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Journal of Applied Agricultural Science and Technology E-ISSN: 2621-2528 4 (2): 181 -188 (2020) ISSN: 2621-4709 Received 13 July 2020; Received in revised form 28 August 2020; Accepted 29 August 2020 https://doi.org/10.32530/jaast.v4i2.179   ANTIOXIDANT PROPERTIES OF HERBAL TEA PREPARED FROM RED DRAGON FRUIT PEEL WITH THE ADDITION OF GINGER Neni Trimedona*, Rahzarni, Syuryani Syahrul, Yenni Muchrida, Irwan Roza Food Technology Study Program, Department of Agricultural Engineering, Politeknik Pertanian Negeri Payakumbuh Kabupaten Limapuluh Kota, Indonesia *Corresponding author Email: nenitrimedona60@gmail.com Abstract. The peel of red dragon fruit usually discarded. It is rich in polyphenol compounds that have antioxidant activity and health benefits. This research aimed to determine the antioxidant properties of herbal tea such as phenolic content, betacyanin content, and antioxidant activity. The herbal tea prepared with hot oven drying methods, where's the fresh peel of red dragon fruit and ginger were cut to be small pieces and dried at 60oC, and ground into tea powder then mixed as treatments. Results showed that the addition of ginger has no significant effect on phenolic content, and betacyanin content decreased by the addition of ginger. The phenolic content of herbal tea (0% ginger) and the highest addition of ginger (12%) were 3.39±1.19 mg GAE/g and 3.59±1.43 mg GAE/g respectively. The betacyanin content were 124.63±1.61 mg/100 g (0% ginger) and 104.01±2.99 mg/100g (12% ginger). As the amount of ginger added increased, the percentage of inhibition of herbal tea decreased from 66.23%±2.67 to 61.19%±2.45%. Keywords: herbal tea; ginger; antioxidant ; phenolic content; betacyanin 1. Introduction Recently, awareness of the health benefits of bioactive compounds has increased, the human diet with the herbal a worldwide trend. Herbal tea is widely consumed around the world that people suppose that it contributes to high antioxidant compounds such as polyphenol, vitamins, and other phytochemicals. Herbal tea is known as 'tisane' and produced from dried leaves, seeds, grasses, barks, fruit, and a flower or the combination of them that give them their taste and provide the

benefits effect of herbal drinks (Ravikumar, 2014). Fruit teas, which are popular because of their fragrance and lower amounts of caffeine, could be a good source of compounds with antioxidant properties. Red dragon fruit (Hylocereus polyrhizus) is a vine cactus belonging to the Cactaceae family, is a fruit crop cultivated in several Asian countries (Rebecca et al., 2010). The flesh popularly consumed in fresh fruit and juice. Fruit juice is therefore industrially manufactured as a functional drink. The peel of red dragon fruit is a by-product of consumption and the amount reaches 22-35% of the overall fruit weight and has most of the polyphenol which the source of antioxidant (Jamilah

Trimedona et al. JAAST 4(2): 181– 188 (2020) 182 et al., 2011; Saati, 2012). Red dragon fruit peels reported to contain substantial amounts of the same health-promoting such as betacyanin pigment (150.46 ± 2.19 mg/100 g), pectin (10.8%), and had very high dietary fiber (Jamilah et al ., 2011). The antioxidant capacity of the peel extract at the concentration of 1.0 mg/mL has greater compared to the flesh of red dragon fruit with a value of 83.48% and 27.45%. The phenolic content of peel extract was 28.16 mg GAE/100g, while the flesh extract was 19.72 mg GAE/100g (Nurliyana et al ., 2010). According to Tenore et al. (2012) research, the peels of the dragon fruit exhibited a higher polyphenolic content than that of flesh, which a value 654.6± 1.0 mg/100g compared with 78.1± 1.4 mg/100g. Besides, also reported that betacyanin pigment may protect against certain oxidative stress-related disorders (Luo et al., 2014; Wu et al., 2006). The use of fruit residue or none edible parts such as peels can give environmental and economic benefits. Red dragon fruit peels can develop as herbal tea. The flavor and taste of red dragon fruit peel herbal tea can improve by added some ginger (Zingiber officinale). The ginger is a traditional herb used widely in Indonesia and has bioactive components that also give to its flavor. The bioactive components such as gingerol, shogaol, zingerone, and their derivatives were phenolic components known as pungent properties of ginger (Ravindran et al ., 2005). Polyphenol components contributed to promoting good health such as anti-inflammatory, antibacterial, and antioxidant. The

total phenolic content of ginger in water extracts was 23.5 mg GAE/g of sample (Hinneburg et al., 2006) and 840 mg TAE/100g of a sample (Pilerood & Prakash, 2010). Herbal tea of dragon fruit peel with ginger added increases its antioxidant properties expected. This study investigates the influence of variation of the ginger addition to red dragon fruit peel on 15 the antioxidant properties of herbal tea infusion include total phenolic content, betacyanin content, and radical scavenging activity (antioxidant activity). 2. Methods 2.1. Samples preparation Red dragon fruits (Hylocereus polyrhizus) obtained from a Politeknik Pertanian Negeri Payakumbuh farm. The fruit was washed and wiped to dry and peeled to separate the peels and flesh. The fresh peel was to cut into thin pieces and followed by oven drying at 60 oC for 14 hours. The dried peels were ground into very small particles and sieved until uniform powdered particles were obtained. Ginger rhizomes (Zingiber officinale var officinarum) obtained from the traditional market were washed and cut into small pieces therefore dried and ground to obtain a uniform size as powdered dragon fruit peel. The ginger powder added to red dragon fruit peel herbal tea with various percentages (formulation): (A = 0%), (B = 3%), (C = 6%), (D = 9%) and (E = 12%) from the total of tea weight. The peel and ginger powder blended and the samples of

Trimedona et al. JAAST 4(2): 181– 188 (2020) 183 herbal tea packed in aluminum foil. For analysis, herbal tea infusion prepared to brew 1 g of tea samples in 100 ml distilled water for 5 minutes and then filtered through a Whatman filter paper. 2.2. Total phenolic content (TPC) The phenolic content in the sample of herbal tea determination according to the FolinCiocalteu methods using gallic acid as a standard (Das et al., 2012) with slight modification. Accurately, 0.5 mL of the samples or gallic acid (Merck) introduced 1 in a test tube followed by 0.5 ml of 50% Folin-Ciocalteu reagent (Merck), 0.5 mL 17.5% Na2CO3, and added of distilled water until the total volume was 5 mL. The solution was mixed thoroughly and allowed to stand in a dark place for 30 minutes before absorbance was measured at 765 nm using Shimadzu UV-Vis spectrophotometer (UV Mini 1240). The total phenolic content expressed as milligrams of gallic acid equivalents (mg GAE) per 1

gram of herbal tea sample. 2.3. Betacyanin content The betacyanin content of samples was measured similar way to that described by Wybraniec and Mizrahi (2002) with minor modification. The absorbance of betacyanin was measured using the Shimadzu UV-Vis spectrophotometer (UV Mini 1240) at 538 nm. The betacyanin content 24 calculated using the following equation (1): $Betacyanin\ content\ (mg\ 100g/of\ dried\ weight\ )$ = ( ) ( ) * (1) Where A538 = absorbance at 538 nm (λmax), L is a pathlength of the cuvette (1.0 cm), DF is dilution factor, V = volume tea infusion (mL), W = weight of tea samples (g). ε is the molar absorptivity of betanin = 6.5 x 104 L/mol cm in H2O and MW is the molecular weight of betanin = 550 g/mol. 2.4. 16 Determination of radical scavenging activity Antioxidant activity analyzed with a 2,2'-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging method. Accurately, a 1 ml sample and 3 ml of methanol were 1 mixed with 1 ml of 0.04 mM DPPH (Merck) in methanol (p.a) and incubated in the dark at room temperature for 30 minutes. 5 The absorbance of the sample was measured using a UV-Vis spectrophotometer at 517 nm where methanol used as blank. Radical scavenging activity started as a percent value of the inhibition using the following equation (2): $\%\ inhibition$ = * 100 (2) Where Control is the absorbance of the DPPH radical solution.

Trimedona et al. JAAST 4(2): 181– 188 (2020) 184 2.5. Statistical analysis All experiments were run in three replicates. Results are expressed as the means ± standard deviation. Analyses of variance were performed by ANOVA procedures. Values were considered significant at a 95% confidence level ($p<0.05$). 3. Result and Discussion 3.1. Total phenolic content (TPC) Folin-Ciocalteu test is used to appreciate the amount of TPC present in the herbal tea infusion. The total amount of 5 phenolic compounds in the sample would be oxidized by phosphotungstic and phosphomolybdic acids present in the reagent and basic condition which then exhibit a blue color solution (Wong et al ., 2006). The absorbances of seven different concentrations of standard solutions (gallic acid) were taken to construct the calibration curve. The calibration equation for gallic acid was y = 0.1051x + 0.0263 (R2

= 0.9987), where y is the absorbance and x is the gallic acid concentration in mg/L. The standard curve presented in Figure 1. Figure 1. The standard curve of gallic acid The total phenolic content of herbal tea infusion from red dragon fruit peel with the addition of ginger can be seen in Table 1. Table 1. Phenolic content of herbal tea infusion Samples Phenolic content (mg GAE/g herbal tea) A 3.39a ± 0,12 B 3.47a ± 0,17 C 3.50a ± 0,05 D 3.52a ± 0,15 E 3.59a ± 0,14 Values followed by the same letter are not statistically different at $p < 0.05$ Table 1 show that the addition of ginger with no significant influence on the total phenolic content of herbal tea infusion ($p<0.05$). It's caused the brewing of herbal tea samples to do at room y = 0.1051x + 0.0263 R^2 = 0.9987 0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0 1 2 3 4 5 6 7 Absorbance Concentration (mg/L)

Trimedona et al. JAAST 4(2): 181– 188 (2020) 185 temperature and only for 5 minutes. Gunathilake and Rupasinghe (2014) reported optimum extraction conditions for the ginger polyphenols at a temperature above 60°C and a time greater than 60 min. Phenolic content comes from phenolic acids such as gallic acid, ellagic acid, protocatechuic acid, vanillic acid, betalamic acid, and others; betacyanin compounds such as betanin, isobetanin, and bougainvilein and flavonoid compound from red dragon fruit (Tenore et al., 2012; Esquivel et al., 2007). TPC from herbal tea infusion varies from 3.39±1.19 mg GAE/g (without ginger) until 3.59±1.43 mg GAE/g (12% ginger addition). This value is in the range of TPC values based on Sahin (2013) reported that the total phenol contents from fruit teas such as pomegranate, peach, lemon, blueberry, apple, apricot, blackberry, and strawberry varied from 0.96 ± 0.01 to 6.91 ± 0.47 mg GAE/g of dried fruit tea. 3.2. Betacyanin content Betacyanin is a pigment that gives a red to purple color which is one type of betalain pigment that is widely found in plants Caryophyllales and Cactaceae (Strack et al., 2003). Betalain is a natural colorant that is widely used in food products. The pigment was contributed as antioxidants and radical scavenging to protect against interference due to oxidative stress (Gengatharan et al ., 2015). The betacyanin content of herbal tea can be seen in Figure 2. Figure 2. Betacyanin content of herbal tea infusion. Values followed

by the different letter are significantly different at p < 0.05 The analysis showed that there were significant differences in betacyanin levels that occurred among all herbal tea samples. Betacyanin content of dragon fruit peel tea decreases with increasing ginger concentration. The highest betacyanin level is found in the treatment of herbal tea without the addition of ginger and decreases with the addition of ginger. This proves that the betacyanin pigment is only found in dragon fruit peels. Betanin, isobetanin, phyllotactic, 124,63a 119,81a 112,17b 108,66b 104,01c 80.00 90.00 100.00 110.00 120.00 130.00 A B C D E Betasianin content (mg betanin/100g sample) Formulation

Trimedona et al. JAAST 4(2): 181– 188 (2020) 186 hylocerenin, and isohylocerenin are the main betacyanin components found in purple pitaya (Hylocereus polyrhizus) (Stintzing & Carle, 2007) 3.3. Radical scavenging activity Antioxidants are substances that can neutralize free radicals, thus defend the body from several diseases by restrictive to free radicals and highly reactive molecules that can impair cells. Free radicals are a constitution of reactive oxygen compound that has unpaired electrons so that unstable and attempt to take an electron from other molecules or cells.. The radical scavenging activity of dragon fruit peel herbal tea is with the DPPH radical (1.1-diphenyl-2- picrylhydrazyl) reagent. The results can be seen in Figure 3. Figure 3. Antioxidant activity of red dragon fruit peel with ginger herbal tea. Values followed by the same letter are not statistically different at p < 0.05 The determination of DPPH radical scavenging activity is based on a decrease in absorbance induced by the antioxidant, reducing the purple color of DPPH radical to a yellow solution. The results exhibited that the radical scavenging activity decreased with an increase in the amount of ginger addition. This is a positive correlation with the level of betacyanin content and not with total phenolic content. Wybraniec & Mizrahi (2002) reported the compound that plays the most role as an antioxidant component in dragon fruit peels is the betacyanin compound. Also, betacyanin was the mayor compound that contributed to the antioxidant activity of red dragon fruit (Tenore et al., 2012; Esquivel et al ., 2007). The radical scavenging effect of dragon

fruit tea infusion without ginger (66,24%) presented the highest activities and the ginger addition 12% exhibited the lowest activities (61.20%). Pekal et al. (2011) reported 2 radical scavenging activity of some fruits tea such as delight citrus, blue fruit, forest fruit, citrus, tropical fruit with various values (25.1% - 67.6%). The dragon fruit herbal tea powder and infusion presented in Figure 4. 66,24a 65,59a 64,08a 63,64a 61,20a 21 56.00 58.00 60.00 62.00 64.00 66.00 68.00 A B C D E Percentage of inhibition (%) Formulation

Trimedona et al. JAAST 4(2): 181– 188 (2020) 187 Figure 4. (a). Red dragon fruit peel and ginger powder; (b). Herbal tea powder; (c). Herbal tea infusion 4. Conclusion 3 The present study found that there was no increase in the antioxidant properties of dragon fruit peel herbal tea with the additional ginger. Betacyanin levels were around herbal tea without ginger addition and decreased with the addition of ginger. Radical scavenging activity exhibited has strongly correlated with betacyanin content. References Das, A. K., Rajkumar, V., Verma, A. K., & Swarup, D. (2012). Moringa oleiferia leaves extract: a natural antioxidant for retarding lipid peroxidation in cooked goat meat patties. International journal of food science & technology , 47(3), 585-591. Esquivel, P., Stintzing, F. C., & Carle, R. (2007). 12 Phenolic compound profiles and their corresponding antioxidant capacity of purple pitaya (Hylocereus sp.) genotypes. Zeitschrift für Naturforschung C, 62(9-10), 636-644. Gengatharan, A., Dykes, G. A., & Choo, W. S. (2015). Betalains: Natural plant pigments with potential applications in functional foods. LWT -Food Science and Technology, 64(2), 645649.

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