



# Research Progress of Anti-breast Cancer Peptides

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## Abstract

Breast cancer is a malignant tumor that occurs in the epithelial tissue of the breast, mostly in female. At present, drug resistance has emerged in the treatment of breast cancer. Therefore, the discovery of new drugs for breast cancer is particularly important. Some peptides have been found to have anti-cancer effects. This article reviews the recent discoveries of anti-breast cancer peptides, hoping to provide some help for the development of breast cancer treatment.

**Keywords:** *research, breast cancer, peptides, female.*

## 1. Introduction

In 2014, about 3.80 million new cancers were diagnosed in China, of which 2.11 million were males and 1.69 million were females, including 0.28 million female breast cancers<sup>[1]</sup>. The estimated new cases of breast cancers in American was 0.27 million, which ranked first in females<sup>[2]</sup>. Beverage alcohol, ionizing radiation and exogenous estrogens are 3 known cause of breast cancer<sup>[3]</sup>. The high incidence of breast cancer in females demonstrates the importance of improving the treatment of breast cancer.

Treatment of breast cancer includes surgery, endocrine therapy, chemotherapy, radiotherapy and molecular targeted therapy. Chemotherapy has become an active treatment for all stages of breast cancer. Most breast cancer is a systemic disease at the time of diagnosis. Systemic chemotherapy can eradicate residual tumor cells in the body, thereby improving the cure rate of surgery. Drug resistance emerged during chemotherapy<sup>[4-5]</sup>. Therefore, the development of new anticancer drugs is of great value for the treatment of breast cancer.

Peptides exhibit many pharmacological activities, such as antimicrobial activity<sup>[6]</sup>, antihypertensive activity<sup>[7]</sup>, antiviral activity<sup>[8]</sup>, and anticancer activity<sup>[9]</sup>. At present, there is no report on the progress of anti-breast cancer peptide. This article will focus on the recent development of anti-breast cancer peptides.

## 2. Peptides with anti-breast cancer activities

Jie Lu and coworkers found a novel glycine-rich antimicrobial peptide, SK-84, had specific inhibitory effects on the proliferation of the MCF-7 cells (IC<sub>50</sub> = 50 μM) in a dose-dependent manner<sup>[10]</sup>.

The weights of two antiproliferative peptides isolated from Protease XXIII (PR) and papain (PA) hydrolysates of tuna dark muscle byproduct were 1124 Da and 1206 Da, and they showed inhibitory effect of the MCF-7 cells in dose-dependent manner, with IC<sub>50</sub> values of 8.8 and 8.1 μM, respectively<sup>[11]</sup>.

Eun-Kyung Kima and coworkers obtained the purified anticancer peptide with the weight of about 1950 kd from *Ruditapes philippinarum*. The amino acid sequence of this peptide was Ala-Val-Leu-Val-Asp-Lys-Gln-Cys-Pro-Asp. Moreover, the cytotoxicity activity of the peptide was investigated, and the LC<sub>50</sub> value was 1.58 mg/ml on MDA-MB-231 cells<sup>[12]</sup>.

Xiaodan Fan and coworkers identified one new peptide VPGTPKNLDSR from the *Porphyra haitanesis* hydrolysate, which displayed good inhibitory effect on MCF-7 cells, with the IC<sub>50</sub> value of 200.97 μg/mL<sup>[13]</sup>.

Che Wang and coworkers found L-K6, a lysine/leucine-rich cationic antimicrobial peptide, displayed anticancer activity both *in vitro* and *in vivo*. Furthermore, it preferentially to kill cancer cells with much lower toxicity to normal cells by nucleus-targeting mechanism. Specifically, L-K6 partially identifies the surface of cancer cells through PS-related mechanisms and passes through the MCF-7 cell membrane through a clathrin-independent macropinocytosis. Ultimately, L-K6 causes cancer cell death through DNA damage and nuclear targeting without obvious destruction of cell membrane, cytoskeleton and mitochondria<sup>[14]</sup>.

Peptide LLPSY, isolated from olive seeds, was found to have a strong anti-proliferative effect dose-dependent manner in MDA-MB-468 cancer cells after 24 h with the IC<sub>50</sub> value of 97.6 μg/mL<sup>[15]</sup>.

AFPep, a 9-amino acid cyclic peptide, was found to inhibit the growth of human MCF-7 breast cancer xenografts without affecting the liver growth<sup>[16]</sup>.

Yun-Jeong Jeong and coworkers found that melittin, a small protein with 26 amino acid residues, could inhibit EGF-induced tumor invasion via suppressing FAK phosphorylation and MMP-9 expression in breast cancer cells<sup>[17]</sup>.

### 3. Conclusion

The high incidence of breast cancer has increased the burden of young mothers. Family problems caused by breast cancer have more or less harmful effects on children's growth. Therefore, it is necessary to strengthen the prevention of breast cancer. Many studies on the prevention of breast cancer have been studied<sup>[18-19]</sup>.

To sum up, only a few anti-breast cancer peptides have appeared at present. More peptides with anti-breast cancer activity need to be found, so as to provide more options for the treatment of breast cancer. At present, there are two ways to increase anti-breast cancer peptide: 1) through screening natural product peptides, new anti-breast cancer peptide can be obtained; 2) structural modification of the discovered anti-cancer peptide, and then further screen its anti-breast cancer activity.

With the discovery of more pharmaceutical-active peptides, more anti-breast cancer peptides will also be found.

### Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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