Inhibitory effects of ginseng seed on melanin biosynthesis

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ABSTRACT

Background: Ginseng root has been traditionally used for the treatment of many diseases in Korea. However, so far ginseng seed has been mostly unused and discarded. As part of our ongoing research on the ginseng seeds, the inhibitory effect of ginseng seeds on melanin production was verified to assess their potential as a skin depigmenting substance. Materials and Methods: The present study measured the inhibitory effect of ginseng seeds on melanin production through the tyrosinase inhibitory effect and analyzed their effects on melanin production in melan-a-cells. Results: Ethanol extract of ginseng seed was applied to melan-a-cells at a concentration of 100 ppm and melanin production was reduced by 35.1% without cytotoxicity. In addition, the ethanol extract of ginseng seed was shown to reduce tyrosinase activity. Conclusion: Because the results showed excellent melanin inhibitory activity compared with that obtained by arbutin, ethanol extracts of ginseng leaf and ginseng root at the same concentration, it can be concluded that ginseng seeds show great potential as a skin depigmenting substance.

Key words: Melanin, panax ginseng, pigmentation, seed

INTRODUCTION

Melanin is an important factor that determines skin pigmentation of many animals including humans. Melanocytes, which produce melanin, are mainly located in the basal layer, the bottom part of the skin's epidermis and are activated by ultra violet light or inflammation to promote the biosynthesis of melanin. Biosynthesis of melanin begins with the oxidation of tyrosine by the action of tyrosinase and then proceeds through dopa, dopaquinone and dopachrome. Melanin produced from this pathway plays a role in the protection of the skin, but overproduced melanin can cause various skin pigment problems such as melasma, freckles and black spots. Thus, many studies on the materials that inhibit melanin production have been actively conducted with a purpose of eliminating such problems.

Furthermore, hydroponically-grown ginseng leaves have been used as vegetables, but so far there have been very few studies on the use of ginseng seeds.

The present study measured the inhibitory effect of ginseng seeds on melanin production via the tyrosinase inhibitory effect and analyzed their effects on melanin production in melanocytes. The inhibitory activity of ginseng root extracts and leaf fractions in melanin production has been reported, but that of ginseng seeds has not been reported. In a previous study on the physiological activity of ginseng seeds by Kim et al., they reported the nuclear factor kappa B inhibitory effect of lupane-type triterpene which was separated from ginseng seeds, while Kim and Kim reported lower DPPH scavenging activity in wild cultivated ginseng seeds compared to that in ginseng root or leaves. However, other related studies have been rarely conducted.

MATERIALS AND METHODS

Samples

The seeds of Panax ginseng Meyer used in the study were purchased in Jeungpyeong-gun, Chungcheongbuk-do, Republic of Korea in March 2011, while ginseng leaves and roots were purchased in Seocheon-gun,
Table 1: Effects of ginseng ethanol extracts on cell viability and melanin production in melan-a-cells

| Samples  | Concentrations (ppm) | Melanin production (%) | Cell viability (%) |
|----------|----------------------|------------------------|-------------------|
| Seed     | 1                    | 97.0±3.5               | 98.8±2.2          |
|          | 10                   | 90.0±5.1               | 100.0±3.7         |
|          | 100                  | 64.9±4.4               | 97.7±4.6          |
| Leave    | 1                    | 88.3±2.8               | 96.3±0.5          |
|          | 10                   | 85.4±5.5               | 100.8±3.8         |
|          | 100                  | 74.9±4.9               | 84.4±3.1          |
| Root     | 1                    | 83.7±4.4               | 94.8±4.0          |
|          | 10                   | 76.2±4.6               | 70.3±2.7          |
|          | 100                  | 17.2±6.1               | 30.5±5.5          |
| Arbutin  | 1                    | 94.5±0.8               | 98.8±3.3          |
|          | 10                   | 81.6±5.9               | 97.0±0.9          |
|          | 100                  | 72.8±4.0               | 96.4±2.2          |

Viability and melanin content of vehicle was set to 100%. Data represent the mean±standard deviation of triplicate experiments.
**Effects on tyrosinase activity and intracellular tyrosinase expression**

Tyrosinase is an important enzyme in promoting the oxidation of tyrosine and L-dopa in the initial steps of melanin biosynthesis. To determine the possible inhibitory effect of ginseng seed extract on tyrosinase activity, tyrosinase and its substrate L-dopa were incubated with the ethanol extract of ginseng seed and the amount of dopachrome thus produced was measured. The results show that ginseng seed 27.1% tyrosinase inhibitory effect at 100 ppm. The ginseng leaf and ginseng root all had a 23.0-24.8% tyrosinase inhibitory effect at 100 ppm [Figure 2]. The ginseng seed extract was added to melan-a-cells for 3 d and then proteins were extracted to measure the amount of expression of tyrosinase, which play an important role in melanin biosynthesis, by western immunoblotting. The ginseng seed extract did not reduce the expression of tyrosinase at 1, 10 and 100 ppm [Figure 3]. Therefore, it is considered that the inhibitory effect of ginseng seeds on melanin production may involve inhibition of tyrosinase activity except tyrosinase expression. Further studies will be needed to demonstrate the depigmenting activity by which ginseng seed inhibits melanogenesis in the animal skin.

**CONCLUSION**

The ethanol extract of ginseng seed showed an excellent inhibitory effect on melanin production and demonstrated low cytotoxicity when applied to melanocytes, compared to the ethanol extracts of ginseng root and ginseng leaf. This inhibitory effect on melanin production was observed to be lower at concentrations below 10 ppm compared to the currently most widely used whitening substance, arbutin, but higher at concentrations over 100 ppm. From the above results, it is considered that ginseng seeds show great potential for use as a skin depigmenting substance.

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