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### Analysis on the use of packaged pineapple juice as an alternative for oral negative contrast medium in magnetic resonance enterography (MRE)

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#### ABSTRACT

##### Background

Oral negative contrast medium used for Abdominal examination made of chemicals has some negative effects on the body and some are difficult to find in the market and are expensive too. Thus, the solution is to conduct a study to find alternative oral negative media in abdominal MRI examination by using fruit ingredients such as, blueberry juice, pineapple juice and tea that contain lots of manganese (Mn) [1]

##### Objective

This study by using natural alternative oral negative contrast medium in MRE that is considered to be ready in Indonesia, the taste is acceptable and not cause a negative effect after its use [2, 3]

##### Methods

This study was an experimental study with Pretest-Posttest Control Group Design. Data analysis was performed with One Way Anova Test and Repeated Anova with Tukey's Post Hoc test.

##### Results

There was a difference on the digestive system diameter before and after the administration of packaged pineapple juice as an alternative oral negative contrast medium in MRE examination with p value < 0.05

##### Conclusion

p value was 0.043 and the optimal scanning time in MRE image was 20 minutes after the administration of packaged pineapple juice based on the highest Mean Rank with the value of (20.16).

##### Recommendation

Packaged pineapple juice with high manganese content can be an alternative oral negative contrast medium in MRE examination with optimal scanning time at 20 minutes after the administration.

**Keywords:** MR Enterography, Packaged Pineapple Juice, Oral Negative Contrast medium

## INTRODUCTION

Crohn's disease is an ulcero-inflammation abnormality in the digestive system that is chronic and can attack any segment of the digestive system, especially in the distal part of the small intestine and right colon<sup>4</sup>. In the United States there were 10% of Crohn's disease cases per 100,000 lives each year. In Indonesia the prevalence of Crohn's disease among patients was 5.2% [5, 6]

In supporting the diagnosis of abnormalities in the small intestine, colon and stomach imaging is done by conventional radiography with contrast medium and CT scan. CT scan requires iodine contrast medium, which is relatively expensive, nephrotoxic, and can cause allergic reactions and cause radiation effect during examination. MRI is still the gold standard in showing soft tissue dominated areas [7]

Abdomen MRI examination without contrast medium does not show significant changes. MRI contrast medium will shorten T1 time on tissue and T2 relaxation. MRI contrast agents can be applied intravenously or orally based on the target tissue. Most contrast medium are used for gastro intestinal (GI) and hepatobiliary examination [8]. MRI Enterography examination is an MRI examination intended to show anatomy and pathology in the small intestine, colon and sequent. T2WI Coronal and HASTE Coronal are usually used in this examination. MRI Enterography is often carried out using oral contrast medium to visualize the small intestine and colon optimally after enhancement and show the width of the small intestine lumen due to the influence of the contrast medium administered [9]

MRI contrast media are grouped into positive contrast and negative contrast. Oral negative contrast media are used for the examination of the abdomen, namely Gadopentate dimeglumine, Ferric ammonium citrate, Manganese chloride, Kaolinate, antacid, Barium sulfate and ferric particles but some of them are difficult to find in the market and are expensive, so alternative natural oral negative contrast medium is required by using ingredients made from drinks/juices, namely, blueberry juice, pineapple juice which contain a lot of manganese (Mn) [1]. The use of natural contrast medium is estimated to be safer for patients and can minimize any chemical allergic effects. The use of tea gives the patient a bitter taste. The use of contrast from

blueberry juice is difficult in Indonesia because the fruit is not produced in Indonesia, while pineapple juice has been readily used by mixing it with contrast media of gadopentate dimeglumin, ferumoxsil lumirem, Gd-DOTA on MRCP. The use of pure pineapple juice on MRCP examination gives an acidic taste to the patient. Due to this limitation, a study will be conducted on the natural alternative oral negative contrast media considering that it can be obtained in Indonesia and the taste is acceptable and does not have a negative effect after its use. [2, 3]

Pineapple Juice is known to have the shortest T1 (243 ms) and the shortest T2 (48 ms). Manganese content for several ingredients can be listed as follows: Milk, Orange Juice, Pineapple Juice, Pineapple Juice 2, Apple Juice, Prune Juice, Blackcurrant Juice, Blueberry Juice, Raspberry Juice, Blackberry Juice (0.09; 0.04; 0.92; 0.92; 0.07; 0.15.0.26; 0.33; 0.33; 0.32). Pineapple juice is safe to use as a contrast medium in neonatal patients. [2] In the MRI Gastrointestinal examination, it is necessary to provide contrast media. Ideal contrast media should be easily tolerated, providing a high signal increase. [3] The use of barium sulfate contrast in gastrointestinal studies has a risk of spills into the respiratory tract or perforation (especially in pediatric studies). Water supply can be neonatal contrast (provides high contrast in the T2W image) but does not allow optimal identification of parts of the flexures, Duodenum and Jejunum, it is difficult to distinguish between existing fluids in jejunal loops and water used. In addition, currently there are no gadolinium-based contrast agents licensed for oral use in children. Thus the solution is to look for paramagnetic properties of fruit juices such as pineapple or blueberry juice to suppress signals from intestinal fluid in pediatric that are safe for children [3]

GI (Gastrointestinal) positive contrast agents will increase signal intensity in the intestinal lumen and GI negative contrast agents will reduce the signal intensity in the intestinal lumen. GI negative contrast agents cause darkening of the area (lumen) so that T1W and T2W are obtained, due to shortening of T2 relaxation from positive contrast agents. [10]

Ideal contrast agent on GI must have certain properties such as tolerability, availability, easy preparation, not stimulating peristalsis,

homogeneously distributed in the GI, does not be absorbed into the systemic circulation, stable characteristics of the contrast effect, complete energy, not related to artifacts, raise diagnostic sensitivity, cost effective and has high safety [10]. Abdominal MRI imaging procedures generally need 500-900 ml (milliliters) of oral contrast agents administered after at least 4 hours of fasting [10, 11]

Pure pineapple juice is a drink containing almost 2.76 mg/dl (milligrams/deciliter) of manganese. This shows that pineapple juice has the ability to shorten T2 relaxation time through in vitro examination. Manganese is the agent responsible for signal reduction and Pineapple Juice also has the highest amount of manganese content [3]. This study is expected to provide a practical, safe, affordable alternative to natural oral negative contrast media for MRE abdomen examination with the best starting time by using negative contrast medium of packaged pineapple juice with scanning start time variation of 10, 20 and 30 minutes after the administration of packaged pineapple juice with the Hastern sequent to obtain the best scanning start time for MR Enterography. Based on a preliminary study with laboratory tests conducted by the Udayana University Analytical Laboratory using the ICPE method for several types of packaged pineapple juices, it was known that packaged pineapple juice with brand A showed the highest Manganese (Mn) content (8.85 mg/L) compared to brand B (8.60 mg/L), brand C (6.10 mg/L), brand D (2.97 mg/L) and brand E (2.95 mg/L) [12]

## METHODS

This was an experimental study with Pretest-Posttest Control Group Design conducted at the

Radiology Unit of Kasih Ibu Hospital Denpasar. The size of the sample was 40 people with a number of samples per group of 10 people (1 control group and 3 treatment groups). The independent variable in this study was the administration of oral packaged pineapple juice as an alternative to negative contrast medium. The dependent variable in this study was information on MRE images (including the diameters of ileum, duodenum, jejunum and stomach).

The study was conducted by identifying the samples' characteristics including age, sex, history of disease, claustrophobia, weight. Volunteers who agreed to take part in the study were asked for written evidence through informed consent, then random allocation was carried out to group them into 1, 2, 3 treatment groups and the control group. After fasting for 6 hours, MRE scanning was carried out to the control group, without the provision of packaged pineapple juice (pre test), then scanning on 10, 20, 30 minutes were carried out afterwards without the administration of packaged pineapple juice (post test). For the treatment group, after fasting for 6 hours, MRE scanning was carried out (pre test), then after that the samples started to drink packaged pineapple juice (500 ml), and scanning rprocess (post test) were carried out, namely to treatment group 1 (X1: 10 minutes), treatment 2 (X2: 20 minutes), treatment 3 (X3: 30 minutes) with coronal oblique slices TSE 3D sequence and T2W coronal Haste. Assessment of diameter, anatomical information of the ileum, jejunum, duodenum and stomach after administration of pineapple juice, both pre-test and post-test were carried out by 1 radiographer using the measurements/tools found on MRI planes. Data analysis was performed with One Anova Test and Repeated Anova with the Tukey's Post Hoc test [13].

## RESULTS AND DISCUSSION

Table 1. The Effect of oral packaged pineapple juice on the digestive system diameters

Variable	Pre	Post	P value
	Mean±SD	Mean±SD	
Control	12.56±2.00	12.70±2.058	0.279
10 minutes	14.54±1.57	104.46±10.52	0.001

met	20	20.25±	134.93±	<0.00
er	minutes	3.38	13.47	1
	30	16.45±	105.59±	0.001
	minutes	2.54	10.89	

Information:

Wilcoxon Test was performed for the control group.

Paired T test was conducted for the treatment group.

There was no difference in diameter of the digestive system before and after the administration of packaged pineapple juice in the control group with p value = 0.279. In the treatment group, there

were differences in the diameter of the digestive system between before the administration of packaged pineapple juice and 10, 20 and 30 minutes after the administration of oral packaged pineapple juice as an alternative to negative contrast medium with p values (= 0.001, <0.001, 0.001), respectively.

**Table 2. Bivariate Test Analysis on the Effect of oral packaged pineapple juice on anatomical information on digestive system**

Variable		Mean Rank		p value
		Pre	Post	
Anatomical Information	Control	2.00	4.00	0.705
	10 minutes	0.00	3.50	0.027*
	20 minutes	0.00	3.50	0.027*
	30 minutes	0.00	3.50	0.027*

There was no difference in anatomical information on the digestive system before and after the administration of oral packaged pineapple juice as an alternative to negative contrast medium in the control group with p value = 0.705. In the treatment group, there were differences in the anatomical information of the biliary system and

the digestive system between before the administration of packaged pineapple juice and after the administration of packaged pineapple juice as an alternative negative contrast medium 10 minutes, 20 minutes, 30 minutes with p values of <0.05.

**Table 3. Different Test on Magnetic Resonance Enterography Diameter After the Administration of Packaged Pineapple Juice as Alternative Negative Contrast medium**

Variable	Mean	p value
Control	12.7	
10 minutes	104.76	
20 minutes	134.93	0.043
30 minutes	105.59	

There was a difference in the diameter values of the digestive system of each group after the administration of packaged pineapple juice with p

value of 0.043 (<0.05). Further diameter assessment from Magnetic Resonance Enterography after administration by using

packaged pineapple juice was carried out with Tukey’s HSD Post Hoc.

**Table 4. Different Test on Digestive System Diameters on Inter-group MRE examination After the Administration of Packaged Pineapple Juice as Alternative Negative Contrast medium**

Variable	Cont rol	10 min utes	20 min utes	30 minu tes
Di a m e t e r	-	<0.01*	<0.01*	<0.01*
Control	-	<0.01*	<0.01*	<0.01*
10 minutes	<0.01*	-	0.189	1.00
20 minutes	<0.01*	0.189	-	0.208
30 minutes	<0.01*	1.00	0.208	-

Analysis of the differences in the effect of oral packaged pineapple juice as an alternative to negative contrast medium between each scanning time in the anatomy of diameter using Magnetic Resonance Enterography showed that there were differences between the control group and the treatment groups of 10 minutes, 20 minutes and 30

minutes with p values of <0.05. There were no differences in the effect of oral packaged pineapple juice as an alternative to negative contrast medium between the groups of 10 minutes, 20 minutes and 10 minutes with 30 minutes, with p values of > 0.05.

**Table 5. Homogeneous Subset Results on Anatomical Information of MRCP, MRE After the Administration of Packaged Pineapple Juice**

Variable	Group	Subset for alpha = 0.05	
		1	2
Anatomical Information MRE	Control	14.83	
	10 minutes	14.50	
	20 minutes		20.1667
	30 minutes	15.66	
<i>p value</i>		0.350	0.983

From the Homogeneous Subsets test table, MRE information were grouped into 2 subsets. In subset 1 there were the control group, 10 minutes and 30 minutes which meant that the assessments of anatomical information in the control group and 10 minutes, 30 minutes groups were the same or homogeneous. In subset 2 there were the groups of 20 minutes, which meant that the assessment of

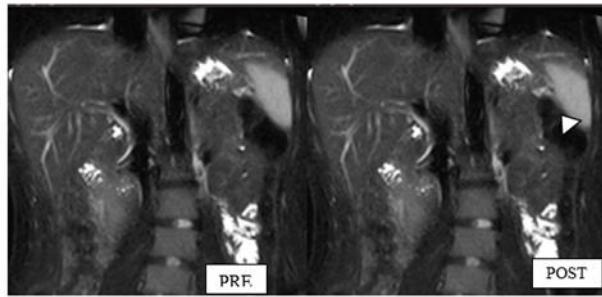
anatomical information in the 20-minute groups were the same or homogeneous. The highest mean rank for assessment of magnetic resonance enterography anatomical information was found in the 20-minute group with the value of (20, 16). Thus, the optimal time to start scanning using oral packaged pineapple juice as an alternative to negative contrast medium in producing an MRE

image was at 20 minutes with the highest mean rank of 20.16.

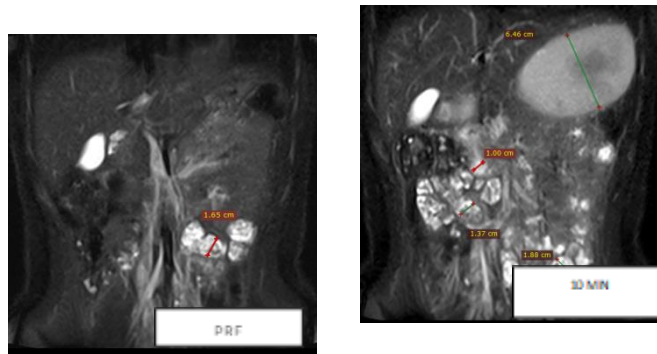
There was a difference in anatomical information of the biliary system and the digestive system before and after treatment (p value <0.05). Manganese content in oral packaged pineapple juice as an alternative to negative contrast medium serves to suppress the T2 signal so that the suppressed signal will appear dark (hypointense) on MRI<sup>2</sup>

The biliary and digestive systems diameters of the control group showed no difference (p values > 0.05). The anatomical information of the biliary and digestive systems appeared unclear in the control group that did not receive packaged pineapple juice. The MR Enterography examination for the control and treatment groups also could not show the images of the small intestine (ileum, jejunum and duodenum) including the stomach, this

was due to the absence of manganese contrast at the MRE examination so that there was no agent that pressed/reduced the signal intensity such as in the intestinal lumen. This led to no change in the signal intensity of the digestive system because without the administration of pineapple juice containing manganese, T2 relaxation time would run according to its phase. T2 relaxation time is the time needed for a tissue to lose its energy up to 63% [11]. When T2 relaxation occurs there is an energy exchange between nuclei with one of the other nuclei around it which is called spin-spin relaxation and it produces decay which results in a short T2 relaxation time so that the visualization of the digestive system image will appear hypointense (dark) resulting in non-visualization of the digestive system in Magnetic Resonance Enterography.

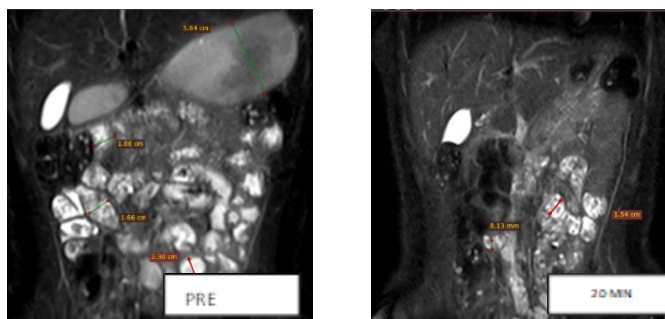


**Figure 1. MRE Image Before the administration of Packaged Pineapple Juice as an alternative negative contrast medium**



There is no visible stomach and parts of the small intestine such as the ileum, duodenum clearly.

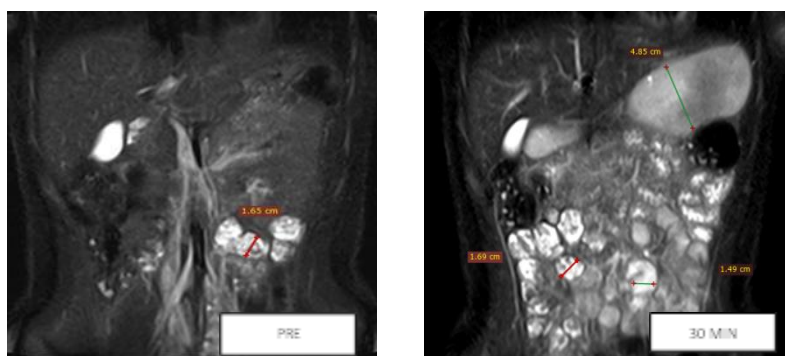
**Figure 2. MRE Image before and after 10 minutes administration of Packaged Pineapple Juice as an alternative negative contrast medium.**



**Figure 3. MRE Image before and after 20 minutes administration of Packaged Pineapple Juice as an alternative negative contrast medium; Biliary System**

There were differences in the diameter of the small intestine and stomach between before and after treatment (p values <0.05). Most of the biliary system length and diameter of the digestive system have increased due to the level of manganese in packaged pineapple juice capable of suppressing

the signal intensity of particular tissues (T2-weighted image). Thus, the signal will be looked dark in the MRI image. Manganese-containing fluids are able to shorten T2 relaxation time and hence reduce T2 signal intensity in MR Enterography [2, 3]



**Figure 4. MRE Image before and after 30 minutes administration of Packaged Pineapple Juice as an alternative negative contrast medium; Digestive System**

The administration of packaged pineapple juice orally as an alternative to negative contrast medium containing manganese could improve the visualization of the digestive system which then increases the diameter, anatomical information of the digestive system in the groups of 10 minutes, 20 minutes and 30 minutes. The diameter of the digestive system experienced a significant increase at 10 minutes to 30 minutes (p values <0.05).

The highest mean rank assessment of anatomical information on the digestive system was in the 20-minute group (20, 16). Thus, the optimal time to start scanning using oral packaged pineapple juice as an alternative to negative contrast medium in producing Magnetic Resonance Enterography image was in the treatment group of 20 minutes. This is in accordance with the

reference time needed for drinks to reach the small intestine of around 15-20 minutes [14]

Overall, the differences in the image information of Magnetic Resonance Enterography both in the effect of oral pineapple juice on diameter and anatomical information proved that the administration of packaged pineapple juice with an manganese content of 8.85 mg/L could be used as an alternative to negative contrast medium, which significantly improved MR Enterography imaging quality with optimal scanning start time of 20 minutes after the administration of packaged pineapple juice in MRE. Packaged pineapple juice is very practical, there are no side effects when consumed, the price is much cheaper than other negative contrast media, it feels familiar to Indonesian tongues and it is easily available for MR Enterography examination on digestive system.

## CONCLUSION

The use of packaged pineapple juice was proven to be effective to produce optimal MRE image information on the digestive system as an alternative to negative contrast medium. There was a difference in the diameter of the digestive system before and after administration of packaged pineapple juice as an alternative negative contrast medium in MR Enterography examination with p value of <0.05 (p value was 0.043). In this study, the optimal scanning start time in generating

digestive system MRE image was 20 minutes after the administration of packaged pineapple juice as an alternative negative contrast medium based on mean rank assessment, the highest MRE anatomical information was in the group of 20 minutes with a value of (20,16)

## RECOMMENDATION

Oral packaged pineapple juice containing 8.85 mg/L of manganese could be used as an alternative negative contrast medium in Magnetic Resonance Enterography examination on digestive system.

## REFERENCES

- [1]. Blakley M. Evaluation of Oral Contrast Agents Are Nature Agents as Effective s Artificial?. Rose State Collage. 2008
- [2]. Owen J Arthurs, Martin J Graves, Andrea D Edwards, Ilse Joubert, Pat AK Set, David J, Interactive neonatal gastrointestinal mannetic resonance imaging using fruit juice as an oral contrast medium. Arthurs et al. BMC Medical Imaging. 14, 2014, 33
- [3]. Owen J. O., Siobhan O. and Maher M. Imaging of Biliary Tract Disease. Residents in Radiology, AJR. 197, 2011, W551-W558
- [4]. Liu C, Crawford JM. The Gastro-intestinal Tract. In: Kumar V, Abbas AK, Fausto N. Robbins and Cotraan. Pathologic Basis of Disease. Philadelphia: Elsevier Saunders,: 7, 2005, 847- 85
- [5]. Perkembangan Terkini Diagnosis dan Penatalaksanaan Inflammatory Bowel Disease (IBD). 2018. <https://www.researchgate.net/publication/321824062>
- [6]. Kelompok Studi Inflammatory Bowel Disease Indonesia. 2011. Konsensus nasional penatalaksanaan inflammatory bowel disease (IBD) di Indonesia. Jakarta: Perkumpulan Gastroenterologi Indonesia
- [7]. Singh, A., Mann, H. S., Thukral, C. L., & Singh, N. R. Diagnostic accuracy of MRCP as compared to ultrasound/CT in patients with obstructive jaundice. Journal of Clinical and Diagnostic Research, 8(3), 2014, 103–107. <http://doi.org/10.7860/JCDR/2014/8149.4120>
- [8]. Nai –Chi Chiu. Yi-You Chiou. Role of MRCP in the measurement of the CBD diameter. Journal of the Chinese Medical Association. 75, 2012, 423-424
- [9]. Christiane A Kuehle, dkk. Hydro-MRI of the Small Bowel: Effect of Contrast Volume, Timing of contrast Administration and data Acquisition on Bowel Distension. 2006.
- [10]. Naglaa Mostafa Elsayed, Shaykha Ali Alsalem, Sultan Abdullah Ali Almugbel, Manal Mane Alsuhaime. Effectiveness of natural oral contrast agents in magnetic resonance imaging of the bowel. The Egyptian Journal of Radiology and Nuclear Medicine. 46, 2015, 287–292
- [11]. Westbrook C and Kaut C. MRI In Practice. Blackwell Sciences Ltd. United Kingdom. 2, 1999.
- [12]. UPT Lab Universitas Udayana, 2016. Hasil Uji Analisis Mangan. Universitas Udayana. Denpasar
- [13]. Dahlan MS. Statistik untuk Kedokteran dan Kesehatan. In: Suslia A. Eds. Jakarta: Salemba Medika. 5, 2012, 31-150.
- [14]. Wylie L. Essential Anatomi dan Fisiologi. In: Praptiani W. Eds. Jakarta: Buku Kedokteran EGC; 2, 2011, 160-161.

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