

## Potential Health Benefits of Almond Skin

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Nut consumption and almond in particular, has been shown to have beneficial effects on blood glucose levels in individuals with type-2 diabetes and prediabetes, with statistically-significant improvements in fasting levels of glucose, insulin, insulin sensitivity and LDL-cholesterol [1,2]. Compared to other tree nuts, almonds are particularly rich in dietary fiber (12%), mostly insoluble, which is mainly present in the skin. Both natural almond skin, present in raw almonds, and blanched skin, a by-product of the almond processing industry from blanching, have been recognised as useful ingredients for the control of oxidative processes in food products and as a potential prebiotics [3,4]. Prebiotics are foods or food ingredients able to modulate the colonic microbiota and are characterized by their resistance to gastric acidity, hydrolysis by mammalian enzymes and gastrointestinal absorption. They are fermentable by intestinal microbiota and cause selective stimulation of the growth and/or activity of intestinal bacteria associated with health and well-being [5-7]. Roberfroid [8] defined a prebiotic as 'a selectively fermented ingredient that allows specific changes, both in the composition and/or activity in the gastrointestinal microbial community that confers benefits upon host well being and health'. The Prebiotic Index (PI) is a comparative relationship between the growth of beneficial bacteria and the less desirable ones, in relation to the changes of the total number of bacteria. The PI obtained with natural and blanched almond skins after 8 and 24h incubation was comparable with the values obtained with Fructo-Oligo Saccharides (FOS), used as positive control [4]. Other health promoting compounds present in almond skins are polyphenols [9], which have been shown to be protective agents against cancer and cardiovascular disease. Among polyphenols, flavonoids are secondary metabolites well documented for their biological effects, including anticancer, antiviral, antimutagenic and anti-inflammatory activities [10-11]. Almond polyphenols have been found to be bioaccessible in the upper Gastro Intestinal (GI) tract and potentially available for absorption [12, 13]. Higher release of flavonoids and phenolic acids was observed with natural skins compared with blanched skins in both simulated gastric and gastric plus duodenal compartment [12].

The polyphenols present in almond skins are also active as antimicrobials against a range of food-borne pathogens. There is an increased effort in trying to avoid foods with chemical preservatives and this is manifested by the food industries growing interest in finding natural compounds with antimicrobial activity. The enhanced demand for natural and minimally processed ingredients is also attributed to the legislations governing the use of current preservatives. A number of aromatic plant oils have found industrial applications as preservatives of raw and processed foods. Almond skin polyphenols-rich fractions were found active against *Listeria monocytogenes* and *Staphylococcus aureus*. Natural almond skins were also active against the Gram-negative food-borne pathogen *Salmonella enterica* [14]. In agreement with the higher polyphenolic content, natural almond skins were more active than blanched skins.

In conclusion, on the basis of our results and a number of other references, it is possible to confirm that almond bioprocessing could result to the production of a by-product, such as skin, which is potentially useful as functional ingredient for the food and pharmaceutical industry. Furthermore, the polyphenols present in

the skin could be used as potential natural antimicrobials in the food preservative market.

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