POTENTIAL OF ACEH ARABICA COFFEE EXTRACT (*Coffea arabica* L.) IN REJUVENATION OF AGING SKIN IN RAT

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ABSTRACT

This study aimed to determine the potency of Aceh Arabica coffee in rejuvenation of aging skin in rat. This study was conducted in vivo using completely randomized design (RAL), which consisted of 4 treatment groups as follows: premenopausal rats as negative control (KON), premenopausal rats with administration of distilled water as placebo (PLS), premenopausal rats with administration of ethinylestradiol $9x10^{-3}$ mg/day/200 g BW (EST), and premenopausal rats with coffee extract administration of 300 mg/day/200 g BW (KOP). Each treatment group consisted of 5 rats. The parameters observed were skin collagen, water content/skin hydration, and skin ribonucleic acid (RNA) level. The data were analyzed using analysis of variance (ANOVA) and Duncan test using SAS 9.13 software. The result showed the average skin collagen and RNA levels were higher in premenopausal rats with administration of coffee extract and ethinylestradiol (P<0.05) than control rats. On the other hand, average of water level in premenopausal rats with coffee extract and ethinylestradiol administration were the same as control rats. It can be concluded that administration of Aceh Arabica coffee extract can repair skin quality, which is indicated by the increase of collagen and RNA level on aging skin in rat.

Key words: Arabica coffee (*Coffea arabica* L.), collagen, extract, rats, RNA, skin quality

ABSTRAK

Penelitian ini bertujuan mengetahui potensi ekstrak kopi Arabika Aceh untuk meningkatkan kualitas kulit pada tikus yang mengalami penuaan. Untuk mencapai tujuan tersebut dilakukan penelitian secara in vivo dengan menggunakan rancangan acak lengkap (RAL), yang terdiri atas empat perlakuan masing-masing terdiri atas lima ekor tikus, yaitu KON= tikus premenopause sebagai kontrol negatif, PLS= tikus premenopause yang dicekok akuades sebagai plasebo, EST= tikus premenopause yang diberi etinilestradiol sebanyak $9x10^{-3}$ mg/hari /200 g BB, KOP = tikus premenopause yang diberi ekstrak kopi 300 mg/hari/200 g bobot badan. Parameter yang diamati ialah kadar kolagen kulit, kadar air kulit, dan kadar ribonucleic acid (RNA) kulit. Data yang diperoleh dianalisis dengan menggunakan analysis of variance (ANOVA) dan dilanjutkan dengan uji Duncan dengan menggunakan program software SAS 9.13. Hasil penelitian menunjukkan bahwa rataan kadar kolagen kulit dan kadar RNA kulit pada tikus premenopause yang diberi ekstrak kopi dan etinilestradiol lebih tinggi (P<0,05), bila dibandingkan dengan tikus kontrol. Sebaliknya, rataan kadar air kulit pada tikus premenopause yang diberi ekstrak kopi dan etinilestradiol, sama dengan tikus kontrol. Dapat disimpulkan bahwa pemberian ekstrak kopi Arabika Aceh dapat memperbaiki kualitas kulit yang ditandai dengan terjadinya peningkatan kadar kolagen dan kadar RNA kulit pada tikus yang mengalami penuaan

Kata kunci: kopi Arabika (*Coffea arabica* L.), kolagen, ekstrak, tikus, RNA, kualitas kulit

INTRODUCTION

Skin plays role as protector from environment exposure and regulator of homeostasis (Baum and Arpey, 2005). Loss of skin integrity results in wounds that cause serious effect on the body when untreated. Tissue lesion triggers intracellular response, which coordinates healing of tissue integrity and homeostasis. The ability to respond and repair tissue injury is a basic thing for multicellular organism. Cutaneous tissue repair occurs through tissue regeneration (Gurtner *et al.*, 2008). Topical use of antioxidants on the skin becomes superior among skin specialist because of its anti-inflammation and anti-carcinogenic activity (Nkondjock, 2009).

Coffee is claimed as functional drink and as an important source of anti-oxidant, especially because of its higher phenolic and caffeine contents. Chemical constituents of Arabica coffee include phenolic and its derivatives (chlorogenic acid), alkaloids (especially caffeine), terpenoid, carbohydrate, lipid, volatile, and heterocyclic compounds (Brezová *et al.*, 2009). In the several last decade, polyphenol compounds has been proposed as one of the effective functional material, which is contained on foods and drinks with anti-aging profile and is capable of neutralizing destructive oxidative effect on the skin (Ratz-Yko *et al.*, 2015). Several study on Arabica coffee has proven its biological activity like anti-bacterial (Almeida *et al.*, 2006), anti-viral (Utsunomiya *et al.*, 2008), anti-inflammation (Chiang *et al.*, 2011), and decreasing macromolecule oxidative damage (Hoelzl *et al.*, 2010). Beside phenolic compounds, coffee is also known as an alkaloid source, particularly caffeine. This secondary metabolite has showed relevant biological activity, such as central nervous system stimulation, diuretic, and peripheral vasoconstriction (Heck and de Mejia, 2007). Caffeine as the main alkaloid in coffee bean and other contents are correlated with the quality of drinks and contributed to the bitterness of the drinks (Farah *et al.*, 2006). Arabica coffee extract, which is administered on hairless mice, can increase collagen level and reduce epidermal hyperplasia because its polyphenol has anti-oxidant and anti-inflammation profile (Po-Yuan *et al.*, 2017). Coffee extract can repair skin wounds on rats (Affonso *et al.*, 2016).

One of the superior natural commodities in Aceh is Arabica coffee. Recently, it is known that coffee contains trigonelline, which has potential protective effect on auditory neuropathy (Hong *et al.*, 2009).

Trigonelline is a new phytoestrogen that can bind to estrogen receptor, functioning like an endogenic estrogen (Kimberly *et al.*, 2009). Until now, there is no report about Aceh Arabica coffee extract as an anti-aging agent, especially in repairing the quality of skin of aging rats. This study aimed to understand the potential of Aceh Arabica coffee in rejuvenation of aging skin in rat.

MATERIALS AND METHODS

Aceh Coffee Extraction

Sample of coffee bean was decaffeinated, fried, and dried using oven. it was then mashed using coffee grinder to be until powder form. This powder was extracted using maceration method with water solvent. The coffee solution was filtered using filter paper and then purified (evaporated) using vacuum rotary evaporator until it became a thick coffee extract. This extract was dried using freeze dryer until the water content less than 10% and the powder coffee extract was obtained.

Administration of Aceh Coffee Extract on Aging Rats

Animal model used in this study was female rat of Prague Dawley rat age 18 months, with aging condition or premenopausal period. The rats were divided into four treatment groups, which consisted of five rats for each group. These rats were placed in plastic cage, closed by ram wire, and covered with husk on the cage base. Food (pellets) and water was provided sufficiently. The cage environment was dry, well ventilated and lighted, with 14 hours light and 10 hoursdark. Each rat was placed in individual cage. Female postmenopausal rats were adapted in cage environment for 1 week and were treated afterward.

The rats were divided into 4 treatment groups as follows: premenopausal rats as negative control (KON), premenopausal rats with administration of distilled water as placebo (PLS), premenopausal rats with ethinylestradiol (synthetic estrogen)

administration of 9×10^{-3} mg/day/200 g BW (EST), and premenopausal rats with coffee extract administration of 300 mg/day/200 g BW (KOP). Coffee extract and ethinylestradiol were administered orally using sonde once a day for 2 months.

On diestrus phase, all of the rats were sacrificed. Prior to dissect, the rat was anesthetized using ether. The skin was separated with soft tissue using little scissor and was weighed before soaked in 10% buffer formalin (BNF) solution for collagen and RNA analysis. The parameters observed were skin wet weight, collagen, water, and ribonucleic acid (RNA) level using a method conducted by Manalu and Sumaryadi (1998).

Analysis Data

The data were analyzed using analysis of variance (ANOVA) and Duncan test with 95% of confidence interval ($\alpha = 0.05$) using SAS 9.13 software.

RESULTS AND DISCUSSION

Average of collagen, water content, and RNA level in premenopausal rats are presented in Figure 1. This result showed that average of skin collagen and RNA in premenopausal rats fed with Aceh Arabica coffee extract and ethinylestradiol administration were higher ($P<0.05$) than control rats. However, average of water level in premenopausal rats administered with coffee extract and ethinylestradiol were the similar to control rats.

The Aceh Arabica coffee extract used in this study could repair skin quality, which is indicated by increasing of collagen and RNA level on premenopausal condition. Coffee extract contained trigonelline, which is an estrogen-like bioactive compound (Kimberly *et al.*, 2009). Trigonelline is expected to have the capability to increase activity of skin cellular synthesis of rats, which is illustrated by an increase of skin RNA level (Figure 1). Previous study by Velazquez *et al.* (2009) showed that green coffee oil (*Coffea arabica* L.) has effects on collagen, elastin, and
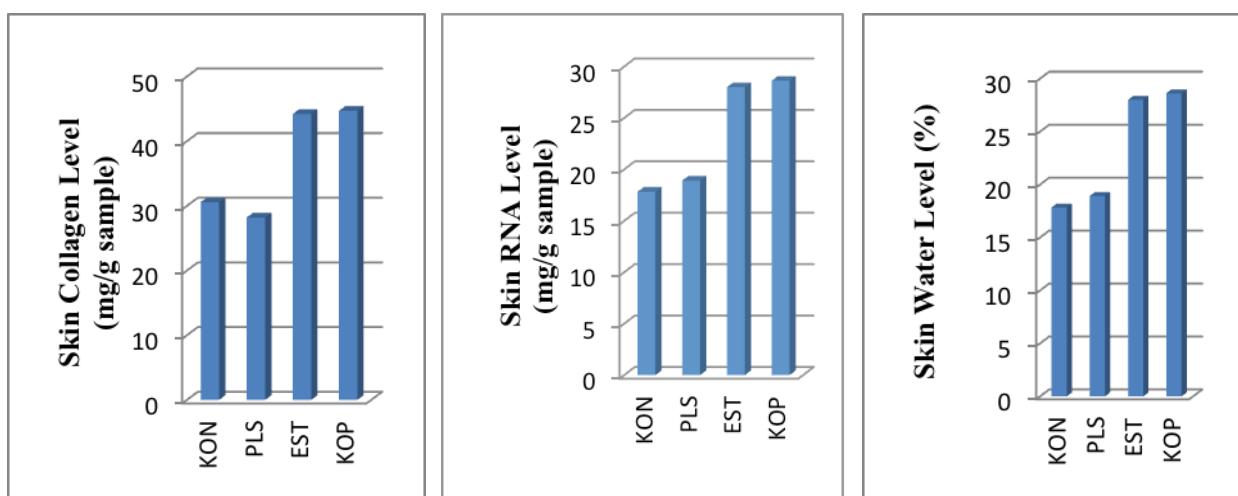
Figure 1. Average of skin collagen, water level, and RNA level of aging rats (KON= Premenopausal rats as negative control, PLS= Premenopausal rats with distilled water administration, EST= Premenopausal rats with ethinylestradiol (synthetic estrogen) administration at dose of 9×10^{-3} mg/day/200 g BW, KOP= Premenopausal rats with coffee extract administration at dose of 300 mg/day/200 g)

glycosaminoglycan (GAG) synthesis. It also has an effect on transforming growth factor beta-1 (TGF-β1) and granulocyte-macrophage colony-stimulating factor (GM-CSF) in-vitro released by fibroblast of the skin. Green coffee oil can repair physiological balance of the skin, thus the new soft tissue can be produced. It also prevents epidermal drying by increasing mRNA aquaglyceroporins-3 (AQP-3) expression. Furthermore, Jadoon *et al*. (2015) reported that coffee which was processed into a cream has been used as one of the dermatological herbs. Study by Hallström *et al.* (2014) stated that coffee consumption did not affect the risk of bone fracture in Swedish men.

CONCLUSION

Administration of Aceh Arabica coffee extract could improve skin quality which is indicated by increasing the collagen and RNA level on aging rat skin.

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