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## The efficacy of pumpkin (*Cucurbita sp.*) on inflammaging



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### ABSTRACT

The aging process can be delayed by antioxidant supplements such as pumpkin. It is useful for reducing oxidative stress, inflammation, and cellular aging so that older people will be fitter and happier. This literature review will investigate the effect of pumpkins on inflammaging. Google Scholar, Researchgate, and Mendeley were used as the search engine. The keywords were pumpkin & inflammaging. The effect of pumpkin on geriatric beta-endorphin was analyzed from fourteen articles. Body homeostasis, organ systems, and other changes will reduce the functional capacity from the cellular to the individual level in the inflammaging process. To delay the physiological process of aging, pumpkin has the potential to improve the cognitive, endocrine, musculoskeletal, cardiovascular, and immunological organ systems. The inflammaging can be improved by the effect of pumpkin for a better quality of the aging process.

**Keywords:** pumpkin; anti-aging; inflammaging; endorphin.

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## INTRODUCTION

Over the next three decades, the number of people 65 and older will triple, reaching 1.6 billion by 2050. Asia leads this trend. Hong Kong, South Korea, and Japan are predicted to have the largest proportion of persons aged 65 and older by 2050.<sup>1</sup> The United Nations considers population aging a “major success story” but also offers problems and possibilities. One of the most difficult tasks is ensuring that the economy can meet the consumption demands of an increasing number of older people.<sup>1</sup>

Since 2021, Indonesia has had an aging demographic structure, with the percentage of the elderly population exceeding 10%. For over a decade (2010-2021), the rate of elderly people has increased by at least 3%, reaching 10.82%.<sup>2</sup> Life expectancy increased from 69.81 years in 2010 to 71.57 years in 2021. According to this data, every individual born in 2021 may expect to live to the age of 71-72.<sup>2</sup>

Aging and age-related disorders are highly dependent on inflammation, with inflammaging occurring with age and inflammation occurring concomitantly with metabolic disease. The gut microbiota is important for both, and emerging

biomarkers can differentiate biological from chronological age.<sup>3</sup> Inflammaging is a lifelong proinflammatory process that can lead to either healthy or pathological aging.<sup>4,5</sup>

Herbal medicine is an important component of traditional and contemporary medicine. There is an urgent need to expand our scientific understanding of its positive effects on inflammatory disorders.<sup>6</sup> Pumpkin has been shown to improve spermatogenesis, wound healing, and aging because it contains antioxidant substances.<sup>7</sup> Based on this context, this article will describe the efficacy of pumpkin for the inflammaging process.

## METHOD

This literature review used Google Scholar, Researchgate, and Mendeley as search engines. The literature review method uses journals and preliminary research publications. The effects of pumpkin on inflammaging are explored. The keywords were pumpkin and inflammaging. The literature search yielded 32,600 articles. Fourteen reliable articles with inclusion criteria published 1993-2023, using Indonesian or English, and non-full-text

literature were excluded.

## RESULTS

Fourteen articles described the efficacy of pumpkin on inflammation, as shown in Table 1. Experimental and literature review methods studied pumpkin efficacy. Samples varied from molecular to bedside investigation.

Pumpkin, a vital food resource in Africa, particularly in Benin, is underutilized due to its nutritional composition. *Cucurbita moschata* Duchesne, a *Cucurbita* species, is mainly cultivated by men and has various uses in Benin. However, 48% of producers abandoned their production due to production and marketing constraints, potentially leading to genetic erosion. The conservation and enhancement of *Cucurbita* species' genetic resources is essential, as it is marginalized in research, production, industrialization, and marketing. Farmers play a crucial role in plant domestication and conservation, ensuring the preservation and management of local species.<sup>22</sup> Pumpkin seed oil has potent anti-inflammatory, antioxidant, antiviral, hypoglycemic, hepatoprotective, neuroprotective, and anti-cancer properties. Cucurbitacin B

**Table 1. The Analysis of Pumpkin Effect on Inflammation**

| Author & publication year              | Research Methodology   | Result  |
|--|--|---|
| Amin et al., 2020. <sup>8</sup>        | In vitro study   | Indigenous pumpkin seed oil has anti-inflammatory, anti-oxidant, and anti-bacterial properties.   |
| Dai et al., 2023. <sup>9</sup>         | Reviewing Cucurbitacin's pharmacology, toxicity, and pharmacokinetics.   | CuB has strong therapeutic benefits by regulating signaling pathways.   |
| Salminen et al., 2021. <sup>10</sup>   | Immunosuppression via the STAT3 pathway affects aging and age-related diseases.                                      | STAT3 signaling causes senescence by activating p53 signaling.  |
| Yan et al., 2022. <sup>11</sup>        | GFF has beneficial effects on Nrf2/ARE.  | GFF activates NRF2 to reduce CDKN2A expression in keratinocytes.  |
| Zhang et al., 2022. <sup>12</sup>      | Gut microbiota regulates NFκB, leading to homeostasis and disease.   | In the context of aging and related illnesses, the critical function of NFκB in host response to microbial signals.   |
| Tabibzadeh, 2021. <sup>13</sup>        | Reviewing the article about AMPK signaling pathways and effectors of aging   | AMPK, sirtuins, Klotho, and hydrogen sulfide pathways disrupt cell metabolism, autophagy, cell division, inflammaging, immunosenescence, stem cells, and aging. |
| Hussain et al., 2017. <sup>14</sup>    | Reviewing the article about pumpkin's functional and therapeutic ingredient  | Pumpkin contains polysaccharides, para-aminobenzoic acid, oils, sterols, proteins, and peptides.  |
| Deng et al., 2023. <sup>15</sup>       | Reviewing the article about Advances in Plant Polysaccharides as Antiaging Agents: Effects and Signaling Mechanisms  | Plant polysaccharides have antiaging effects through signaling pathways   |
| Shayganni et al., 2016. <sup>16</sup>  | Reviewing the article about Inflammaging and cardiovascular disease, which medicinal plants managed                  | Autophagy removes stress signals and has immunomodulatory effects.  |
| Sagone et al., 1993. <sup>17</sup>     | In vitro study of para-aminobenzoic acid biotransformation by PMN  | PABA breakdown by PMN limits PABA availability for bacterial growth.  |
| Singh et al., 1997. <sup>18</sup>      | Fatty acids of fixed oil have anti-inflammatory activity.  | Linolenic acid in fixed oils inhibits arachidonate metabolism and has an anti-inflammatory effect.  |
| Dang et al., 2019. <sup>19</sup>       | Reviewing the article about the mechanism and reason for loss of sterol metabolic homeostasis triggers inflammasomes | Inflammasomes are responsible for the loss of sterol metabolic homeostasis.   |
| Draganidis et al., 2016. <sup>20</sup> | Reviewing the articles about inflammaging and skeletal muscle after protein Intake                                   | Protein intake and supplementation may have anabolic potential in elderly people with inflammation.   |
| Kennedy et al., 2020. <sup>21</sup>    | Experimental study of an artificial intelligence-characterised functional peptides                                   | Peptides from rice inhibit TNF- and improve physical strength.  |

(CuB) is the most prevalent and active member of the cucurbitacin family of tetracyclic triterpenoids.<sup>8,9</sup> Insulin/IGF-1 signaling is linked to immunosuppressive STAT3 signaling, which causes insulin resistance and senescence. NRF2 is susceptible to *Galactomyces ferment filtrate* (GFF), which has high antioxidative action against UV irradiation and proinflammatory cytokines.<sup>10,11</sup>

Aging is characterized by chronic inflammation, cellular senescence, immunosenescence, organ dysfunction, and aging-related diseases. Senescent cells secrete factors like the senescence-associated secretory phenotype (SASP), which promote inflammation and induce senescence in normal cells. Chronic inflammation accelerates immune cell senescence, weakened immune function, and a vicious cycle of inflammation and senescence. Eliminating inflammation could be a potential strategy for anti-

aging.<sup>23</sup>

The previous study in Arab found that applied topically and orally pumpkin extract effectively reduced inflammatory and oxidative changes in male albino rats exposed to psychological stress and contact dermatitis. This suggests that pumpkin extract could be an alternative or complementary approach for treating depression-related contact dermatitis.<sup>24</sup>

NF-B, AMPK, sirtuins, Klotho, and hydrogen sulfide and transsulfuration pathways are essential for cell survival and defense against harm.<sup>12,13</sup> Pumpkin is a useful vegetable due to its high carotenoid content, low energy value, and high carbohydrate and mineral content. It has pharmacological properties such as antiaging, antifungal, antibacterial, anti-inflammation, and antioxidant benefits.<sup>14,15,16,17</sup> Fixed oil and linolenic acid reduce PGE2, leukotriene, and arachidonic acid-induced paw edema, sterol

production must be properly regulated, and protein intake and supplementation may be beneficial.<sup>18-20</sup> Bioactive peptides from food can potentially treat and maintain chronic inflammation, and rice NPN showed anti-inflammatory effects in an aged "inflammaging" group.<sup>25</sup>

Haila et al. study assessed the effectiveness of *Cucurbita pepo* L. (CP) ethanolic extract in prompting excisional wound healing in rats exposed to chronic stress. The study involved 50 albino rats exposed to chronic, unpredictable mild stress, induced depressive-like behavior, and excisional wounds. Results showed that CP administration significantly reduced depressive-like behavior and corticosterone and pro-inflammatory cytokines levels while up-regulating antioxidant activity. The combined CP-treated groups showed complete re-epithelialization, reduced inflammatory cell infiltration, collagen fiber deposition,

and increased CD3 CD4 positive T cell count. Overall, Cucurbita pepo L. can enhance wound healing in rats with depressive-like behavior through its antioxidant, anti-inflammatory, and antidepressant activities.<sup>26</sup>

Carotenoids, including  $\alpha$ - and  $\beta$ -carotene, have been studied for their antiproliferative and differentiating activity in cancer. A pumpkin-derived carotenoid-enriched extract demonstrated an anti-proliferative effect on HG3 cell lines, causing a 40% delay in cell proliferation without cytotoxicity. This delay was associated with p27Kip1 over-expression, AMPK activation, and modulation of autophagy flux. The presence of bioactive carotenoids in the extract suggests additive or synergistic action in retarding cancer cell growth.<sup>26</sup>

## CONCLUSION

As shown in the fourteen articles used, pumpkins can affect the inflammaging process in several organ systems. Clinical-level molecular, cellular, and organic evidence for the effectiveness of pumpkin in regulating inflammaging in the elderly. Pumpkin can be an alternative supplement for an anti-aging lifestyle. It is hoped that future research on anti-aging pumpkins will be conducted with a larger sample size, gender balance, and age-specific criteria.

## CONFLICT OF INTEREST

We declare that there were no conflicts of interest in this study.

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## AUTHOR CONTRIBUTION

All of the authors equally contributed to the study.

## DISCLOSURE

The authors disclose no conflicts of interest.

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