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The crosstalk between miRNAs and the PI3K/AKT signaling pathway in breast cancer

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Introduction:

Breast cancer is one of the most frequently diagnosed tumors

Second highest rate of mortality in women worldwide

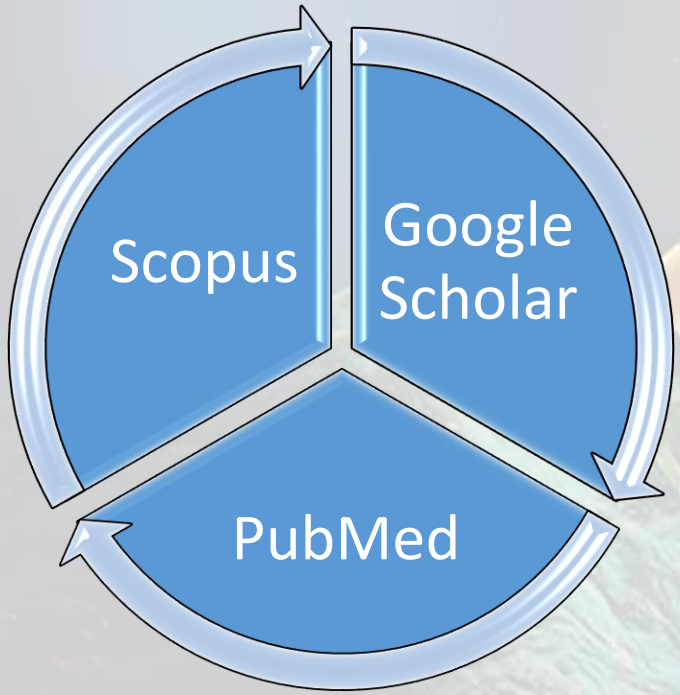
Breast cancer tumorigenesis is a complicated process involving the upregulation of oncogenes or downregulation of tumor suppressor genes

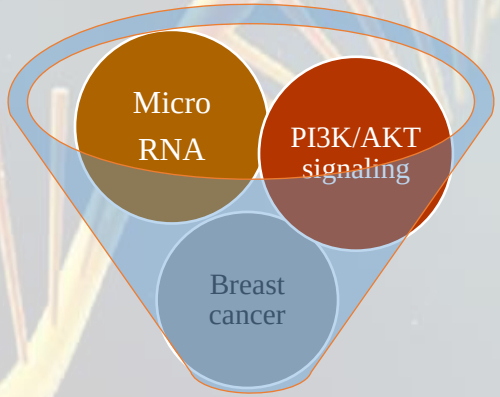
Some MicroRNAs (miRNAs) as oncogenic factors are upregulated and promote tumor growth and metastasis by inducing the oncogenic signalings such as PI3K/Akt, Ras/Raf/Mek/Erk, and Wnt/β-catenin pathways.

Regulatory miRNAs are involved in PI3K/AKT signaling in breast cancer pathogenesis.

Material & Method

Narrative Review





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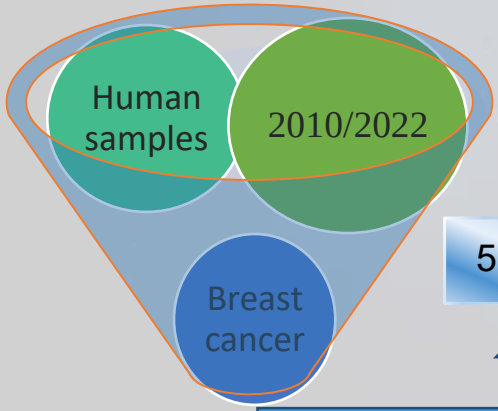

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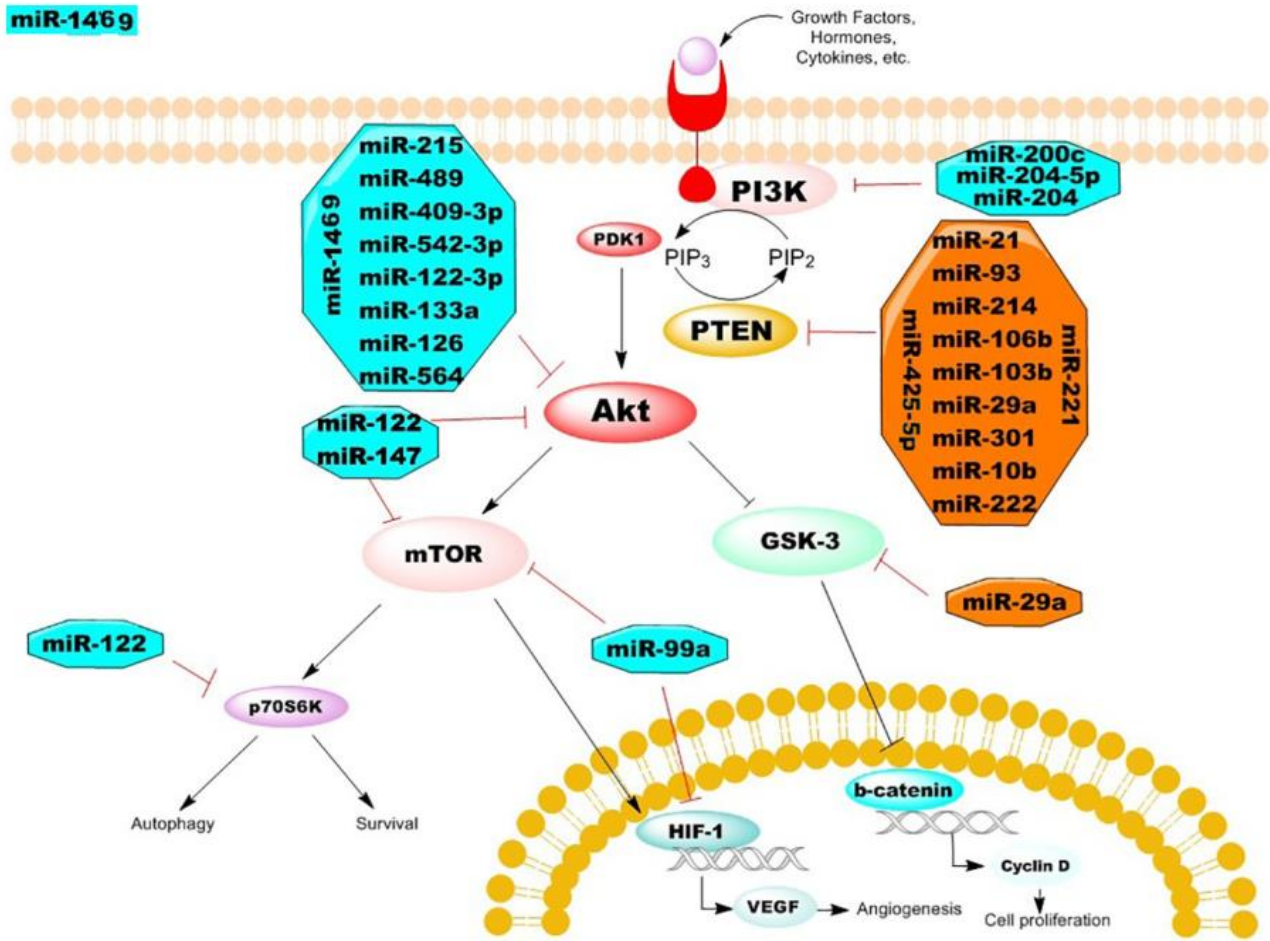
Results

miRNAs can affect many important cellular processes including cell proliferation, apoptosis, invasion, and metastasis by regulating the expression of their related mRNAs. It has been shown that the oncogenic or tumor suppressive effects of miRNAs on breast cancer tumorigenesis may be mediated by regulating the activity of PI3K/Akt signaling pathway.

microRNA	Target	Molecular alteration	Function	Reference
miR-99a	mTOR/ HIF1-α	Downregulation	Induces cellular apoptosis	(Hu et al., 2014)
miR-122	AKT/ mTOR/ p70s6k	Downregulation	Cell cycle arrest at G1 phase	(Wang et al., 2012)
miR-122-3p	PTEN, AKT, Vimentin and E-cadherin	Downregulation	Cellular apoptosis	(Zhang, 2017)
miR-147	AKT/ mTOR	Downregulation	Inhibiting cell proliferation and metastasis	(Zhang, 2016)
miR-200c	K-Ras/ PI3K/ AKT	Downregulation	Inhibiting EMT and metastasis	(Song, 2015)
miR-1469	PI3K/ AKT	Downregulation	Induces cell cycle arrest and cellular apoptosis	(Zhang et al., 2019)
miR-204		Downregulation		(Fan, 2019)
miR-204-5p	PIK3CB	Downregulation	Inhibiting cell growth and metastasis	(Hong, 2017)
miR-409-3p	AKT1	Downregulation	Inhibiting tumor cell proliferation, migration and invasion	(Zhang et al., 2016)
miR-215	AKT1	Downregulation	Inhibiting cell proliferation and metastasis	(Yao, 2017)
miR-489	PI3K/AKT	Downregulation	Inhibiting cell proliferation	(Chen, 2016)
miR-542-3p	PI3K/AKT	Downregulation	Inhibiting tumor cell growth	(Ma et al., 2015)
miR-133a	EGFR/ AKT	Downregulation	induces cell cycle arrest in G2/S phase	(Cui, 2013)
miR-126	VEGFA /PI3K/ AKT	Downregulation	inhibits tumor progression and angiogenesis	(Zhu, 2011)
miR-564	AKT2, SRF, GNA12 and GYS1	Downregulation	blocks EMT and metastasis	(Mutlu, 2016)
miR-21	PTEN	Upregulation	Inhibits autophagic cell death	(Fang, 2017)
miR-425-5p	PTEN	Upregulation	Inducing tumor cell proliferation, migration and invasion	(Zhang, 2019)
miR-93	PTEN	Upregulation		(Li, 2017)
miR-106b	PTEN	Upregulation		(Li, 2017)
miR-301	PTEN	Upregulation		(Shi, 2011)
miR-214	PTEN	Upregulation	Tumor metastasis	(Wang, 2016)
miR-19b	PI3K/AKT	Upregulation	Cell proliferation and invasion	(Li, 2018)
miR-10b	PTEN	Upregulation	cell survival and metastasis	(Bahena-Ocampo, 2016)
miR-29a	PTEN/ GSK3β	Upregulation	Tumor cell growth/ Drug resistance	(Shen, 2016)
miR-221	PTEN	Upregulation		(Yin, 2020)
miR-222	PTEN	Upregulation		(Li, 2016)
miR-103b	PTEN	Upregulation		(Miao, 2017)

Conclusion



Keywords: PI3K/AKT signaling, MicroRNA, Breast cancer