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Mini Review

The Functions of Chicken Embryo Extract

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Introduction

Chicken embryo eggs are regarded as a high-quality natural nutrition supplement and sickness cure in China (where they are known as Mao Dan) and other Southeast Asian nations [1]. Pregnant women, the elderly and even cancer patients are advised to consume it [2]. Because of its anti-wrinkle activity and stimulation for cell culture, the embryo extract is also frequently employed in the cosmetics industry as well as scientific research field [3]. The functions of chicken embryo extract are summarized in this publication.

Nutrition Supplement

Chick embryo eggs have long been known to be a rich source of nutrients and to contain a variety of bioactive substances [4]. Proteins, amino acids, carbohydrates, lipids, fatty acids, and vitamins have all been found in them [5]. During egg hatching, the nutrients within the embryo alter [6-8]. Seed germination in plants appears to represent a similar transition in the natural world. Beside the abundant amino acids and vitamins, the chick embryo eggs also contain phospholipids and growth factors [9,10].

Antioxidant Activity

Egg white protein hydrolysate has been shown in several studies to have high antioxidant activity [8]. Certain hydrophobic amino acids and basic amino acids have been shown to improve peptide scavenging activity [11]. More hydroxyl radical scavenging chemicals are created during egg hatching. The study's findings show that chicken embryo hydrolysate has a higher antioxidant content and nutritional value than an unhatched egg. Chick embryo eggs were found to have strong antioxidant activity and to delay aging [12,13]. Separated from the egg white protein hydrolysate, two types of peptides have high radical-scavenging activity [14].

The ability of chick embryo egg hydrolysates (CEEH) to scavenge free radicals was concentration-dependent. CEEH also has a higher antioxidant capacity and nutritional value than an unhatched egg. Furthermore, the antioxidant activity of the 11-day and 14-day CEEH was higher, indicating that the incubation medium-term chick embryo eggs have a higher nutritional value [15]. This study's findings may provide significant insight into the possible use of chick embryo eggs in the functional food business.

The antioxidant activity of peptides in fertilized eggs increased as the incubation time rose. In addition, the natural antioxidant peptide HLFGPPGKKDPV was isolated and described [16].

Immune Function Enhancement

Chick embryo contains interleukin-4 (IL-4) and interleukin-2 (IL-2) [17,18], which could activate the immune system. On the immunosuppressed mouse, chicken embryo eggs act as a robust immunopotentiator, which could be advantageous for the successful application of chicken embryo eggs as a superior immunostimulatory tonic [19].

In *in vivo* mouse tests, crude chicken embryos homogenate has been indicated to have immunomodulatory effects in recent pharmacological investigations [20]. Spleen (spleen lymphocyte proliferation and IL-2 production) and macrophage function (macrophage phagocytosis and NO production) were improved by chicken embryo eggs. The lipid-soluble fraction was mostly important for spleen function, whereas the water-soluble fraction was primarily responsible for macrophage behavior, both of which were dose-dependent. The function of spleen lymphocytes and peritoneal macrophages is improved by mohicken embryo extracts [19].

Scholars confirmed that CEEH (chicken embryo egg hydrolysates) can increase the spleen index, promote mouse lymphocyte proliferation, increase hemolysin activity and macrophage phagocytic capacity, and prolong exhaustive lethal swimming time [21]. In aging rats, the chick embryo and nutrient cocktail improved immunological function, increased antioxidant enzyme activity, and repaired organ damage in a synergistic manner [22].

Anticancer Activity

Animal embryo extract has been shown to have anticancer properties in several investigations. Tumor cells were treated with animal embryonic extracts and then transplanted into an embryo, demonstrating that the embryonic milieu supported tumor cell reprogramming [23,24]. Tumor cells *in vitro* were inhibited and their apoptosis was promoted by extracts from frog ocytes and *Danio rerio* (zebrafish) embryos. The link between the extracts' action and DNA methylation modification in tumor cells has been established.

CEE treatment killed the majority of cultivated melanoma cells, but those that survived produced a subclone of actively proliferating cells that showed stronger resistance and proliferative potential than the original line and exhibited stem cell markers and possible tumor development markers [25]. A unique protein complex derived from chicken liver embryo was proved to decrease the invasiveness of HepG2 cancer cells [26]. CEE may promote the reversion of metastatic phenotypes of osteosarcoma cells [27].

Supplement for Cell Culture

Hayden et al. separated the chicken embryo extract fraction into high and low molecular weight components on Sephadex G-25 as early as 1966. In clones of cartilage and pigmented retina cells,

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the medium supplemented with the low molecular weight fraction could support complete differentiation. With the inclusion of a big molecular weight component, growth rates could be boosted [28]. Several factors have been discovered in chick embryos, including stem cell factor (SCF), nerve growth factor (NGF), and epidermal growth factor (EGF) [17,18]. These factors perform a variety of physiological functions, such as maintaining neuron survival and healing tissue damage. As a result, animal embryonic extract is employed as a growth factor cocktail for growing diverse stem cells.

As an addition to the medium in cell growth *in vitro*, chicken embryo extract is thought to be a source of functional and structural proteins [29,30]. It has also been utilized to support the growth and development of neuronal, neuroepithelial, and embryonic stem cells in culture [31,32]. A particular neural crest stem cell medium (NCSCM) is necessary to develop neural crest stem cells (NCSC) *in vitro*, which incorporates the most complicated section of the chick embryo extract, which provides crucial growth factors for the NCSC [33]. Treatment with CEE has been shown to improve the morphology and growth rate of the slower-growing SC-1 cell line [34].

Anti-Aging

Aging is a natural process that causes changes in the biological system as well as tissue and organ degeneration. Several functional foods have been discovered to have powerful anti-aging properties, making them suitable candidates for anti-aging therapy [35].

Jia Ma et al. found that supplementing with dietary chicken embryo plus nutritional mixture improves cognitive deterioration in D-gal caused aging rats [36]. Meanwhile, another study from the same group, which used a bone marrow-derived mesenchymal stem cell model, found that chicken embryos may have anti-aging properties. All of these studies could lead to the development of new anti-aging therapies [22]. The efficacy of different sections of the chicken embryo against aging induction was tested using a D-gal-induced aging mice model. The chicken embryo possesses significant antifatigue properties, which may help to reduce the emergence of age-related disorders [37].

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