EDITORIAL

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"Rescue-Egg" Antioxidants: What Do They Really Do?

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Dear Readers,

The common knowledge of antioxidants and their beneficial activities on human body are increasing and people are trying to include the best source in their dietary program. However, in Asian and Mediterranean countries, the use of green tea (epigallocatechin gallate), turmeric (curcumin) and red wine (resveratrol) was, and still is, a normal everyday practice. Not to mention other dietary benefits of these substances such as glysemic control, anti-inflammatory and neuro-protective characteristics, which have already been shown in valid clinical studies, these polyphenols can exhibit antioxidant activities [1].

Endogenous oxidants are usually small-sized oxygen-based electron-full molecules. They can be referred to as free radicals or reactive oxygen species (ROS) including peroxides, superoxide, hydroxyl radical, etc. Mitochondria are responsible for 90% of ROS production in human cells. In a normal cell, the production and the elimination rate of ROS are balanced to a non-toxic level; however, in situations such as starvation and trauma, the rate of ROS production can surpass cell elimination capacity. ROS can oxidize proteins, nucleic acid and lipids by breaking down their hydrogenic bond and transforming them into useless or even harmful molecules; as free radical-mediated DNA damage and tumorigenesis are only examples [2].

High electron molecules such as polyphenols cannot scavenge ROS from the cells like ascorbic acid does; as a study showing that the superoxide-scavenging activity of resveratrol is much less than ascorbic acid [3]. Instead, these molecules force cells to produce and activate an internal antioxidant, superoxide dismutase (SOD), which is the main antioxidant enzyme in human body. This enzyme can dismute superoxide into oxygen and hydrogen peroxide. The main three types of SOD are: SOD1 or Cu-Zn SOD or Intracellular SOD (50% to 80% of total SOD, localized primarily in the cytosol and nucleus); SOD 2 (Mn-SOD or Intra-mitochondrial SOD, smaller quantities and localized to the mitochondria) and SOD 3 (extra-cellular SOD). However, not all SOD molecules inside the cells are activated; therefore, SODs should undergo an activation process before they can come into action [4]. Sirtiuns are proteins which are known as one of the main deasetylases of cells and have been shown that sirtuin gene knockout mice have higher oxidative stress and exhibit early aging features [5].

On the other hand, Forkhead box O (Foxo) proteins are a family of transcription factors that play important roles in regulating the expression of genes involved in cell growth, proliferation, differentiation and longevity. Studies have demonstrated that resveratrol-treated cells have more SOD content compared to controls. Furthermore, FOX can also be activated by Sirtuin [6, 7].

Studies have suggested that "Rescure Egg" (Resveratrol-Curcumin-EpiGallocatechin Gallate) induce the expression of several lon-

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gevity genes including Sirt1, Sirt3, Foxo1, Foxo3a, etc. Sirtuin molecules (mainly SIRT1 and SIRT3) can deacetylate lysine amino-acids in SOD and activate them. Furthermore, Sirtuin can induce nuclear translocation of Foxo3a, which can subsequently increase transcription on mRNAs for longevity enzymes such as SODs. All and all, scientists are trying to demonstrate that these polyphenols can indirectly activate and increase the concentration of SOD (and to some extent other antioxidant enzymes such as catalase or gluthatione peroxidase) [4-8]. The good news is they were successful. But the bad news is there are lots of questions, which we still need to answer such as; do all cells respond in the same way? What about their activity in certain diseases? Can we use these substances as drugs or are they just dietary supplements? Why cannot we just use purified SOD and Sirtuin as a supplement instead of resveratrol or green tea extract? Are these molecules really antioxidants or are they just antioxidant (read SOD) activators? There are maybe hundreds of other questions which still remain unanswered. Till date, we can just put a "to be continued" sign at the end of our publication regarding resveratrol and curcumin instead of a definite conclusion.

Keywords: Resveratrol; Curcumin; Epigallocatechin Gallate; Superoxide Dismutase; Reactive Oxygen Species

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