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Mechanism in Antibacterial Activity of Medicinal plant against *Candida albicans*

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Abstract: The purpose of this study is to determine the mechanism in antibacterial activity of medicinal plant against *Candida albicans*. In order to best anti-*Candida albicans* effects for nine kinds of medicinal plant, *Artemisia apiacea* Hance, *Artemisia annua*, *Brassica oleracea* L., *Coptis chinensis*, *Pogostemon cablin* Bentham, *Loranthus chinensis* Danser, *Ulmus macrocarpa* Hance (bark). Medicinal plant ethanol extracts were examined by disc diffusion method for anti-*Candida albicans* activity and used fluconazol (50 mg/mL), 99% ethanol as a positive controls. We measured the area of clear zone and evaluated that the larger size of the area was more effectives against *Candida albicans*. The result of this study, *Artemisia apiacea* Hance value was highest as 38.2 mm and next *Ulmus macrocarpa* Hance (bark) 32.8 mm. This result is a result which is equivalent to about 97% when compared to 39.1 mm of the fluconazol (50 mg/mL) positive control. The present results, along with the observation, suggested that *Artemisia apiacea* Hance and *Ulmus macrocarpa* Hance (bark) extracts could be anti-*Candida albicans* agents to cause the infection candidiasis in humans

Key words: *Candida albicans*, disc diffusion method, medicinal plant, *Artemisia apiacea* Hance, *Ulmus macrocarpa* Hance (bark), activity

INTRODUCTION

Candida albicans is a dimorphic fungus that grows both as a couple and thought the genus *Candida* that causes yeast cells and human infection *Candida* species (McClary, 1952; Erdogan and Rao, 2015; Martins *et al*., 2014). For human candidiasis 50-90% are responsible for *Candida albicans* (Tortora *et al*., 2010). *Candida albicans* in the human intestinal parasites in the gastrointestinal tract of healthy adults, 40% can bedetected. *Candida albicans* is a fungus that grows both as a couple and thought the genus *Candida* that causes yeast cells and human infection *Candida* species. For human candidiasis 50-90% are responsible for *C. albicans*. Computational systemic fungal infections caused by infection *C. albicans* can be found in immunocompromised patients (for example, AIDS, cancer chemotherapy, organ or bone marrow transplant) (Mukherjee *et al*., 2015; Zadik *et al*., 2010; Ryan and Ray, 2004). It usually occurs in the mucous membrane in the mouth or vagina. In addition, *C. Candida* has become a major cause of health problems in hospital acquired infections caused by albicans. About 85-95% of women hospital care is mostly a vaginal infection case. Candidiasis is present in an opportunity infections (Tortora *et al*., 2010; Jeon *et al*., 1987). *Candida albicans* causes candidiasis in the human body when excessive yeast growth as kind to all people present in normal fungal gun. Candidiasis is primarily intrusion from young children to opportunistic infections that cause infections in people with immune deterioration in the body skin and mouth, groin, a woman's vagina up to the adult elderly and heart, liver, lungs, spleen and kidneys host the line can be life-threatening (Kim *et al*., 2006; Lee *et al*., 1997). Since, the 1990's, antibiotic therapy or chemotherapy, depending on the patient, increases patients with endocrine imbalance, the patient is reduced salivary gland function have received this opportunity to infection by Candida is a trend that is increasing rapidly (Madigan and Brock, 2011; Shin, 2009). Infections caused by fungi such as Candida growing in the world and has increased the use of antifungal agents such as fluconazole (Epstein, 1990; Guida, 1998). The fungi have resistance to conventional antifungal drugs in additionto the increase. An antibiotic for the treatment of *Candida albicans* was reported to large tolerance and adverse drug reaction (Akpan and Morgan, 2002; Frozza *et al*., 2013).

It is very beneficial for health to eat vegetables and fruits prevent cancer and another disease was well-known. We want to know anti-*Candida albicans* effects of common vegetables and plants that have been

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most frequently eaten as a variety of dishes. A comparative investigation was subsequently performed concerning the anti-*Candida albicans* actions of the ethanol extracts of the selected vegetables and plants.

MATERIALS AND METHODS

Plant material and preparation of extracts: The plant materials *Artemisia apiacea* Hance, *Artemisia annua*, *Brassica oleracea* L., *Coptis chinensis*, *Pogostemon cablin* Bentham, *Loranthus chinensis* Danser, *Ulmus macrocarpa* Hance (bark), *Beta vulgaris* L., *Arctium lappa* L. were purchased on market from Gwangju City, Korea. The air-dried plant 600 g were extracted twice with 70% ethanol at 50°C water bath for 24 h and then filtered. The extracts were combined and evaporated in a vacuum at 50°C. The 4 g of the plant material extracts were diluted with 10 mL of distilled water and used sample solutions (400 mg/mL).

Culture of *Candida albicans*: *Candida albicans* (ATCC 18804, KCCM 50235) purchased from the Korean Culture Center of Microorganisms (KCCM) were routinely cultured in Yeast Medium (YM, containing Yeast extract, Malt extract, Peptone, Dextrose, Agar) at 3°C for 24 h in incubator (SANYO, JAPAN). The concentration of *C. albicans* was 5.5×10^4/20 uL.

Paper disc diffusion methods: Susceptibility tests were performed by the disc diffusion method by Bauer Dropping the sample solutions on 8 mm sterile paper discs with micropipette at 50 μL and drying it with hot air dryer. It was repeated 2 times (100 μL, 40 mg) and then it was placed on the medium in plate. The inhibitory zone diameters were measured at the transitional point where growth abruptly decreased after 24 h of incubation in the incubator.

Statistical analysis: The result is ±SD of triplicate experiments are represented as means. Statistically compared using the Student's t-test a significant value, p-value of 0.05 was considered as being statistically significant.

RESULTS AND DISCUSSION

In the disc diffusion test by 400 mg/mL concentration, anti-*C. albicans* effects of nine kinds of vegetables and plants (medicinal plants). Inhibiting area of each sample are *Artemisia apiacea* Hance 38.2 mm, *Brassica oleracea* L., 18.5 mm, *Artemisia annua* 11.1 mm in Fig. 1. It showed strong antimicrobial activity in

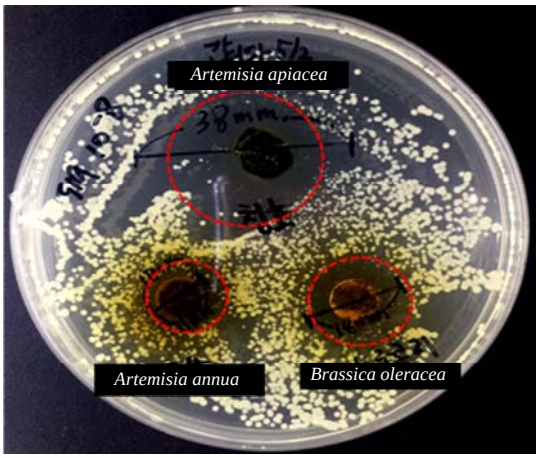

Fig. 1: Inhibitory zone of medicinal plant 70% ethanol extracts by disc diffusion method against *C. albicans* after 24 h. *Artemisia apiacea* Hance: 38.2 mm, *Brassica oleracea* L.: 18.5 mm, *Artemisia annua*: 11.1 mm

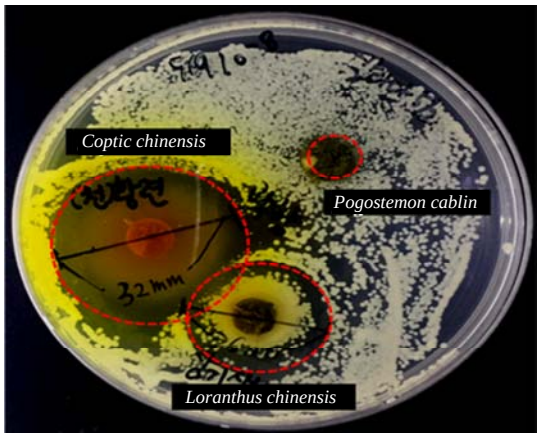

Fig. 2: Inhibitory zone of medicinal plant 70% ethanol extracts by disc diffusion method against *C. albicans* after 24 h. *Coptis chinensis*: 32.8 mm, *Pogostemon cablin* Bentham: 9 mm, *Loranthus chinensis* Danser: 26 mm

the hexene fraction of *Artemisia apiacea* Hance *Arctium lappa* L. has been demonstrated that it contains 3-dimethyl apigenin, apigenin and apigenin glucoside (Yang *et al*., 1995). These compounds may be useful as an anti-*C. albicans* agent (Kim *et al*., 1997).

Inhibiting area value of each sample are *Coptis chinensis*: 32.8 mm, *Pogostemon cablin* Bentham: 9 mm, *Loranthus chinensis* Danser: 26 mm in Fig. 2.

In Fig. 3, inhibiting the growth of *H. pylori* is *Ulmus macrocarpa* Hance (bark): 35.9 mm, *Beta vulgaris*

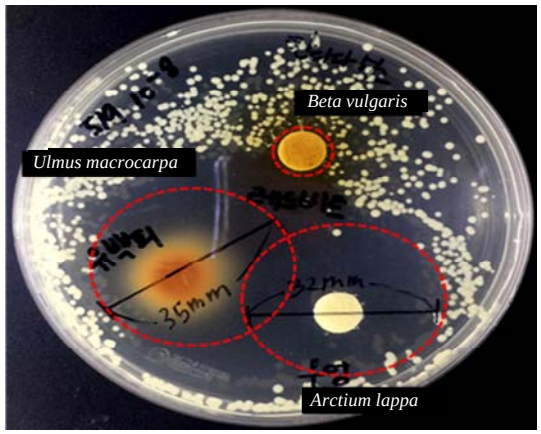

Fig. 3: Inhibitory zone of medicinal plant 70% ethanol extracts by disc diffusion method against *C. albicans* after 24 h. Diameter: *Ulmus macrocarpa* Hance (bark): 35.9 mm, *Beta vulgaris* L., 9.1 mm, *Arctium lappa* L., 32.6 mm

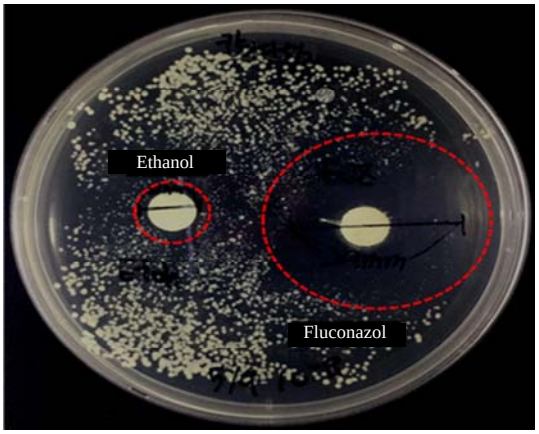

Fig. 4: Inhibitory zone of fluconazol by disc diffusion method against *C. albicans* after 24 h. Diameter: fluconazol (50 mg/mL): 39.1 mm, 99% Ethanol: 10.5 mm

L., 9.1 mm, *Arctium lappa* L., 32.6 mm. *Ulmus macrocarpa* Hance (bark) has been reported that the antifungal action. There *Ulmus macrocarpa* Hance (bark) also contain a variety of physiologically active substance, a flavonoid (+) catechin and a glycoside of the (+) a catechin -5-O-β-D-apiofuranoside separated (Son *et al*., 1989; El-Sayed *et al*., 2016). As positive controls, fluconazol (50 mg/mL) value was 39.1 mm, 99% ethanol: 10.5 mm in Fig. 4.

As shown in Table 1, inhibition area (mm) of vegetables, plants ethanol extracts and positive controls by disc diffusion method against *Candida albicans* is arranged (Jayandran *et al*., 2016). Relatively, it can identify excellent inhibition of *Artemisia apiacea* Hance and *Ulmus macrocarpa* Hance (bark).

Table 1: Inhibition zone of vegetables and plants ethanol extracts by disc diffusion method against *Candida albicans* after 48 h *Artemisia apiacea* Hance: 38.2 mm, *Brassica oleracea* L., 18.5 mm, *Artemisia annua*: 11.1 mm. *Coptis chinensis*: 32.8 mm, *Pogostemon cablin* Bentham: 9 mm, *Loranthus chinensis* Danser: 26 mm: *Ulmus macrocarpa* Hance (bark): 35.9 mm, *Beta vulgaris* L.: 9.1 mm, *Arctium lappa* L., 32.6 mm fluconazol (50 mg/mL): 39.1 mm, 99% ethanol: 10.5

Medicina plants (400 mg/mL)	Inhibitory zone diameter (mm)
Artemisia apiacea Hance	38.2
Artemisia annua	11.1
Brassica oleracea L.	18.5
Coptis chinensis	9.0
Pogostemon cablin Bentham	26.0
Loranthus chinensis Danser	26.0
Ulmus macrocarpa Hance (bark)	32.8
Beta vulgaris L.	9.1
Arctium lappa L.	32.6
Fluconazol (positive control) (50 mg/mL)	39.1

CONCLUSION

Candida albicans for the nine kinds of medicinal plants 70% ethanol extract of the paper disc diffusion method, antibacterial test results 400 mg/mL extract of *Artemisia apiacea* Hance concentration in the inhibition ring diameter 38.2 mm were in the highest, *Ulmus macrocarpa* Hance (bark) exhibited a 32.8 mm. The results of the positive control fluconazol (50 mg/mL) of 39.1 mm compared to the concentration of about 25% compared to the result but on the next *Artemisia apiacea* Hance and *Ulmus macrocarpa* Hance (bark) is developed as a potential antifungal material is high.

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