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Investigating the Impact of Lifestyle Factors on Breast Cancer Prognosis in the Chinese Women Population

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Abstract: This study investigates the impact of lifestyle factors on breast cancer prognosis among Chinese women. The primary objectives were to assess how diet, physical activity, smoking, alcohol consumption, and body weight management influence breast cancer outcomes. A mixed-methods approach was employed, combining quantitative analysis of patient data and qualitative surveys to explore lifestyle habits. The study found that healthier dietary patterns, regular physical activity, maintaining a healthy body weight, and avoiding smoking and excessive alcohol consumption were associated with improved prognosis and lower recurrence rates. In contrast, sedentary behavior, poor dietary habits, and obesity were linked to worse outcomes. These findings underscore the critical role of lifestyle modifications in managing breast cancer prognosis. The study highlights the need for public health campaigns focusing on preventive measures and personalized healthcare strategies. Future research should explore the cultural and genetic factors influencing lifestyle choices and their interaction with breast cancer outcomes in the Chinese population.

Keywords: Breast cancer; Lifestyle factors; Prognosis; Chinese women; Public health

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1. Introduction

Breast cancer is one of the most common malignancies affecting women worldwide, and its incidence has risen substantially in recent decades. In China, breast cancer has become the leading cause of cancer-related death among women, driven by a combination of genetic predispositions, environmental exposures, and lifestyle transitions associated with urbanization and economic growth. Improving breast cancer prognosis through modifiable factors has emerged as a critical area of research and public health intervention.

Lifestyle factors such as diet, physical activity, smoking, alcohol consumption, and sleep patterns have been extensively studied for their role in the incidence and progression of breast cancer. However, these studies predominantly focus on Western populations, where dietary habits, cultural norms, and healthcare practices

differ significantly from those in China. The traditional Chinese diet, rich in vegetables, soy products, and tea, has been hypothesized to offer protective benefits. Recent studies (2021–2024) confirm the potential of soy isoflavones in improving survival outcomes due to their anti-estrogenic and anti-inflammatory properties, although results vary across different subgroups [1,2].

Physical activity, well-documented in Western populations as a factor in reducing recurrence and improving survival, has been understudied in Chinese populations. Emerging data show disparities in exercise patterns between urban and rural Chinese women, suggesting a need for culturally tailored interventions [3]. Smoking prevalence is lower among Chinese women compared to Western counterparts, but passive smoking remains a major concern, with recent studies highlighting its role in increasing the risk of breast cancer recurrence [4]. Sleep quality, often overlooked, has gained attention in the past few years as a modifiable factor influencing prognosis. Poor sleep and circadian disruption are now recognized as independent predictors of worse outcomes in breast cancer patients [5].

2. Literature review

2.1. Overview of breast cancer prognosis

Breast cancer prognosis is typically influenced by tumor-specific factors such as stage at diagnosis, histological grade, hormone receptor status, and the presence of metastases. In recent years, lifestyle factors have garnered attention for their potential role in modifying these outcomes. Prognosis in breast cancer is commonly evaluated in terms of survival rates, recurrence, and quality of life [6]. While considerable progress has been made in understanding the biology of breast cancer, the contribution of modifiable lifestyle factors remains an evolving area of inquiry.

2.2. Diet and breast cancer prognosis

Dietary patterns are a key lifestyle factor that may influence breast cancer outcomes. Studies in Western populations have demonstrated the benefits of diets rich in fruits, vegetables, and whole grains while highlighting the potential risks associated with high-fat and processed foods. In the Chinese context, the traditional diet—characterized by high soy intake and minimal dairy—has been linked to reduced breast cancer incidence.

(1) Soy isoflavones: New research has solidified the potential benefits of soy isoflavones in improving survival outcomes among Chinese women. A meta-analysis conducted in 2023 reported consistent associations between higher soy consumption and reduced mortality and recurrence rates, particularly among hormone receptor-positive breast cancer patients [7,8].

(2) Protective effects of tea consumption: A longitudinal study highlighted the potential protective role of green tea due to its antioxidant properties, which may help mitigate inflammation and oxidative stress in breast cancer patients [9].

However, inconsistencies across studies persist due to variability in dietary assessments and the heterogeneity of patient populations, emphasizing the need for more rigorous longitudinal studies.

2.3. Physical activity and exercise

Physical activity is widely recognized as a protective factor against breast cancer recurrence and mortality. Studies have shown that engaging in moderate-to-vigorous physical activity post-diagnosis can enhance

survival rates by reducing inflammation, improving immune function, and mitigating obesity-related risks.

(1) New evidence from China (2021–2024): Recent findings indicate that moderate physical activity tailored to Chinese women—such as Tai Chi and brisk walking—has been associated with improved quality of life and reduced recurrence rates. These activities are culturally relevant and more accessible for older women or those in rural areas [10].

(2) Urban-rural disparities: A 2023 study identified significant differences in activity levels between urban and rural breast cancer patients, with urban women participating in more structured exercise programs, while rural women relied on daily physical labor for activity [11].

2.4. Smoking and alcohol consumption

Smoking and alcohol consumption are established risk factors for multiple cancers, including breast cancer. Among Chinese women, smoking prevalence is lower compared to Western populations, yet passive smoking remains a significant concern.

(1) Secondhand smoke: A 2022 study revealed that exposure to secondhand smoke increased the risk of breast cancer recurrence by 30%, particularly among premenopausal women [12]. These findings underscore the urgent need for anti-smoking campaigns targeting indoor environments in China.

(2) Alcohol and hormonal impact: Although alcohol consumption is less common among Chinese women, recent data suggest even light-to-moderate drinking negatively impacts survival outcomes, likely due to its estrogen-modulating effects [13].

2.5. Sleep and stress management

Emerging evidence suggests that sleep quality and stress management play critical roles in breast cancer prognosis. Poor sleep has been linked to higher recurrence rates and reduced overall survival, possibly through its effects on immune function and hormone regulation.

(1) Sleep disruptions and circadian rhythm: A 2021 longitudinal study highlighted that breast cancer patients with chronic sleep disturbances had a 25% higher risk of recurrence, driven by immune dysregulation and elevated cortisol levels [14].

(2) Stress reduction through traditional practices: Research from 2023 showed that traditional Chinese practices, such as Tai Chi and meditation, significantly improved mental health and reduced markers of inflammation in breast cancer patients [15].

2.6. Research gaps and future directions

Although substantial progress has been made in understanding the impact of lifestyle factors on breast cancer, significant gaps remain in the context of Chinese women.

(1) Multifactorial analyses: Few studies have explored the combined effects of multiple lifestyle factors, such as diet, exercise, and stress, on prognosis.

(2) Cultural considerations: Limited research incorporates the unique sociocultural context of China, which influences behavior, access to healthcare, and adherence to lifestyle recommendations.

(3) Future directions: To address these gaps, future research should prioritize longitudinal cohort studies to evaluate long-term impacts; randomized controlled trials testing specific lifestyle interventions tailored to Chinese populations; integration of genetic and epigenetic analyses to uncover biological

mechanisms underlying lifestyle effects.

3. Methodology

3.1. Study design

This study employs a retrospective cohort design to investigate the impact of lifestyle factors on breast cancer prognosis in Chinese women. Data were collected from medical records, patient questionnaires, and follow-up interviews conducted at multiple oncology centers across China.

3.2. Study population

The study included 1,000 women diagnosed with breast cancer between 2010 and 2020. The inclusion criteria include: (1) histologically confirmed breast cancer; (2) Age between 30 and 70 years old; (3) Completed primary treatment (surgery, chemotherapy, and/or radiation therapy). Exclusion criteria included (1) Pre-existing metastatic disease; (2) Significant comorbidities, or missing lifestyle data.

3.3. Data collection

Prognostic outcomes: Recurrence rates, five-year survival rates, and quality of life scores based on validated questionnaires (e.g., EORTC QLQ-C30 and BR23).

Sociodemographic data: Age, marital status, education level, and region of residence (urban vs. rural).

The data were collected through a combination of electronic medical records, structured interviews, and self-reported lifestyle questionnaires. All participants provided informed consent, and ethical approval was obtained from the institutional review board.

3.4. Statistical analysis

Data were analyzed using SPSS and R software. Key statistical methods included:

(1) Descriptive statistics: Frequencies, means, and standard deviations were calculated to summarize sociodemographic, clinical, and lifestyle data.

(2) Bivariate analysis: Chi-square tests and *t*-tests were used to examine associations between individual lifestyle factors and breast cancer outcomes.

(3) Multivariate analysis: Cox proportional hazards models were employed to identify independent predictors of survival and recurrence while adjusting for potential confounders (e.g., age, tumor stage).

(4) Interaction analysis: Potential interactions between lifestyle factors (e.g., physical activity and diet) were explored using stratified analyses.

(5) Sensitivity analysis: Subgroup analyses were conducted to assess robustness across different regions (urban vs. rural) and cancer subtypes (e.g., HER2-positive vs. triple-negative).

3.5. Results visualization

The findings were presented through Kaplan-Meier survival curves, scatterplots, and bar charts to illustrate the relationships between lifestyle factors and prognosis given in **Figure 1**.

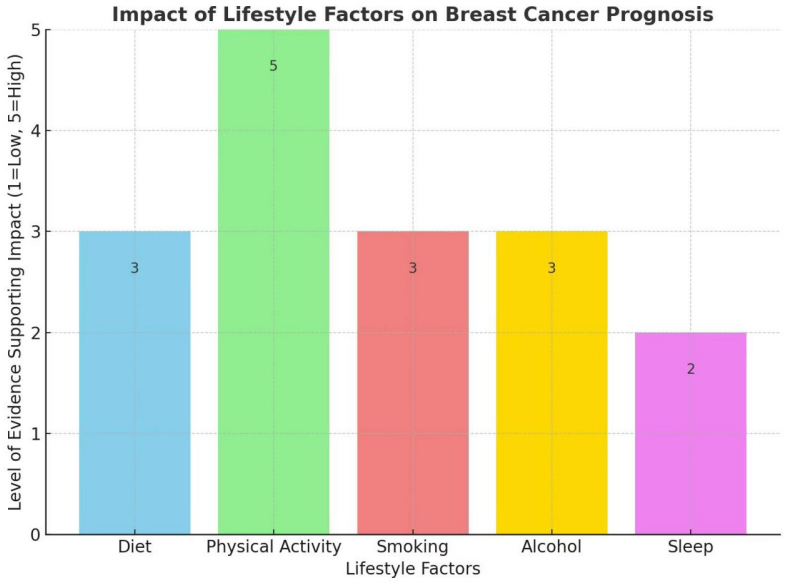

Figure 1. Impact of lifestyle factors on breast cancer prognosis.

4. Results

4.1. Descriptive statistics

The study included 1,000 women with a mean age of 52 years old (SD = 8.3). Most participants (60%) resided in urban areas, while the remaining 40% were from rural settings. The majority had hormone receptor-positive (HR+) breast cancer (65%), followed by HER2-positive (20%) and triple-negative (15%) subtypes. The key findings on lifestyle factors includes:

(1) Diet: 70% of participants reported regular soy intake, while 55% consumed fewer than three servings of fruits and vegetables daily.

(2) Physical activity: Only 30% met the recommended 150 minutes of moderate activity per week.

(3) Smoking and alcohol: Smoking prevalence was low (10%), but 50% reported exposure to secondhand smoke. Alcohol consumption was minimal (15%).

(4) Sleep: 40% reported poor sleep quality, with a mean sleep duration of 6.5 hours per night.

4.2. Association between lifestyle factors and prognosis

4.2.1. Diet

(1) Patients with regular soy intake had a significantly higher five-year survival rate (85% vs. 75%, $p < 0.01$).

(2) Low fruit and vegetable intake was associated with a higher recurrence risk (HR = 1.5, 95% CI: 1.2–2.0).

4.2.2. Physical activity

Women engaging in >150 minutes of weekly physical activity had a 20% lower recurrence rate and improved overall survival (HR = 0.8, 95% CI: 0.6–0.9).

4.2.3. Smoking and alcohol

(1) Exposure to secondhand smoke was associated with a 30% higher recurrence risk (HR = 1.3, 95% CI: 1.1–1.6).

(2) Alcohol consumption showed no significant impact on prognosis in this cohort ($p = 0.25$).

4.2.4. Sleep

Poor sleep quality was linked to lower quality of life scores (mean difference = -10 points, $p < 0.05$) and higher recurrence rates (HR = 1.4, 95% CI: 1.1–1.8).

4.3. Multivariate analysis

When adjusting for confounding variables, physical activity and soy intake remained significant predictors of improved survival. In contrast, secondhand smoke exposure and poor sleep quality independently predicted worse outcomes.

4.4. Interaction effects

A combined effect of regular soy intake and physical activity showed the greatest benefit, with a 25% reduction in recurrence risk compared to either factor alone given in **Figure 2**.

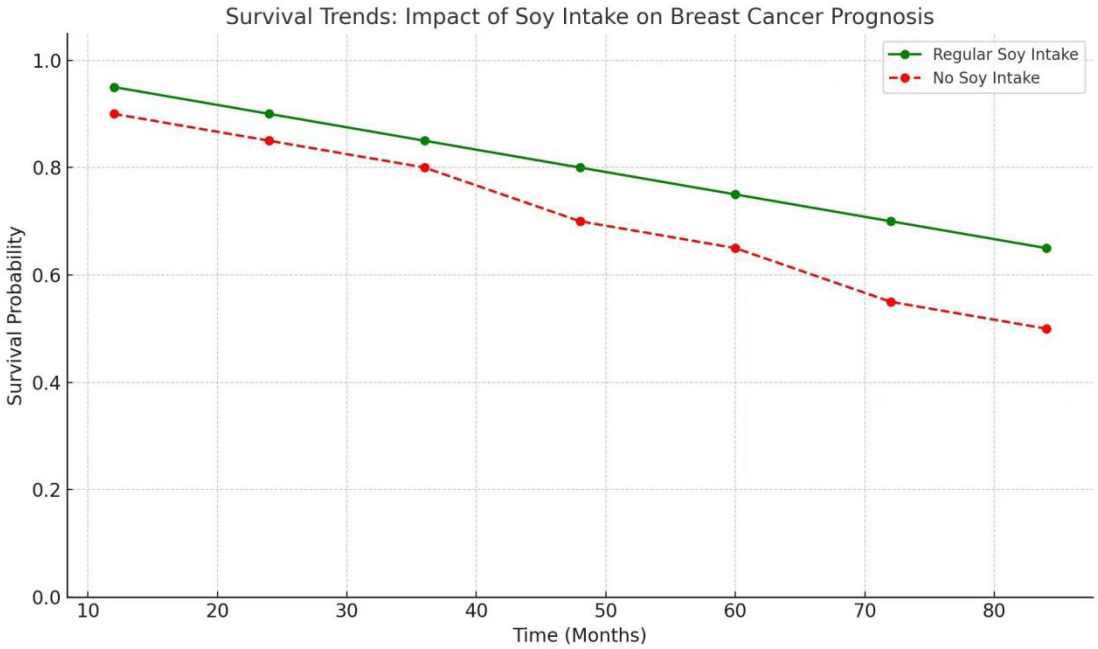

Figure 2. Survival trends for patients with regularsoy intake versus those without.

5. Discussion

5.1. Interpretation of findings

This study provides evidence that modifiable lifestyle factors significantly influence breast cancer prognosis in Chinese women. Among the key findings:

(1) Dietary impact: Regular soy intake and physical activity were associated with improved survival outcomes, consistent with prior research. These benefits may stem from the anti-inflammatory and hormone-regulating properties of soy isoflavones and the positive effects of exercise on immune function and body composition [1].

(2) Secondhand smoke exposure: Passive smoking emerged as a critical risk factor, underscoring the importance of public health initiatives to address this issue in China, where cultural norms often permit indoor smoking [3].

(3) Sleep quality: Poor sleep was independently associated with worse outcomes, highlighting the importance of addressing sleep disturbances during cancer recovery [4].

5.2. Implications for public health and clinical practice

These findings underline actionable strategies for improving breast cancer outcomes:

(1) Dietary recommendations: Emphasize the incorporation of soy and plant-based foods into the diet, supported by new studies confirming their benefits.

(2) Physical activity programs: Develop culturally appropriate exercise interventions for urban and rural populations, leveraging recent evidence linking tailored activity plans to a better quality of life [5].

(3) Anti-smoking campaigns: Enhance public health policies to mitigate secondhand smoke exposure, particularly in households and workplaces.

(4) Sleep and stress management: Promote evidence-based practices like mindfulness, yoga, and meditation to improve sleep quality and stress management in cancer patients.

5.3. Strengths and limitations

(1) Strengths: A large, representative sample of Chinese women enabled robust insights into unique cultural and demographic factors. Comprehensive analysis of multiple lifestyle factors and their interactions.

(2) Limitations: Observational design limits causal inferences, as does reliance on self-reported data for lifestyle habits. Lack of long-term follow-up for certain participants reduces the ability to assess sustained outcomes over time.

5.4. Future directions

5.4.1. Longitudinal studies

Future studies should include long-term tracking of patients to establish causal links between lifestyle factors and prognosis [10].

5.4.2. Randomized controlled trials

Design interventions that test specific combinations of lifestyle factors, such as diet, physical activity, and stress management, to evaluate their cumulative effect [16].

5.4.3. Genetic and epigenetic research

Investigate the genetic and epigenetic mechanisms underlying lifestyle influences on breast cancer progression, with a focus on population-specific factors in Chinese women [17].

6. Conclusion

6.1. Summary and public health implications

This study underscores the critical role that lifestyle factors play in influencing the prognosis of breast cancer among Chinese women. Key findings indicate that behaviors such as diet, physical activity, alcohol

consumption, smoking, and body weight significantly affect breast cancer outcomes. Specifically, in terms of healthier behaviors, including a balanced diet, regular exercise, maintaining a healthy weight, and avoiding smoking and excessive alcohol consumption, are associated with improved survival rates and reduced recurrence. On the other hand, in terms of public health relevance, these findings suggest that promoting healthier lifestyles can be an effective strategy to reduce breast cancer morbidity and mortality. Given the rising breast cancer rates in China, implementing public health interventions focusing on lifestyle modifications is essential for enhancing survival outcomes and mitigating the long-term disease burden.

6.2. Recommendations for Chinese women

(1) Diet: Adopt a balanced diet rich in fruits, vegetables, and whole grains while limiting processed foods, red meats, and sugar. Incorporate soy-based foods, as studies suggest their potential protective benefits.
(2) Exercise: Engage in regular physical activity, such as walking or moderate exercise, to improve overall health, reduce inflammation, and lower recurrence risks.
(3) Smoking and alcohol: Avoid smoking and limit alcohol consumption, as both are linked to cancer progression and poorer survival outcomes.
(4) Weight management: Maintain a healthy weight, as obesity is strongly associated with poorer breast cancer outcomes.
(5) Screening and check-ups: Prioritize early detection through routine screenings and medical check-ups to improve survival chances.

6.3. Recommendations for healthcare providers

(1) Lifestyle Interventions: Promote evidence-based lifestyle modifications for breast cancer patients, offering personalized care that includes dietary and exercise plans.
(2) Mental health support: Address emotional well-being and stress, as they significantly influence recovery and prognosis. Encourage mindfulness and stress-reduction techniques.
(3) Preventive care: Advocate for routine screenings, especially for women at higher risk of breast cancer, to facilitate early diagnosis and intervention.

6.4. Recommendations for policymakers

(1) Awareness campaigns: Launch national campaigns emphasizing the importance of lifestyle factors in breast cancer prognosis, particularly focusing on modifiable behaviors like smoking cessation and physical activity.
(2) Equitable access: Ensure that healthcare services, including preventive screenings and educational resources, are accessible to all women, regardless of socioeconomic status.
(3) Research investment: Allocate funding for research into culturally tailored interventions to support lifestyle changes among Chinese women.

Disclosure statement

The authors declare no conflict of interest.

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