

## Metabolic Syndrome, Breast Cancer and Exercise

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### Abstract

Risk of breast cancer and recurrence is increased by Metabolic syndrome. Metabolic syndrome can get improved in patients with breast cancer by regular exercise or physical activity.

**Keywords:** Lipid profile; Hypertension; Insulin resistance; Insulin like growth factors; Metabolic syndrome

### Introduction

Breast cancer has recently been the most common cancer among women [1] and age-related incidence rates are increasing in most countries [2]. Also, breast cancer is the second most common cause of cancer-related deaths [1]. Breast cancer risk increases in women right after the menopause [3]. Breast carcinoma is composed of a dissimilar group of tumors with variable prognosis [4]. Age, family history of cancer, reproductive and menstrual history, overweight and obesity, lack of physical activity and consumption of alcohol are known as the risk factors for breast cancer [5]. Obesity, as an instance, elevates the risk of breast cancer in postmenopausal women. There is a relationship between body mass index (BMI) as a measure of obesity and breast cancer [6] and also BMI has been correlated with risk of recurrence, and mortality in breast cancer survivors [7]. Some evidence has been reported to prove the association of BMI with breast cancer in postmenopausal women. First, the estrogens levels in adipose tissue are usually high in obese postmenopausal women. Second, obesity, associated with metabolic syndrome, is related to increased insulin and insulin-like growth factor (IGF) levels acting as mitogens [8]. Furthermore, obese postmenopausal women have higher concentration of estrogens that heighten the bioavailability fraction of estradiol by reducing sex hormone binding globulin (SHBG) [9]. Emami et al. founded that declined SHBG can augment breast cancer risk as well as its recurrences in postmenopausal women survivors [10]. Simply put, a positive relationship exists between BMI and IGFs. IGFs can raise the risk of breast cancer in postmenopausal [11]. In fact, metabolic syndrome is characterized by a group of biological abnormalities and related clinical conditions such as disturbed glucose and insulin metabolism resulting in hyperglycemia and hyperinsulinemia, dyslipidemia, hypertriglyceridemia and low levels of high-density lipoprotein cholesterol (HDL-C), and hypertension [12]. Although metabolic syndrome meets different definitions, the most frequent definition goes to "enhancing waist circumference (WC), dyslipidemia (high triglycerides and low HDLC), hypertension, and impaired fasting glucose in their criteria for diagnosis of 1) fasting glucose levels of 110 mg/dl or more 2) high density lipoprotein cholesterol (HDL-C) levels less than 50 mg/dl for women and 40 mg/dl for men; 3) triglyceride (TG) levels of 150 mg/dl or more; 4) WC greater than 88 cm for women and 102 cm for men; and 5) blood pressure (BP) of 130/85 mmHg or higher; [13]. Elements of the

metabolic syndrome and risk of breast cancer or recurrence seem to have a relationship as well. For example, insulin resistance is natural in obese individuals and is said to be a crucial factor in the pathogenesis of the metabolic syndrome. Another element i.e. Hyperinsulinemia has been linked with BMI, risk of recurrence, and mortality in breast cancer survivors [7]. On the other hand, Hyperinsulinemia results in decreased concentrations of SHBG which in turn can increase risk of breast cancer and recurrence [14]. Furthermore, dyslipidemia, as one of the components of metabolic syndrome, can raise breast cancer risk. It is observed that Cholesterol and low density lipoprotein (LDL) levels have positive relationship with breast cancer [15]. Also, an inverse association was reported between HDLC level and risk of breast cancer [16,17]. Metabolic syndrome might not only raise the risk of breast cancer but also is associated with increased breast cancer recurrence [18]. However, Bjørge et al. demonstrated that the metabolic syndrome have link with a decreased risk of incident breast cancer in women below age 50 with high BMI, and with an increased risk of breast cancer mortality in women above 60 years old [19]. In general, metabolic syndrome can cause an increasing breast cancer risk in postmenopausal women. It is lately recommended that people with metabolic syndrome be targeted for lifestyle changes, which consist of increased physical activity and modified diet [20,21]. It seems that increased levels of physical activity or exercise can improve metabolic syndrome.

A reduced risk of breast cancer and recurrence emerges from physical activity and exercise. There are several mechanisms for exercise or physical activity effects on reduced breast cancer risk and recurrence caused by changes in metabolic and inflammatory biomarkers [22]. Chilibeck reported that 6-month aerobic exercise can reduce metabolic syndrome risk in breast cancer survivors [23]. Bao et al. reported that regular and constant exercise after cancer diagnosis, even at low-to-moderate intensity level, drops the metabolic syndrome among long-term breast cancer survivors. It's been suggested that the exercise beneficial on metabolic syndrome is expected to be mediated by losing weight and reduced central adiposity [24]. Thomas found that sustained aerobic exercise yields health benefits relevant to metabolic health in women with breast cancer [25]. It seems that their exercise protocol was less than the American College of Sport Medicine with the recommendation of 220 minutes of exercise per week indicating the fact that higher amount of exercise does not necessarily produce additional benefits [26]. Also, Dieli-Conwright reported that 16-weeks supervised resistance and aerobic exercise intervention attenuated metabolic syndrome in overweight and obese

breast cancer patients [27]. On the other hand, Nuri et al. reported that combination of aerobic and resistance training for 15 weeks can improve metabolic syndrome in women with breast cancer [28]. Previously, it has been documented that exercise can improve body weight, BMI, WC, HDL-C, LDL, VLDL and TG [29], insulin levels and insulin resistance, IGF-s and bindings proteins in breast cancer survivors [10,11]. Some studies indicated that there is inverse relationship between physical activity or exercise, BMI and WC [30]. Also, there is positive relationship between BMI and insulin levels [31] i.e. decrease of BMI seems to be related to reduced insulin and insulin resistance after exercise training. Mechanism for lipid profile improvements is to be defined as the cholesterol metabolism resulted from increasing cholesterol absorption that can be caused by exercise. Also, there is inverse relationship between body weight and HDLC and direct correlation between body weight and LDL, VLDL and TG. Regular exercise can reduce body weight resulting in reduced LDL, VLDL and TG and increased HDLC. On the other hand, during exercise there was cholesterol transportation from peripheral tissue to the liver for degradation [28]. Moreover, there is a relationship between aerobic capacity and increased HDLC and decreased TG. It has been documented that exercise training can improve aerobic capacity in women with breast cancer [32,33]. On the other hand, Rahnama et al. demonstrated that likewise other components of metabolic syndrome in breast cancer patients, exercise training have positive effect on systolic blood pressure [33].

## Conclusion

In conclusion, changes in components of metabolic syndrome via regular exercise or physical activity can reduce breast cancer risk or recurrence.

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