

Might the cargo of extracellular vesicles constitute a biological link between psychosocial stress and osteoporosis?

A narrative review

INTRODUCTION

- Stress-related diseases such as depression may impair bone quality and lead to osteoporosis.
- Extracellular vesicles (EVs) carry multiple biological cargoes as intercellular communication tools, they can deliver substances during bone remodeling and have effects on bone health.
- Psychosocial stress causes mitochondrial allostatic load, which lead to mitochondrial DNA (mtDNA) damage. Since mtDNA is present in EVs, the changed mtDNA in EVs may serve as biological cargoes in the psychosocial stress process.
- Mitochondrial allostatic load is associated with changes in blood-borne microRNA (miRNA). Since naked circulating miRNAs are degraded quickly in the bloodstream, some blood-borne miRNAs are packaged into protective EVs, such as exosomes.

AIM

A literature review was conducted to summarize if the cargo of EVs can constitute a biological link between psychosocial stress and osteoporosis.

METHOD

Databases:

PubMed, Google Scholar, and Science Direct

Keywords:

allostatic load; bone remodeling; microRNA; osteoblast; osteoclast

Number of Articles:

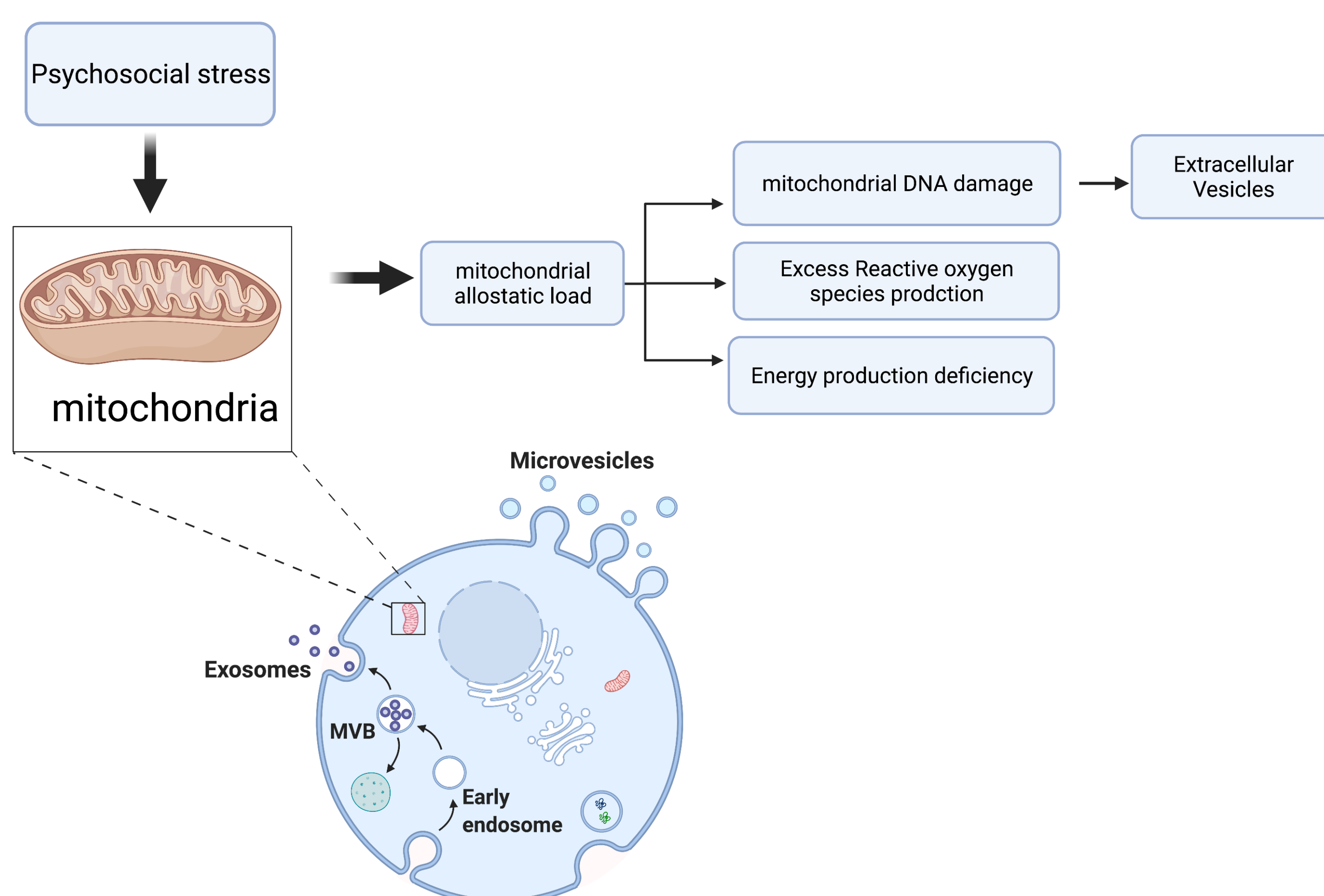
Total studies included in narrative review (n=21)

Review articles and document results:

Summarize and synthesize the findings from the articles we have found.

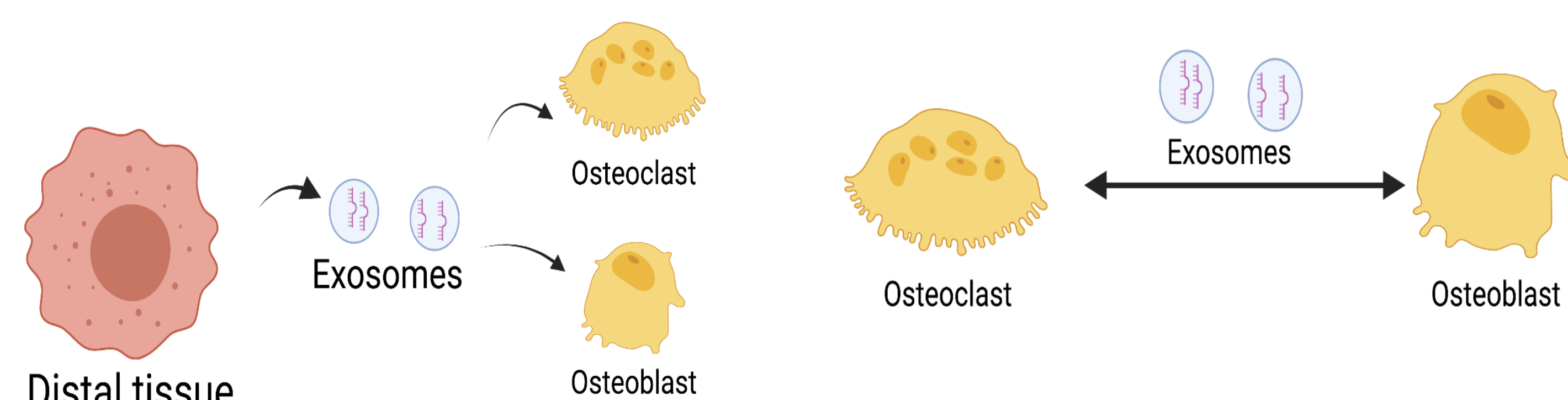
RESULTS

- EVs may transport biological cargoes for psychosocial stress



RESULTS

- EVs transport biological cargoes for bone remodeling



Source	Bioactive Factors Contained in EVs	Target
growth hormone-secreting pituitary adenoma	miR-21-5p	osteoblast
breast cancer cell	miR-20a-5p	osteoclast
osteoclast	miR-214	osteoblast
osteoblast	receptor activator of nuclear factor κ -B ligand(RANKL)	osteoclast

Some miRNAs with the most significant alterations in mice's serum EVs after stimulation with depression model were shown to harm bone formation and may be involved in osteoporosis progression.

MiRNAs in EVs	Stress-induced change	The effect of MiRNAs in EVs on bone
miR-126a-3p	↑	Inhibits the osteogenesis of human adipose-derived mesenchymal stem cells
miR-128-3p	↑	Inhibits the osteogenic differentiation of mesenchymal stem cells
miR-187-5p	↓	Promotes differentiation of bone marrow mesenchymal stem cells to osteoblasts

DISCUSSION

- Current research on psychosocial stress and osteoporosis has focused on the hypothalamic-pituitary-adrenocortical axis, the sympathetic nervous system. The innovation of this review takes EVs as a mediator between psychosocial stress and osteoporosis for the first time. Our future studies will focus more on the specific mechanisms by which EVs serve as mediator between both.
- Limitation of the review is the inability to consider whether EVs-mediated transport of biological cargoes can alter the function of target cells in a real physiological environment.

REFERENCE

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