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衰老中蛋白质和DNA氧化损伤的影响及其通过热量摄入限制与锻炼产生的干预

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Implications of oxidative damage to proteins and DNA in aging and its intervention by caloric restriction and exercise

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摘要 本文将与年龄相关的蛋白质改变和DNA氧化称为“生物性衰老的公共机制”。氧化修饰的蛋白质和DNA随增龄而加剧，这一结论已在啮齿类动物中得到证实。通过调养可使老年动物蛋白质半衰期延长，DNA修复活动下降。在动物晚年限制饮食，可将蛋白质半衰期缩短降至年轻时的水平，从而降低老年动物体内变异蛋白质的水平。有规律的锻炼能减少大脑中氧化修饰的蛋白质，改善认知功能；还能缓解肝脏的氧化应激：改善NF-kB活性，增加还原型谷胱甘肽，并降低细胞核和线粒体DNA中的氧化鸟嘌呤。研究结果表明，有规律的运动对降低氧化应激有全身效应。因此，饮食控制和锻炼等生活方式能够扩大健康的范围，通过调节整体的抗氧能力(包括蛋白质转换和DNA修复)，从而减少促使生理和病理性衰老的潜在受损蛋白质和DNA。

关键词： 衰老 饮食限制 DNA 运动 氧化应激 蛋白质

Abstract: In this short review we describe implications of age-related changes of protein and DNA oxidation as a public mechanism of biological aging. Oxidativelymodified protein andDNAhave been demonstrated to increasewith advancing age in rodents. Half-life of proteins is extended andDNArepair activity declines in old animals.Dietary restriction initiated late in life can shorten the half-life of proteins to levels of young animals, thus contributing to reduce level of altered proteins in old animals by the regimen. Regular exercise reduced oxidativelymodified proteins in the brainwith improved cognitive functions. It attenuated oxidative stress in the liver, i.e., ameliorating activation of nuclear factor kB, increasing reduced glutathione, and decreasing oxidized guanine base in nuclear and mitochondrial DNA. These findings suggest that regular exercise has systemic effects in reducing oxidative stress. Thus, life-styles such as diet and exercisemay extend health span, by up-regulating overall anti-oxidant capacities that include proteins involved inprotein turnover and DNA repair, resulting in reduction of damaged proteins and DNA that potentially promote physiological and pathological aging.

Significant point: Evidence is presented that dietary restriction and exercise initiated late in life may extend healthspan by upregulating overall anti-oxidant capacities that include enzymes involved in protein turnover and DNA repair, resulting in reduction of damaged proteins and DNA that potentially advance physiological and pathological aging.

Key words: Aging Dietary restriction DNA Exercise Oxidative stress Protein

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