

## The potential of Robusta (*Coffea canephora*) green beans as a dentin hypersensitivity therapy agent: A review

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### Abstract

Dentin hypersensitivity or sensitive teeth is one of the most disturbing diseases caused by the opening of the dentinal tubules which can transmit fluid to the pulp nerves of the tooth, so that patient feel a short and sharp pain when exposed to triggering agents. This can cause physical and psychological problems for the patient. In addition, it can have a negative impact on a person's quality of life, especially regarding food selection, plaque control methods, and aesthetic aspects. One of the treatments for dentine hypersensitivity is by using materials that contain a desensitizing effect, such as stannous, strontium, potassium, arginine, oxalate, and hydroxyapatite. These ingredients can be contained in toothpaste, serum, mouthwash and in dental office materials. Robusta green beans is known to contain fluoride and oxalic acid. Fluoride is needed by the teeth to prevent and repair porous teeth, cavities to hypersensitive teeth. While oxalic acid is a material that has a desensitizing effect, which can be used to treat dentine hypersensitivity. However, the content of oxalic acid and fluoride in Robusta green bean has not been studied further to determine its desensitization potential. This review article will discuss the possible desensitization potential of Robusta green bean.

**Keyword:** Robusta green bean; Dentin hypersensitivity; Fluoride; Oxalic acid

### 1. Introduction

Dentine hypersensitivity is a condition that can be found every day in both men and women, especially those who are getting older [1,2]. Causes of pain can be classified as pain with a cavity due to the presence of a cavity or caries, for example due to abrasion, attrition, erosion or abfraction; and pain without cavities, generally due to gingival recession which causes exposed root surfaces, and pain after bleaching, scaling and root planing treatments, defective restorations, cracked tooth syndrome, use of burs without cooling water [3].

One of the treatments for dentine hypersensitivity is by using materials that have a desensitizing effect, both used in the office by dentists and at home by patients. There have been several products containing desensitizing agent, including stannous, strontium, potassium, arginine, oxalate, and hydroxyapatite ingredients that would suggest treating dentin hypersensitivity [4].

Robusta green beans contain natural ingredients that are beneficial for health, such as anti-bacterial and anti-inflammatory properties. In addition to anti-bacterial and anti-inflammatory properties, Robusta coffee bean extract also contains fluoride and oxalic acid [5,6]. Unroasted green coffee beans contain about 0.5mg/L of fluoride [6]. Fluoride is needed by the teeth to prevent and repair porous teeth, cavities to hypersensitive teeth [3,7]. Oxalic acid is a material that has a desensitizing effect which can be used to treat dentine hypersensitivity [8,9]. However, the content of oxalic

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acid and fluoride in Robusta green bean has not been studied further to determine its desensitization potential. This review article will discuss the possible desensitization potential of Robusta green bean.

## 2. Dentin Hypersensitivity

Dentin hypersensitivity is a condition that has been defined as a “short and sharp pain” that caused by exposed dentin in response to chemical, thermal, tactile, or osmotic stimuli [10,11]. Exposed dentin allows stimuli from the external environment to enter the pulp, which is rich in nerves, through the canals of the dentinal tubules. The level of sensitivity can be influenced by the number and size of the exposed dentinal tubules. As the numbers of wider dentinal tubules and open dentinal tubules increase, hypersensitive pain becomes more severe [11].

Hypersensitive pain affects patients’ quality of life, producing significant impairment on patients’ daily life such as speaking, eating, drinking and toothbrushing. Splieth and Tachou (2013) in their epidemiology study of dentin hypersensitivity explained that the prevalence rates of dentin hypersensitivity range from 3 to 98%. This range is based on the differences of the selection criteria for the study sample and also the variety in diagnostic approaches or time frames. Women are slightly more affected than men and a high number of cases reported in the 30–40 year old range has been reported. Maxillary teeth are affected to a higher extent and buccal surfaces show the highest prevalence rates [12].

The opening of the dentinal tubules can be caused by several conditions such as gingival recession, tooth bleaching treatments as well as scaling and root planning [3,13]. Gingival recession is a condition where the root surface is exposed due to loss or pulling or retraction of the gingiva towards the root which results in the root surface not being protected. Gingival recession generally occurs at the age of 40 or more but can also be found at a younger age. Bleaching is an action to whiten teeth that experience discoloration. Bleaching treatment of vital teeth has the potential to irritate the pulp causing dentine hypersensitivity. Scaling and root planing actions also cause loss of the smear layer on the tooth root surface which results in reduced cementum protection, resulting in hydrodynamic movement of fluid in the dentinal tubules which results in stimulation of the pulp nerves [13].

## 3. Desensitizing Agent

Management of dentin hypersensitivity include:

- Oral hygiene education and brushing technique instruction for prevention of dentin hypersensitivity
- Behavioural control and elimination of predisposing factors for dentin hypersensitivity
- Non-invasive treatments for pain relief through occluding dentin tubules and blocking nociceptive transduction/transmission.
- Restoration or surgical treatments for dental hard and soft tissue defects [2].

Application of desensitizing agents is the most frequently used non-invasive treatment for dentin hypersensitivity. Especially in cases with limited or invisible dental hard tissue loss or cervical exposure (i.e. no obvious erosive defects, classical abrasive lesions or gingival recession), the use of desensitizing agents or other analgesic treatments should be considered. Conceptually, desensitizing agents or analgesic treatments aim to suppress nerve impulses by either mechanical or chemical blockage of the dentin tubules or by directly stopping the nociceptive transduction/transmission occurred within dentin-odontoblasts nerve terminal complex of the dental pulp. Based on the mode of their administration, the desensitizing treatment can also be classified into at-home therapy or in office therapy categories. At home desensitizing products include toothpastes, mouthwashes and chewing gums. In-office desensitizing products can be found in the form of gels, solutions, varnishes, resin sealers, glass ionomers, and dentin adhesives. In-office desensitizing treatments also include more sophisticated laser techniques. In general, all interventions should start with non-invasive, reversible, non-hazardous, easy to perform, and inexpensive options [2].

The active compounds found in desensitization products could either block the openings of dentinal tubules thereby isolating the tubule contents or might directly desensitize the pulpal nerves [2]. Some examples active compounds that blocking the dentinal tubules with sodium fluoride, stannous fluoride, strontium chloride, potassium oxalate, calcium phosphate, calcium carbonate, and bioactive glasses ( $\text{SiO}_2\text{-P}_2\text{O}_5\text{-CaO-Na}_2\text{O}$ ). Adhesive dentin sealer with fluoride varnishes, oxalic acid and resin, glass ionomer cement, composites, and dentin bonding agent [14].

Various dentin desensitizers have been proven effective for dentin hypersensitivity. Suda (2016) in their study explain that an oxalic acid potassium salt desensitizing agent was used because of its easy application and immediate

effectiveness. This agent reacts with the calcium in the dentinal tubules to form insoluble calcium oxalate crystals which occlude the dentinal tubules. This agent is easy to use without any device and can be applied within seconds before ultrasonic scaling procedure [14].

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#### 4. Potential of Robusta Coffee Beans as a dentine hypersensitivity therapy agent

Coffee is a mainstay commodity in the Indonesian plantation sector [15]. Coffee comes from the Rubiaceae family, the *Coffea* genus has 124 species spread throughout the world. The coffee plant itself has been cultivated since for 1500 years ago in Yemen. As the fourth largest coffee producing country in the world, coffee has an important role for the Indonesian economy, namely as a source of income for farmers and a provider of employment, as well as a source of foreign exchange [16].

Coffee contains more than 800 active compounds consisting of volatile and non-volatile compounds. Coffee also contains many antioxidants consisting of several types of polyphenols, one of which is flavonoids. The most well-known compounds for its effects are caffeine and chlorogenic acid. In addition, Robusta coffee is also known to have a high fluoride content. The concentration of fluoride in coffee beans depends on the species and conditions of manufacture. Unroasted Robusta coffee beans contain about 0.5 mg/L of fluoride ion [6].

Fluoride or fluorine is an anionic inorganic chemical which is highly electronegative and is a reactive element. The crystal structure of fluorine is more resistant to acids so it can inhibit the initiation and progression of cavities. Fluoride works in the body in 2 ways, namely systemic and topical. The predominance of fluoride action in the oral cavity is on the topical mechanism of action when fluoride ions are present in the saliva at optimal concentrations. If optimal fluoride ions are present in saliva during tooth development, enamel is constantly exposed to remineralization processes. This process can strengthen the email [7].

Topical fluoride application in combination with preparations such as toothpaste will increase the remineralization effect and increase enamel hardness so that it can cover the microporosity of the teeth and dentinal tubules. Fluoride topically has 3 mechanisms of action, namely through increasing remineralization, preventing demineralization, and inhibiting glycolysis in caries bacteria. Fluor has no systemic anti-bacterial effect. Fluor is systemically more useful during the enamel formation period than when the teeth have erupted [7].

Fluoride accumulates in the dentin-pulp interfacial layer as dentine continues to form. Fluoride can be deposited on the hard tissues of the teeth, bound to the oral mucosa and absorbed by dental plaque. Fluoride is also stored in dental plaque where the cleaning and remineralization processes take place. Fluoride must always be present in the oral cavity at low concentrations to inhibit the process of dental caries formation and initiate tooth remineralization. When bacteria produce acid, the fluorine in the plaque fluid will penetrate along with the acid below the surface and then be absorbed onto the surface of the crystals and prevent dissolving of the crystals. If the entire surface of the crystal is covered by adsorbed fluorine, the fluorine will not dissolve. This type of coating gives crystal characteristics similar to fluorapatite covering the tooth microporous layer and dentinal tubules [7]. However, the use of Robusta coffee beans as a therapeutic agent for dentine hypersensitivity is still unknown.

Robusta coffee beans also contain of various types of acids, including types of carboxylic acids, namely formic acid, acetic acid, oxalic acid, citric acid, lactic acid, malic acid, and quinic acid [5]. Oxalic acid in some studies have reported that this component reacts with the calcium ions available in the dentin surface and dentin fluid, transforming the labile cover in an acid-resistant structure by replacement of the smear layer with a layer of calcium oxalate crystals. So that, the use of dentin adhesives over oxalate salts provides better tubular occlusion of the exposed dentin and significantly reduces dentin sensitivity [8]. Corral (2016) also confirm in their study that applications of oxalic acid-based desensitizing agent reduce the risk of dentin hypersensitivity after 6 months of treatment [9].

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#### 5. Conclusion

Robusta green beans may have the potential as a desensitizing agent because contain of active components that have a desensitizing effect, namely fluoride and oxalic acid. However, further research is needed in this regard.

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## Compliance with ethical standards

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### Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article review.

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