution was relatively balanced: illiterate (28.3%), secondary education (26.0%), and higher education (28.9%), while primary education formed the lowest proportion (16.8%). This indicates a heterogeneous educational background, important for interpreting health awareness and lifestyle practices. Economic status revealed that the majority were of fair economic level (65.9%), while only 17.3% were poor and 16.8% good, reflecting a middle-income predominance. Marital status showed most patients were married (74.3%), suggesting family responsibilities may influence lifestyle and dietary practices. Regarding menstrual cycle status, 66.5% reported regular cycles, while 33.5% did not, which could be linked to hormonal imbalance or age. Physical activity was largely favorable, with 86.4% active compared to 13.6% sedentary, an encouraging pattern for health outcomes. As in table 1.

Table 1: Patient's demographic profile.

Variables		Frequency	Percentage
	20-29	49	14.2
Age groups (years)	*30-39*	107	30.9
	40-49	120	34.7
	≥50	70	20.2
Education	*Illiterate*	98	28.3
	Primary	58	16.8
	Secondary	90	26.0
	Higher	100	28.9
Economic level	*Poor*	60	17.3
	Fair	228	65.9
	Good	58	16.8
Marital state	*Single*	89	25.7
	Married	257	74.3
Menstrual cycle	*No*	116	33.5
	Yes	230	66.5
Physical activity	*Sedentary*	47	13.6
	Active	299	86.4

The chart shows that most patients had a medium dietary index (254 patients; 73.4%), while smaller proportions had a high index (54 patients; 15.6%) or a low index (38 patients; 11%). This indicates that the majority maintained a moderate-quality diet, but relatively few followed very healthy or very poor diets. The findings suggest opportunities to improve dietary habits by shifting patients from medium to high index, while also addressing the smaller high-risk group with low dietary index. As in fig 1.

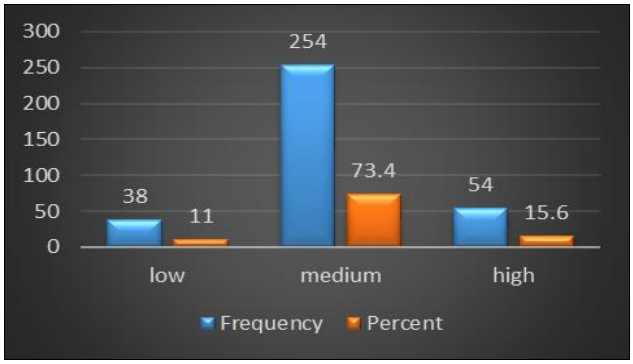

Fig 1: Distribution of patients according to dietary index history.

Both weight (78.72 → 79.98 kg) and BMI (31.25 → 31.81 kg/m²) increased significantly after hormonal therapy (p=0.0001 for both). Although the absolute changes were modest, the statistical significance indicates that hormonal therapy contributed to measurable weight gain and BMI elevation. Clinically, this aligns with known side effects of hormonal treatments, which often alter metabolism and fat distribution. As in table 2.

Table 2: Differences mean in weight and BMI in patients before hormonal therapy and after that.

Parameter	Before (Mean±SD)	After (Mean±SD)	P-value
Weight (kg)	78.72±13.59	79.98±12.93	**0.0001**
BMI (kg/m²)	31.25±5.12	31.81±4.98	**0.0001**

Patients with a low dietary index had the highest baseline weight (86.39±17.76 kg) and BMI (33.42±6.27 kg/m²) compared to medium and high dietary index groups (p=0.001 for weight, p=0.021 for BMI). This suggests that poorer dietary habits are strongly associated with obesity markers even before intervention. Conversely, patients with medium or high dietary index had lower weight and BMI, emphasizing the protective effect of balanced diets on body composition. As in table 3.

Table 3: Differences mean in weight and BMI in patients before hormonal therapy according to Dietary index history

Parameter	Dietary index history	Mean±SD	P-value
Weight (kg) before	Low	86.39±17.76	0.001
	Medium	77.94±11.23	
	High	77.00±18.21	
BMI (kg/m²) before	Low	33.42±6.27	0.021
	Medium	30.98±4.33	
	High	30.98±7.00	

After hormonal therapy, the differences between dietary index groups diminished. Weight differences (p=0.3) and BMI differences (p=0.09) were no longer statistically significant. While low dietary index patients still had slightly higher BMI, hormonal therapy appeared to overshadow dietary influence, leading to weight/BMI increases across all groups. This highlights the dominant metabolic effect of hormonal therapy regardless of dietary background. As in table 4.

Table 4: Differences mean in weight and BMI in patients after hormonal therapy according to Dietary index history

Parameter	Dietary index history	Mean±SD	P-value
Weight (kg) after	Low	79.01±16.83	0.3
	Medium	79.62±10.76	
	High	82.34±18.19	
BMI (kg/m²) after	Low	31.01±6.05	0.09
	Medium	31.65±4.19	
	High	33.11±7.09	

This table explores whether demographics influenced dietary index distribution:

- **Education:** No significant association (p=0.5). Across all education levels, most patients fell into the medium dietary index category, indicating that education did not strongly influence dietary quality.
- **Economic status:** No significant differences (p=0.9). Both poor and good groups showed a majority in the medium category, suggesting diet quality was not markedly tied to income in this cohort.
- **Marital status:** No association (p=0.6). Both single and married patients predominantly reported medium dietary index.
- **Menstrual cycle:** Borderline significance (p=0.05). Patients without menstrual cycles were more likely to have a **high dietary index (19.0%)**, potentially linked to age or hormonal status.
- **Physical activity:** No significant relationship (p=0.5). Active and sedentary individuals both mostly had medium dietary index.

- **Age groups:** Borderline significance (p=0.05). Younger patients (20-39 years) showed higher proportions of low dietary index, while older groups (40-50 years) more often reported medium dietary index. This may reflect lifestyle improvements with age or increased health awareness.

Table 5: Association between Dietary index history and demographic factors.

		Dietary index history		
Education Level	**Low (No. %)**	**Medium (No. %)**	**High (No. %)**	**P-value**
Illiterate	8 (8.2%)	73 (74.5%)	17 (17.3%)	0.5
Primary	9 (15.5%)	39 (67.2%)	10 (17.2%)	
Secondary	8 (8.9%)	72 (80.0%)	10 (11.1%)	
Higher	13 (13.0%)	70 (70.0%)	17 (17.0%)	
Economic Status	**Low (No. %)**	**Medium (No. %)**	**High (No. %)**	**P-value**
Poor	7 (11.7%)	42 (70.0%)	11 (18.3%)	0.9
Fair	25 (11.0%)	168 (73.7%)	35 (15.4%)	
Good	6 (10.3%)	44 (75.9%)	8 (13.8%)	
Marital state	**Low (No. %)**	**Medium (No. %)**	**High (No. %)**	**P-value**
Single	10 (11.2%)	68 (76.4%)	11 (12.4%)	0.6
Married	28 (10.9%)	186 (72.4%)	43 (16.7%)	
M.C.	**Low (No. %)**	**Medium (No. %)**	**High (No. %)**	**P-value**
No have	7 (6.0%)	87 (75.0%)	22 (19.0%)	**0.05**
Have	31 (13.5%)	167 (72.6%)	32 (13.9%)	
Physical activity	**Low (No. %)**	**Medium (No. %)**	**High (No. %)**	**P-value**
Sedentary	5 (10.6%)	32 (68.1%)	10 (21.3%)	0.5
Active	33 (11.0%)	222 (74.2%)	44 (14.7%)	
Age groups	**Low (No. %)**	**Medium (No. %)**	**High (No. %)**	**P-value**
20-29	7 (14.3%)	34 (69.4%)	8 (16.3%)	**0.05**
30-39	19 (17.8%)	74 (69.2%)	14 (13.1%)	
40-49	6 (5.0%)	95 (79.2%)	19 (15.8%)	
50	6 (8.6%)	51 (72.9%)	13 (18.6%)	

Discussion

The present study investigated weight change and its association with dietary index and demographic factors in women undergoing hormonal therapy for breast cancer. The findings demonstrated a statistically significant increase in both weight and BMI after 16 weeks of treatment, despite the changes appearing modest in absolute terms. This suggests that hormonal therapy exerts a measurable effect on metabolic regulation and body composition, consistent with reports highlighting weight gain as a common side effect of adjuvant endocrine therapy. At baseline, patients with low dietary index had the highest mean weight and BMI compared to medium and high dietary index groups. This confirms that poor dietary quality is closely linked with obesity markers and may predispose patients to metabolic complications even before initiation of hormonal therapy. However, after treatment, differences between dietary groups were no longer statistically significant, indicating that hormonal therapy itself overshadowed the influence of dietary quality. This finding aligns with observations by Raghavendra *et al*., who showed that weight gain during endocrine therapy occurred regardless of lifestyle and was significantly associated with recurrence risk in long-term survivors [11]. The observed increase in body weight and BMI is clinically important, as prior studies have linked weight gain during breast cancer treatment to worse prognosis, higher recurrence rates, and increased mortality. Playdon *et al*. conducted a meta-analysis and concluded that post-diagnosis weight gain was associated with all-cause mortality and poorer survival [12]. Similarly, Makari-Judson *et al*. emphasized that mechanisms underlying this gain include estrogen deprivation, reduced metabolic rate, and increased adiposity, particularly central fat deposition [13]. These biological mechanisms correspond with the results in our cohort, where weight gain was uniform across dietary categories after therapy. Demographic factors such as age, education, marital status, and economic level did not show significant associations with dietary index distribution, except for borderline significance with menstrual cycle status and age. Younger women were more likely to report low dietary index, while older groups leaned toward medium index. This may reflect improved health awareness or lifestyle modifications with age. Comparable findings were reported by Busund *et al*., who observed BMI trajectories over adulthood and their relation to postmenopausal breast cancer risk, noting that younger women often experience less stable weight regulation compared to older women [14].

Our results also resonate with international trials evaluating endocrine therapy. The IBIS-II DCIS trial comparing anastrozole and tamoxifen in postmenopausal women reported that both agents were associated with metabolic and musculoskeletal side effects, including weight-related changes, though not always differing significantly between treatment arms [15]. Similarly, Boszkiewicz K *et al*. demonstrated that both tamoxifen and anastrozole led to measurable weight changes, supporting the notion that endocrine manipulation directly contributes to body composition alterations [16]. The lack of significant correlation between physical activity and dietary index with weight outcomes after therapy further emphasizes the metabolic dominance of hormonal treatment. Although lifestyle interventions are important, the biological effects of estrogen suppression may be the overriding determinant of weight change. This highlights the importance of incorporating structured weight management and nutritional counseling into survivorship care plans.

Conclusion

This study confirms that hormonal therapy for breast cancer contributes to significant weight and BMI increases within a relatively short treatment period, independent of baseline

dietary or demographic characteristics. Similar studies worldwide corroborate these results, underscoring the need for preventive strategies to mitigate therapy-induced weight gain and its long-term oncologic and metabolic consequences.

Conflict of Interest
Not available

Financial Support
Not available

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