Increasing Content Of Local Commodity Resistant Starter For Health

Welli Yuliatmoko, Eko Yuliastuti, Dini Nur Hakiki

Abstract: Changes factor of the style of life today has increased a wide range of degenerative diseases such as diabetes, stroke, heart coroner, and dyslipidemia. Functional Food has been believed to be an alternative in preventing or reducing these diseases. The ability of functional foods to have health effects is due to the presence of bioactive components they contain. Indonesia is rich will be the product local potentially enhanced content of bioactive components such as resistant starch. The large population, increasing awareness and public welfare have the potential to increase demand for functional food products or products that have health effects. The content of resistant starch in local products can be increased through various efforts such as processing modifications, increasing the amylose content of the material, modifying particle size, and adding chemicals.

Index Terms: Resistant Starch, health, local commodity, functional food, dyslipidemia.

1 INTRODUCTION

Dyslipidemia can be defined as a lipid metabolism disorder characterized by an increase in LDL and total cholesterol, an increase in triglycerides and a decrease in HDL cholesterol in the blood plasma [1]. Dyslipidemia is one of the main risk factors for coronary heart disease [2]. Thus, it must be treated immediately because it can trigger other more severe diseases such as coronary heart disease. The treatment of dyslipidemia is currently still dominated by the use of chemical drugs such as simvastatin, colistyramine and so on [3]. The use of chemical drugs for a long period of time can harm the user because it can cause unwanted side effects. Another alternative in dealing with the condition of dyslipidemia and other degenerative diseases are food consumption funsional which can be obtained from plants local. The functional properties of functional foods are determined by the bioactive components they contain, such as antioxidants, inulin, FOS, dietary fiber, and resistant starch. Resistant starch is a type of starch that is difficult to digest in the small intestine but can be digested in the colon and produces several products such as acetic acid, propionate, butyrate, and others which are reported to have health effects. The physiological effects of resistant starch are closely related to its physical and chemical properties. Publication Some of the physiological effects of resistant s tarch include: viscosity, fermentability, water binding capacity, absorption of organic molecules and ion exchange properties [4]. With the physiological effects of resistant starch can reduce the absorption of glucose and cholesterol. Thus Konsum the starch resistant that can prevent diabetes or hyperkolesterol. Resistant starch can produce short chain fatty acids or better known as SCFA (short chain fatty acids), such as acetate, propionate and butyrate. Propionic acid is reported to prevent the rise of cholesterol. Meanwhile, butyrate is reported to prevent colon cancer. Resistant starch has also been reported to prevent constipation The content of resistant starch in raw foods is usually small. However, the percentage of resistant starch content can be increased by several processing efforts and others. Several f actors that can influence the establishment of the hospital, among others

a) Intrinsic properties of natural starch. These properties include starch crystalline form, starch granule structure, amylose to amylopectin ratio, and amylose chain length. Starch granules with type B crystallinity have greater resistance to enzymes.
b) Heat and water
c) Interaction of starch with other components
d) Heating process
e) Various kinds of treatment
f) Storage condition diverticulosis

By knowing the factors that influence the formation of hospitals and the ability to modify these factors, various technologies can be developed to increase hospital content. Several technologies can be used to increase the RS content, such as blanching, steaming ceriping and cooling, autoclaving-cooling, and others. The purpose of the article is to describe several technologies that have succeeded in increasing the content of local plant hospitals.

2 RESISTANT STARCH

Physiologically, RS is defined as the amount of starch that is not absorbed in the small intestine of healthy individuals [5]. Analystically, RS is defined as starch that is resistant to dispersion in boiling water and hydrolysis of amylase prankreas and pullulananase, but can be dispersed by KOH and hydrolyzed by amyloglucosidase [6].

Hospitals can be classified into 5 (five) including:

(1) RS1 is RS that cannot be hydrolyzed because the starch is protected or physically trapped in the matrix, for example in whole or broken cereals and legumes as well as in highly dense processed starchy foods. In chemistry, RS1 is determined based on the difference between the glucose liberated by enzyme digestion of food samples homogeneous and released from non-homogeneous samples. RS1 is heat stable in most normal cooking methods, so a variety of conventional foods are possible sources of RS.
Mathematically, RS1 = TS - (RDS+SDS) – RS2-RS3

(2) RS2 is RS that cannot be hydrolyzed because raw starch is contained in starch granules with a strong and dehydrated radical structure structure, making it

- *Welli Yuliatmoko is a lecturer at the open university food technology study program. Jl. Cabe Raya Pondok Cabe, Pamulang, South Tangerang, Banten, Indonesia. Email: welli@ecampus.ut.ac.id*
- *Co-Author name is Eko Yuliastuti, and Dini Nur Hakiki) are lecturers at the open university food technology study program. Jl. Cabe Raya Pondok Cabe, Pamulang, South Tangerang, Banten, Indonesia.*

difficult for enzymes to access when they are raw or ungelatinized , for example in potato starch, green banana flour, and corn starch. However, if the starch granules receive hydrothermal treatment or cooking so that they undergo starch gelatinization, the presence of RS2 can be reduced or even lost. RS2 was determined based on the difference between glucose liberated from enzymatic hydrolysis in inhomogeneous food samples that were not boiled. RS1 and RS2 are starch residues which are digested incompletely and very slowly in the small intestine. Mathematically, RS2 = TS-(RDS+SDS) – RS1-RS3

(3) RS3 is RS resulting from retrogradation of starch which forms a strong structure due to the presence of hydrogen bonds so that it is resistant to enzyme hydrolysis. RS3 is the most important RS in processed foods because it is formed from the retrogradation of amylose during starch gelatinization and cooling. Chemically RS3 was determined as the fraction that was not dispersed during boiling and was resistant to digestive enzymes (amylase). RS3 can only be dispersed by KOH or dimethyl sulfoxide (DMSO)
Mathematically, RS3 = TS – (RDS+SDS)-RS1-RS2

(4) RS4 is RS which is formed due to chemical modification to form bonds such as (1-4) and (1-6) bonds so that it will block the access of enzyme work. Chemical modification of starch can be carried out by esterification, acid modification, and oxidation or cross-linking.

(5) RS5 is the RS formed due to the interaction of starch (amylose and amylopectin) with lipids (fatty acids) to form a complex that is resistant to hydrolysis of the amylase enzyme. Amylose-lipid interactions can occur in natural or processed starch granules. Besides being difficult to digest by enzymes, the formation of RS5 complex also causes limited swelling ability ofstarch granules. RS type 5 is known to have the ability to reduce the development of colon cancer.

3 TECHNOLOGY OF LEADING IMPROVEMENT OF LOCAL COMMODITY RESISTANT STARCH

3.1 Ceriping

Ceriping's treatment of local products can increase the RS content of these local products. Ceriping treatment on bananas can increase RS by 14.5%. While the Cerping treatment on breadfruit can increase RS levels by 47% (Table 1). The increase in RS in the ceriping treatment came from the frying and drying process. Both processes allow the formation of retrograded starch which is resistant to digestive enzymes.

TABLE 1. RS CONTENT OF SOME FRESH FOOD INGREDIENTS AND THEIR CHERRY PRODUCTS

Sample	Resistant starch (mg/g)	
	Fresh	Ceriping
Banana	9,0	10,7
Cassava	11,5	13,5
Breadfruit	13,6	20,0
Melinjo	11,7	13,4

Frying treatment can increase the RS content of food ingredients. Frying treatment on local products of banana to pok and banana horn (Fig 1). The increase in RS content in kapok bananas and horn bananas due to frying treatment can cause gelatinization events with less water, causing incomplete gelatinization and increasing the RS content. In addition, the increase in RS content of kapok and horn bananas was due to the formation of amylose-lipid complexes which were more difficult to digest [7].

3.2 Steaming

Steaming treatment can affect the content of some foodstuffs RS lok al. Steaming Gembili, Suweg, Uwi, and Breadfruit can increase the RS content of the ingredients.

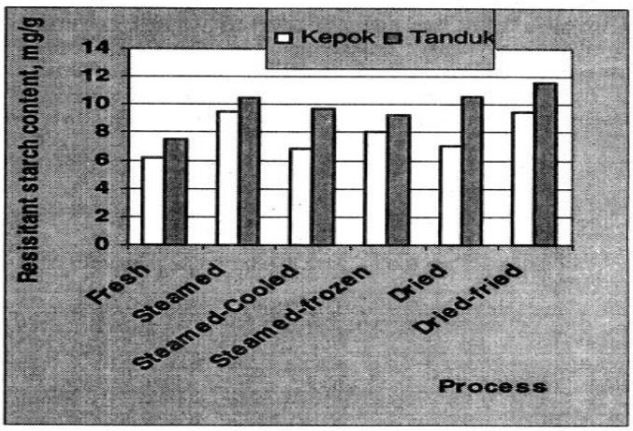

Fig. 1. The Effect of Processing on the Levels of the Kepok banana and Tanduk banana RS

The increase in the hospitalization of local foodstuffs due to the steaming treatment is thought to involve gelatinization and retrogradation processes (Marsono, 1998). Meanwhile, the treatment of steaming on local ingredients such as entik, banana, and rice expeienced a decrease in RS. At the local food Entik RS content of crude by 6.9 mg / g db RS decreased to 6.5 mg / g db. Unripe bananas have RS content of 9.5 mg / g db decreased hospital after getting a steaming treatment to 7.9 mg / g db. The decrease in RS content in local ingredients is suspected to be due to the physical release of starch molecules during preparation before steaming and during steaming.

3.3 Autoclaving-Cooling Process

The combination of Autoclaving-Cooling and Citric Acid Hydraulics can increase the amylose and RS content of foodstuffs. Autoclave treatment-cooling of local wallet varieties of mung bean can increase amylose by 20 % and RS levels by 47.3% [8] (Table 1). Pressurized heating and hydrolysis of citric acid are thought to cause amylopectin branching to be cut straight chains with shorter chain lengths and smaller molecular weights that contribute to an increase in amylose content and RS-3 levels [9].

TABLE 2. RS AND AMYLOSE LEVELS OF RS-3 WALLET VARIETY MUNG BEAN STARCH WITH A COMBINATION OF 2 CYCLE AUTOCLAVING AND CITRIC ACID HYDROLYSIS

Sampel	Resistant starch (RS) % bk	Amilosa %bk
Natural starch*)	10,58[a]	55,39[a]
RS-3 Combination of 2 cycle autoclave and citric acid hydrolysis	15,58[b]	66,47[b]

Different superscripts in one column indicate a significant difference ($p < 0.05$)
*) Triwitono et al (2016).

Modified acid hydrolysis

Modified acid hydrolysis can increase the RS content of foodstuffs [10].

Acid hydrolysis using hydrochloric acid has been carried out on several types of starch, including arrowroot starch [11], sweet potato starch [12], banana starch [10] and peanut starch. Pods [13], and Sago Ihur starch [14]. The process of acid hydrolysis in increasing the RS content of foodstuffs can be explained as follows. The acid hydrolysis process occurs in two stages of attack on the starch granules, namely the fast attack stage on the amorphous part and the slower attack stage on the crystalline part of the amylopectin fraction. Starch treated hydrolysis hydrochloric acid will result in termination of the amylose chains, thereby causing the release of molecules less soluble in water and is too short to form a complex with iodine. Besides that, hydrolysis causes the breaking of amylose chains into simple sugars, such as dextrins [15].

3.4 Treatment that lowers RS

Treatment using acid has been reported to reduce levels of amylose (18.29 - 27.22 %) and RS levels (0.06 - 0, 37%) [14].

4 RESISTANT STARCH HEALTH CLAIMS

The physiological effects of resistant starch are closely related to its physical and chemical properties. Several physiological effects of resistant starch are related to physical and chemical properties, including: viscosity, fermentability, water binding capacity, absorption of organic molecules and ion exchange properties [4]. The health effects of functional food sources of resistant starch are closely related to the physiological effects of RS. Resistant starch gives high viscosity to digesta. This property can reduce the absorption of glucose and cholesterol, so that high RS consumption can prevent diabetes and hypercholesterolemia. Resistant starch in the colon will ferment to produce SCFA (short chain fatty acids), including acetate, propionate and butyrate which are reported to prevent the increase in cholesterol (propionate) or prevent colon cancer (butyrate) (Fig. The large water-binding capacity of dietary fiber can result in bulk digestion (intestinal contents) and high water content, thereby preventing constipation and diverticulosis. The ability to bind organic molecules can result in the binding of bile and ultimately can lower cholesterol. Thus it is clear that resistant starch can prevent type II diabetes, prevent hypercholesterolemia and nourish the colon. Food sources of resistant starch include bran, vegetables, fruit, cereals, and seaweed to prevent diabetes and hypercholesterolemia [16].

Recent research related to the health claims of resistant starch in local food reports that the dietary intervention of EBP Batang Pisang J 30 flour with 10 minutes blanching treatment (EBP J30 blanching) and canna starch food bar substituted with EBP J30 flour (food bar) was reported to reduce total cholesterol levels. , LDL cholesterol, triglyceride cholesterol, and increased serum HDL cholesterol levels of hypercholesterolemic Sprague Dawley rats. Meanwhile, the in vitro test results show that the diet of EBP J30 blanching flour and food bars can increase the ability to bind bile acids (Fig.3). EBP J30 blanching flour and food bars can improve the lipid profile of hypercholesterolemic rats allegedly because they have the capacity to increase bile acids in the blood [17].

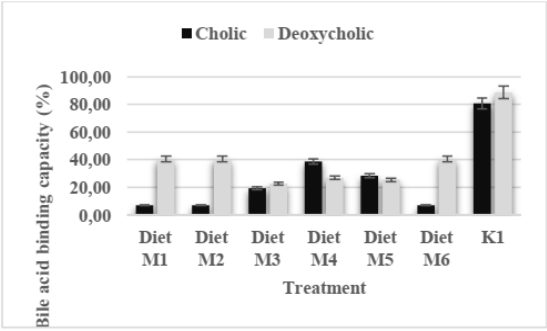

Fig. 3. Bile acid binding capacity in each treatment. Standard feed diet (M1, M2), Natural EBP flour diet (M4), EBP blanching flour diet (M5), Food bar diet diet (M6), Colistyramine (KI). Different letter notations behind the mean standard deviation in the same figure show significant differences ($p < 0.05$).

5 CONCLUSION

Indonesian is very rich will be food or local products such as tubers, horticultural, and others. These local ingredients contain very diverse bioactive components. One of the boactive components of local plants is resistant starch (RS) which has health claims such as preventing constipation and diverticulosis, lowering cholesterol, and preventing colon cancer. The resistance starch content of raw products is very low. The content of resistant starch in local products can be increased through various efforts such as processing modifications, increasing the amylose content of the material, modifying particle size, and adding chemicals.

ACKNOWLEDGMENT

The author would like to thank Mrs. Eko Yuliastuti and Dini Nur Hakiki who have helped write this article.

REFERENCES

[1] P.M. Arsana, R. Rosandi, A. Manaf. Guidelines for the management of dyslipidemia in Indonesia-2015. PB. Perkeni, 2015.
[2] J. Fulcher, R. O'Connell, M. Voysey, “Efficacy and safety of LDL-lowering Therapy among men and women: a metaanalysis of the data from 174 000 Individual of participants in 27 randomized trials,” The Lancet, vol. 385, pp. 1397– 1405, 2015.
[3] A. Erwinanto, J.N.E. Santoso, P. Putranto, R. Tedjasukmana, R. Sukmawan, S. Suryawan, S. Rifki, and S. Kasiman, Panduan Procedure Dyslipidemia. First

edition. Indonesia. PP. Perki, 2017.
[4] Y. Marsono, “Dietary Fiber in the Perspective of Nutritional Science,” Unpublished.
[5] N.G. Asp and. I. Bjorck, Resistant Starch. In Trends in Food Science and Technology 3: Elsevier, London, pp.111-114, 1992.
[6] I.D. Morton, Cereals in a European Contex. Chichester: Firs European Conference on Food Science and Technology, Ellis Horwood, pp. 221-233, 1987.
[7] Y. Marsono, “Effect of Processing on Resistant Starch of Banana Kepok (Musa paradisiaca fa.typica) and Horned Banana (Musa paradisiaca fa. Corniculata),” Agritech vol.22 No.2 pages 56-59, 2000.
[8] P.Triwitono, M. Yustinus, M. Agnes, W.M. Djagal, “The effect of two cycles autoclaving and citric acid Hydrolysis Combination to Chemical and Physical Characteristic of Mung Beans (Vigna radiate L.) Starch RS-3,” AGRITECH, VOL.3, No.3. pp. 312-318, (2017).
[9] S. Ozturk, H. Koksel, and Ng, PKW, “Production of resistant starch from Acid Modified amylotype starches with enhanced functional Properties,” Journal of FoodEngineering 103: 156–164, 2011
[10] A. Aparicio-Saguilán, E. Flores-Huicochea, J. Tovar, F. Gracíasuárez, F. Gutiérrez-Meraz & LA. Bello-Perez, “Resistant starch-rich powders prepared by autoclaving of native And lintnerized banana starch: partial characterization,” Starch/Stärke, 57(9), 405–412, 2005.
[11] D.N. Farida, W.P. Rahayu, and M.S. Apriadi, “Arrowroot starch modification (Marantha arundinacea) by acid hydrolysis treatment and heating-cooling Cycle for Produces type 3 resistant starch,” Journal of Agricultural Industrial Technology, 23(1), 61-69, 2013.
[12] K.O. Falade and A.E. Ayetigbo, "Effects of annealing, acid hydrolysis and citric Acid modifications on physical and functional properties of starches from Four yam (Dioscorea spp.) cultivars,” Food Hydrocolloids, 43, 529–539, 2015.
[13] U. Lehmann, C. Rossler, D. Schmiedl & G. Jacobasch, “Production and Physic chemical characterization of resistant starch type III derived from pea starch,” Nahrung, 47(1), 60–63, 2003.
[14] F.J. Polnaya, A. A. Huwae, G. Tetelepta, “Physico-chemical and Functional Properties of Ihur Sago (Metroxylon sylvestre) Starch by Modified Acid Hydrolysis,” Agritech, 38 (1). pp 7-15, 2018
[15] F. Kusnandar, Macro Component Food Chemistry. Jakarta (ID): PT. People's Diane, 2010.
[16] Y. Marsono, Y, “Prospects for the development of functional foods,” JournalFood Technology and Nutrition 7(1): 19-27, 2008.
[17] W. Yuliatmoko, A. Murdiati, Y. Pranoto, Y. Marsono, “The Effect of Banana Pseudostem Flour and Food Bar of Edible Canna Substituted with Banana Pseudostem Flour on Lipid Profile of Hypercholesterolemia Mice,” International Journal on Advanced Science Engineering Information on Technology. Vol 11. No. 1.PP. 197-203, 2021.