

The Effect of *Arenga Pinnata* Merr. Polysaccharide Extract on Blood Glucose Level

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Abstract: An observational experiment was designed to study the effect of *Arenga pinnata* polysaccharide extract on blood glucose level of the rat. The rats weigh from 151 – 207 g were fed by the extract from the different hardness level of *Arenga pinnata* endosperm. Three different weight of 50, 100 and 200 mg containing 1% of *Arenga pinnata* endosperm extract were studied and compared simultaneously with a common diabetic drug (glibenclamide) and glucose 50%. The blood glucose level was determined in the range time of 0 – 120 min using a glucometer. The result shows that the endosperm extract of *Arenga pinnata* could reduce blood glucose due to high fiber contained. *Arenga pinnata* endosperm extract 1 and 3 with a level of 200 and 50 mg, respectively, significantly reduced blood glucose after 90 min treatment compared to diabetic rats. Even though glibenclamide showed a better result, this finding opens the possibility to use natural *Arenga pinnata* endosperm as diabetic controlled.

1 INTRODUCTION

Dietary fiber has been recognized playing an crucial role in reducing the risk of chronic diseases such as diabetic type 2, lever and obesity (2010, Mann and Cummings, 2009). Diabetic is a metabolic chronic which identified from hyperglycaemic and insulin deficiency (Watanabe et al., 2010). It was predicted that in 2030 more than 552 million people in the world will suffer from diabetic (Whiting, 2011).

Even though the synthetic diabetic drug has been widely used for diabetic type 2, some side effects such as hypoglycemia, drug-resistant, edema and increasing body weight have limited the utilization (Tahrani, 2010). Therefore another alternative therapeutics drug must be developed not only by using synthetic material but also from a natural product. The polysaccharide of *Pleorutus ostreatus* has been identified and used as a traditional antidiabetic drug (Zhang, 2016). Another polysaccharide like galactomannan fenugreek potentially can be used as a diabetic drug (Madar, 1988) as well as their combination with pectin citrus (Shtriker, 2018).

One of the abundant sources of galactomannan in Indonesia is *Arenga pinnata* endosperm (APE)

which usually sell in the traditional market as “kolang-kaling” (Mogea, 1991). The utilization of APE is limited for a cocktail and food (Orwa, 2009). APE contains a high amount of fiber (Tarigan, 2012) and has water dissolved and not dissolved fraction. Dissolved water fraction compose of carbohydrate at 62.49% and crude fiber (1.11%) (Tarigan and Kaban, 2010). The main component of polysaccharide in APE is galactomannan that can dissolve in water (Rao, 1961) which contains galactose and mannose ratio of 1:1.33 with the antioxidant activity of $IC_{50} = 22.109$ mg/mL (Tarigan, 2012), (Tarigan, 2014). To the date, no studies have been done regarding to galactomannan as an antidiabetic drug.

Based on that, this study aims to explore the possibility of APE powder as antidiabetic. The APE was categorized into three different groups based on their texture (hard, medium and soft). This systematic study provides greater understanding and information about the prospect of APE endosperm extract as an antidiabetic food supplement or drug.

2 EXPERIMENTAL

2.1. Materials

The APE was brought from a local traditional market in Medan, North Sumatera – Indonesia. All the chemicals used were brought from local chemicals dealers and was used without any purification.

2.2. Procedures

2.2.1. Extraction of Galactomannan from APE

Preparation of dry APE and extraction of galactomannan from APE based on their texture were conducted based on our previous study with slight modification (Tarigan, 2012). The APE was categorized based on their texture of (1) hard, (2) medium, and (3) soft. Qualitative analysis of monosaccharide component in dissolved and undissolved water fraction were done following procedure from (Mulimani and Prashanth, 2002). A 100 mg galactomannan was mixed with 50 mL 1M HCl and heated in a water bath for 14 h followed by thin layer chromatography analysis. After 14 h hydrolysis, the solution was discarded and neutralized with barium carbonate. The filtrate was evaporated to form syrup and was dropped in chromatography paper (20 x 20 cm) using glass pipette. Separation of the thin layer chromatography was conducted using two solvent systems in one phase. Firstly, a mix of n-butanol : ethanol : water (BEW) solvent at a ratio of 4:1:1 was added and the plate was drying in the dryer. Next a mix of n-butanol : acetic acid : water (BAW) solvent at a ratio of 4:1:1 was added. The appearance of sugar was detected by spraying with a p-anisidin solvent in methanol and dry in oven drying for 20 min. The brown spot signed the appearance of sugar.

2.2.2. Preparation of APE Extract

The APE extract was prepared from mixed of 1% dry APE with water stirred at 50 - 55°C until all the APE dissolved followed by a shaker for 30 min at the same temperature.

2.2.3 Determiation of Blood Glucose Level using a Blood Glucose Test Meter

This procedure was conducted based on previous researcher (Thomson, 1985). The blood glucose level of fasting rats was determined for 18 h. Blood

from each rat was taken from vena vessel which firstly the end tail of rats was disinfected by ethanol 70%. The first drop of rat blood was discarded, and the next blood drop was absorbed to the strip layer of blood glucose test meter and the blood glucose level determined in mg/dL.

2.2.4. Determiation of the Effect of APE Extract in Blood Glucose Level using Tolerant Method

Rats weight ranging from 150 – 200 g had food fasting for 24 h and was measured the as fasting blood glucose level categorized in 5 different groups which each group contain three rats.

Group 1, rats fed by 1% hydrogel from APE 1 with a dosage of 50, 100, 200 mg.

Group 2, rats fed by 1% hydrogel from APE 2 with a dosage of 50, 100, 200 mg.

Group 3, rats fed by 1% hydrogel from APE 3 with a dosage of 50, 100, 200 mg.

Group 4, rats fed by glibenclamide with a dosage of 0.65 mg.

Group 5, rats fed by glucose dosage 50%

3 RESULTS AND DISCUSSION

The APE endosperm was categorized into three different groups based on their texture. The percentage yield of dry APE had reported in the previous studied (Tarigan, 2018). Table 1 depicts the yield of dry APE which contains dissolved water fraction (galactomannan) and undissolved water fraction (mannan). Separation of galactomannan and mannan could be done through a simple method using water in the neutral condition. Extraction process in this condition does not require further purification since it uses alcohol as a solvent and could produce material with good quality and environmentally friendly (Cerqueira, 2009). Commonly crude galactomannan is used in pharmaceutical and cosmetical industry (Üner and Altinkurt, 2004). Galactomannan and mannan could easy to separate with centrifugation which galactomannan is in supernatant and mannan which is in undissolved water fraction. In addition of alcohol, both fractions will form precipitation which further drying to form a dry extract.

Dissolved water fraction obtained highly in APE 2 while undissolved water fraction occurred mostly in APE 3. Based on our previous study, the hard texture is obtained in APE 3 which is ripened. Usually immature APE contains more

galactomannan than mannan (Kooiman, 1971). A polysaccharide containing in mannan is mannose range from 85 – 95% (Aspinall, 1959). Releasing galactosyl residue by α -galactosidase in endosperm increasing ratio mannose in galactomannan (Iglesias, 2014).

appearance spots as showed in figure 1B. Therefore it can be concluded that undissolved water fraction contains a high amount of mannan. This result similar with the previous researcher reported (Kaban, 2018).

Table 1. The yield of APE

| Parameter | APE 1 | APE 2 | APE 3 |
|--|-------|-------|-------|
| Dry weight APE (%) | 2,785 | 5,650 | 7,144 |
| Weight of dissolved water fraction (%) | 1,688 | 4,267 | 3,158 |
| Weight of undissolved water fraction (%) | 0,504 | 1,140 | 2,966 |
| Weight loss (%) | 2,965 | 1,215 | 5,100 |

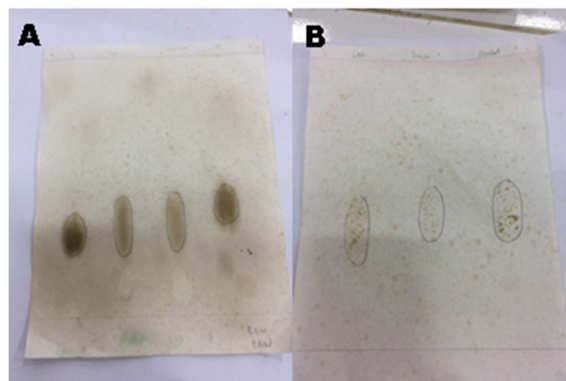


Figure 1 depicts the thin layer chromatography result for standard galactose, mannose, dissolved water fraction, undissolved water solvent and mannose + glucose. As shown, both dissolved water and undissolved fraction contains galactose which their spots appeared in between spot of mannose and galactose (Fig. 1b & 1c). This was supported by the

Figure 1. Thin layer chromatography spectrum of (A1) galactose standard; (A2) dissolved water fraction; (A3) undissolved water fraction and (A4) mannose; and (B1) dissolved water fraction; (B2) undissolved water fraction; and (B3) mannose + galactose.

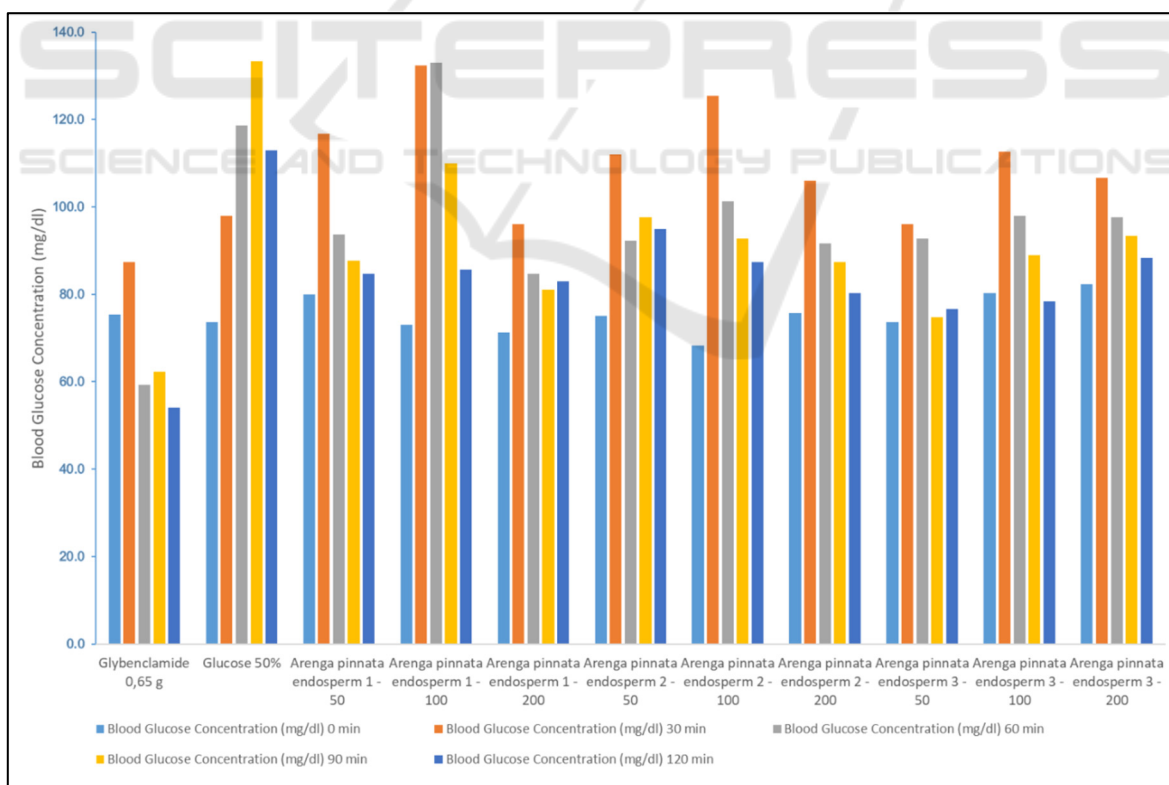


Figure 2. Graph the effect of APE extract on blood glucose level.

The effect of APE extract on blood glucose level of rats was presented in figure 2. Some researchers have demonstrated that galactomannan could decrease blood glucose level (Madar, 1988), (Shtriker, 2018), (Kendall, 2010), (Mann and Cummings, 2009). However no study is found for APE in decreasing blood glucose level. Three different weights of 50, 100 and 200 mg containing 1% of APE extract were studied and compared simultaneously with a common diabetic drug (glibenclamide) and glucose 50%. The blood glucose level was determined in the range time of 0 – 120 min using a glucometer. The result shows that the APE extract could reduce blood glucose due to high fiber contained. Most of the rats fed by APE extract showed slightly higher blood glucose level than rats fed by the antidiabetic drug (glibenclamide). This is because the concentration of APE used is lower than glibenclamide. APE extract 1 and 3 with a level of 200 and 50 mg, respectively, significantly reduced the blood glucose level after 90 min treatment compared to diabetic rats. Therefore it can be concluded that APE could be used to reduce blood glucose level.

4 CONCLUSIONS

Galactomannan obtained from APE 1 – 3 were 1.688, 4.267, and 3.158%, while mannan was occurred at 0.504, 1.140, and 2.966%, respectively. APE extracts 1 and 3 with a dosage of 200 and 50 mg, respectively significantly reduce blood glucose level after 90 min treatment compared to diabetic rats. APE potentially could be used to reduce blood glucose level and do not have any side effect.

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