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THE USE OF GREEN BEAN JUICE AS AN EFFORT TO IMPROVE MSCT IMAGE IN ABDOMEN MSCT PROTOCOL (IN VITRO STUDY)

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KEYWORDS
green bean juice, enhancement, in vitro, msct abdomen.

ABSTRACT
Oral contrast media usually used in abdominal MSCT examinations are water and contrast media containing iodine. However, there are advantages and disadvantages, so an alternative replacement for natural ingredients is needed, namely green bean juice. This study aims to prove that using mung bean extract can improve MSCT images for oral contrast media in the MSCT Abdomen protocol based on in vitro studies. The research method used was a quasi-experimental study to compare the extent to which mung bean extract improved MSCT images compared to water and contrast media containing iodine as oral contrast media in the Abdomen MSCT protocol based on in vitro studies. Measurement of image enhancement is done by measuring ROI. Furthermore, the measurement results were analyzed using the difference test and a follow-up test, namely the Least Significance Difference (LSD) test. The research results show that green bean juice can improve abdominal MSCT images to be used as an oral contrast medium in the Abdominal MSCT protocol based on in vitro studies. Then, there was a difference in improving the MSCT image when using green bean juice, water, and contrast media containing iodine as oral contrast media in the abdominal MSCT protocol based on in vitro studies, and it was found that there was a difference in the concentration of green bean juice in getting optimal results in the MSCT protocol. Abdomen based on in vitro studies. Conclusion Mung bean extract can be used as an oral contrast medium instead of water because it can improve MSCT images.

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INTRODUCTION

The abdomen is the area between the thorax and pelvis. The abdomen comprises layers of skeletal muscle that line the abdominal wall, abdominal cavity, and visceral structures. Viscera structures located intraperitoneally include the gastrointestinal tract and associated organs (liver, gallbladder, and pancreas), the spleen, and the urinary system (kidneys and ureters), which are located retroperitoneally (Hansen, 2019).

Green bean juice contains an iron that include material that used to produce contrast media in MSCT examinations. Green beans contain 6.7 mg of iron per 100 grams. The iron in green beans can be used as a marker, so it can be a potential alternative to improve MSCT image. It appears visually brighter because its content produces much more light scattering than other molecules (Nazli et al., 2018).

According to Riskesdas of the Ministry of Health (2018), diseases of the abdomen have a prevalence of 2.2% (Riskesdas, 2018). In the diagnosis of diseases of the abdomen, modalities are needed in the field of radiology. The modalities in the field of radiology used are Ultrasonography (USG), Conventional Radiography, Multislice CT Scan (MSCT), and *Magnetic Resonance Imaging*

(MRI). The Multislice CT Scan (MSCT) used as a modality in radiology in diagnosing abdominal disease is the Multislice CT Scan (MSCT) Abdomen. Abdomen MSCT examination is a computerized tomographic examination to find abnormalities in the abdominal area (Zech et al., 2016).

To support the diagnosis of MSCT Abdomen, a substance in the form of positive or negative contrast media is needed, which is administered orally. Contrast media per oral on the Abdomen MSCT examination is useful for evaluating the gastrointestinal lumen or intestinal wall. However, oral contrast media is not necessary to diagnose *appendicitis* or *diverticulitis*. In patients with non-specific abdominal complaints, some argue that the additional use of oral contrast media can optimize the diagnostic results of the Abdominal MSCT examination (Radetic et al., 2020).

One of the positive contrast media per oral on MSCT Abdomen examination is containing iodine. The use of contrast media containing iodine can allow for increased ileocaecal evaluation compared to neutral oral contrast media such as water, but the use of oral contrast media containing iodine can increase the time (due to administration), increase costs, and increase the risk of aspiration (Pickhardt, 2020). In addition to positive contrast media oral containing iodine, there is also a negative contrast medium, namely water (de Wit et al., 2020).

Water as an intraluminal negative contrast medium can produce better image quality by reducing artifacts. Water as a contrast medium can improve reading results on the body's anatomical structures (Lee et al., 2016). Water as an oral contrast medium in MSCT abdominal examinations is used because it tastes cheap is safe, and allows good visualization of the organs in the abdomen. In addition, they using water as an oral contrast medium allows the assessment of intraluminal contents that are otherwise obscured by high-density positive oral contrast media, such as those containing iodine (Lee et al., 2016). However, there are shortcomings in using water as an oral contrast medium in Abdominal MSCT. Water as an oral contrast medium is considered difficult to evaluate peritoneal or omental deposition and fistulas and measure masses if they are located close to or fused with the intestine (de Wit et al., 2020).

The materials used to produce contrast media in MSCT examinations can come from iodine, gold, bismuth, bromine, tantalum, platinum, ytterbium, yttrium, gadolinium, tungsten, titanium, and iron (Cormode et al., 2015). According to Nazli et al. (2018), green plants with nanoparticles, namely green beans (*Vigna radiata L.*), contain titanium and iron. Nanoparticles such as green beans (*Vigna radiata* L.) contain iron minerals. According to *the United States Department of Agriculture*, green beans contain 6.7 mg of iron per 100 grams. The iron in green beans can be used as a marker. It appears visually brighter because its content produces much more light scattering than other molecules (Nazli et al., 2018).

According to previous research, green bean extract contains minerals such as iron (Fe), calcium (Ca), and phosphorus (P). Using green bean juice as an oral contrast medium in previous studies was carried out using an abdominal MRI protocol. The results of *in vitro* research in previous MRI research show that using green bean juice in this examination can increase signal intensity (Medista, 2017). Green bean juice has never been studied as an oral contrast medium to enhance MSCT images in abdominal MSCT protocols.

Based on the literature study, researchers are interested in discussing green bean juice with its relevance in increasing enhancement in the abdominal MSCT protocol, which was applied to an acrylic phantom in this study. From this background, the author is interested in conducting research titled "Use of Green Bean Juice as an Effort to Improve the Image of MSCT in the Abdominal MSCT Protocol (*In Vitro Study*)".

Based on the background above, this research aims to understand and analyze the use of green bean juice to improve the image of MSCT in the MSCT abdominal protocol (in vitro study). The benefit

of this research is that it produces a better understanding of the potential for using green bean juice to improve image quality in the MSCT Abdomen protocol. The results can help improve the accuracy of diagnosis and treatment of abdominal diseases. This research drives innovation in medicine and medical technology, opening up opportunities for discoveries in using natural ingredients in treatment and diagnosis.

METHOD

Study Design

The research method used is quasi-experimental to compare the extent to which green bean juice can improve MSCT images compared to water and contrast media containing iodine as oral contrast media in the Abdomen MSCT protocol based on in vitro studies. Scanning was carried out after treatment (post-test) using an acrylic phantom containing green bean juice using the same volume, namely 1 litre (L) and with varying concentrations of 1:10, 3:10, and 5:10.

Sample Preparation

The samples in this study were green bean extract without skin and with skin with various concentrations of 1:10, 3:10, and 5:10, oral contrast media containing iodine, and water. The manufacture of green bean juice starts from soaking, cooking, and filtering to produce mung bean extract.

In Vitro Study Setup

In vitro testing was carried out using an acrylic phantom with a cube design and in the middle there was a long, towering beam with mung bean juice inserted in the long beam in the middle.

Image Analysis

Image analysis used a measurement of image enhancement. The measurement of image enhancement is done by measuring Region of Interest (ROI) in MSCT image of green bean juice.

Data Collection and Analysis

MSCT image of green bean juice with skin and without skin with varying concentrations of 1:10, 3:10, and 5:10 were collected in one place. Then pick one image to do the measurement of image enhancement to analyze the data. Furthermore, the measurement results were analyzed using the difference test and a follow-up test, namely the Least Significance Difference (LSD) test.

Data interpretation

Data interpretation show the results from difference test, a follow-up test, and least significance difference (LSD) test.

RESULTS AND DISCUSSION

Content of MSCT Image Enhancing Substances in the Use of Mung Bean Extract

One of the materials used to produce contrast media for MSCT examinations can be iron-based. Green beans (*Vigna radiata L.*) contain iron, one ingredient that produces contrast media in MSCT examinations. The mineral content, namely iron, in green bean juice can improve the MSCT image. Before conducting research on green bean juice with skin and without skin at concentrations of 1:10, 3:10, and 5:10 in vitro, an *iron* (Fe) test was carried out using Atomic Absorption Spectroscopy with the following results:

Table 1. Test Results for Iron (Fe)

Material	Fe (mg/L)
Skinless Mung Bean Extract 1:10	0.2619
Skinless Mung Bean Extract 3:10	0.3635
Skinless Green Bean Juice 5:10	0.4022

Material	Fe (mg/L)
Green Bean Juice With Skin 1:10	0.4129
Green Bean Juice With Skin 3:10	0.5718
Green Bean Juice With Skin 5:10	0.6249

Based on Table 1, it can be seen that mung bean extract which has the highest levels of iron (Fe) is mung bean extract with skin at a concentration of 5:10 (500 g mung bean with skin, 1000 ml water) with iron content (Fe) of 0.6249 mg/L Fe. Meanwhile, green bean juice, which has the lowest iron (Fe) content, is skinless green bean juice with a concentration of 1:10 (100 gr of skinless green beans, 1000 ml of water) of 0.2619.

***Phantom* MSCT Scanning with the Abdomen MSCT Protocol**

After testing the iron (Fe) content, MSCT scanning was then carried out by creating an acrylic phantom image consisting of 1000 ml of water, skinless green bean juice in a ratio of 1:10 (100 gr of skinless green beans: 1000 ml of water), 3:10 (300 gr green beans without skin: 1000 ml water), 5:10 (500 gr green beans without skin: 1000 ml water), green bean juice with skin in the ratio 1:10 (100 gr green beans with skin: 1000 ml water), 3:10 (300 gr green beans with skin: 1000 ml water), 5:10 (500 gr green beans with skin: 1000 ml water), and 1000 ml water mixed with ten cc of contrast medium containing iodine. The eight materials were scanned using the abdominal MSCT protocol (35 mA, 120 kV, and 5.3 s), resulting in the following image results:

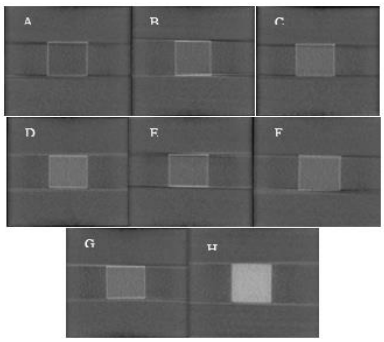

Figure 1. Scanning Results A.) Water, B.) Green bean juice without skin concentration 1:10, C.) Green bean juice without skin concentration 3:10, D.) Green bean juice without skin concentration 5:10, E.) Green bean juice with skin concentration 1:10, F.) Green bean juice with skin concentration 3:10, G.) Green bean juice with skin concentration 5:10, H.) contrast medium containing iodine with a concentration of 300 mg/ ml

MSCT Image Enhancement Measurement Results

Image enhancement assessment was carried out by measuring the HU value on the MSCT image of the acrylic *phantom* from water, green bean juice with skin in a ratio of 1:10, 3:10, 5:10, and green bean juice without skin in a ratio of 1:10, 3:10, 5:10, and *iodine*-containing contrast medium in one of the *coronal sections.* The measurement of the HU value is obtained using *the tools* in the MSCT tool, namely *the Region of Interest (ROI) tool*. HU values were measured using ROI at five points in each MSCT image of the acrylic phantom on one of the *coronal sections.* The five points are located at the top right point, top left point, bottom right point, bottom left point, and middle point. The average results obtained are as follows:

Table 2. Average HU Value Measurement Results for All Materials

Material	Average
Water	0.36
Skinless Mung Bean Extract 1:10	11.52

Material	Average
Skinless Mung Bean Extract 3:10	14.66
Skinless Mung Bean Extract 5:10	19.02
Mung Bean Extract With Skin 1:10	22.34
Mung Bean Juice With Skin 3:10	29.16
Mung Bean Juice With Skin 5:10	33.72
Iodine Contrast Media	101.22

From Table 2, the average HU value measurement results were obtained to see the improvement in the MSCT image for all materials, namely water, green bean juice with and without skin with concentrations of 1:10, 3:10, and 5:10, and iodine contrast media. Then, the average is displayed in a graphic image as shown in Figure 2 below:

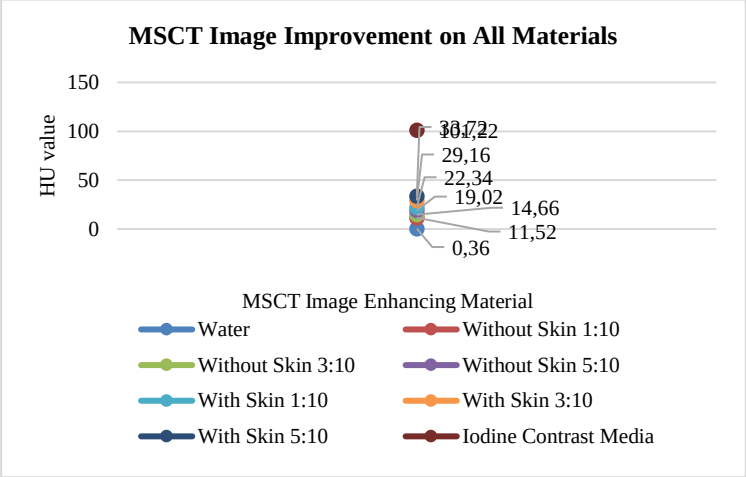

Figure 2. Graph of the Mean Value of HU Measurements for All Materials

Figure 2 shows that when compared with contrast media containing *iodine*, green bean juice with skin at a concentration of 5:10 is below it. In other words, the increase in MSCT images in contrast media containing iodine mixed with water is higher than in green bean juice with the skin at a concentration of 5:10. Meanwhile when the mung bean extract is compared to water, the MSCT image enhancement value is higher as seen from the average HU value.

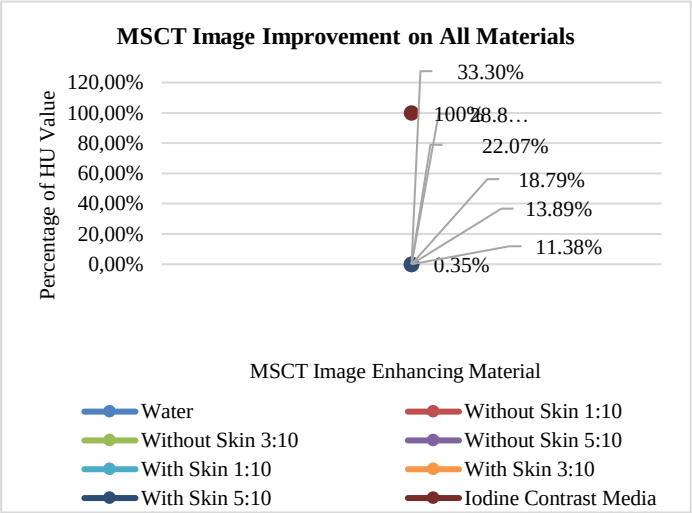

Figure 3. Image Enhancement Percentage Graph for All Materials

According to Figures 2 and 3, there was an increase in the MSCT image of 14.52% for skinless green bean juice from water. In green bean juice with skin, there was an increase of 27.71% in water. According to Figure 4.12, in the graph of the percentage of MSCT image enhancement for all materials, contrast media containing iodine is the highest gold standard with a percentage of 100%. To obtain enhanced MSCT images such as contrast media containing *iodine*, water requires 285 times, green bean juice without skin 1:10 requires 8.7 times, green bean juice without skin 3:10 requires 7.1 times, peanut juice green beans without skin 5:10 needs 5.3 times, green bean juice with skin 1:10 needs 4.5 times, green bean juice with skin 3:10 needs 3.4 times, and green bean juice with skin 5:10 requires three times to achieve MSCT image enhancement like iodine-containing contrast media.

Then, after that, also look at the standard deviation value. The standard deviation at the top and bottom of the acrylic phantom containing green bean juice was also looked at to see the noise and deposition. The average standard deviation value for the acrylic phantom containing the upper portion of green bean juice was obtained in Table 3 below:

Table 3. Results of Mean HU Value Measurements at Mung Bean Extract Top of Acrylic Phantom

Concentration	Average	
	Skinless	With Skin
1: 10	8.38	8.24
3: 10	9.86	10.64
5: 10	10.22	9.04

Table 3 shows the average HU value measurements at each concentration of mung bean extract without skin and with skin at concentrations of 1:10, 3:10, and 5:10 on the top of the acrylic phantom. Then, the average is displayed in a graphic image as shown in Figure 4 below:

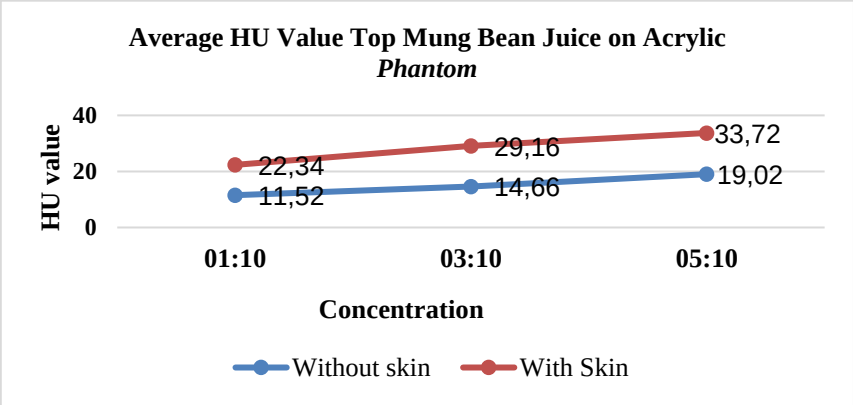

Figure 4. Graph of the Average HU Value of Upper Mung Bean Juice on the Acrylic Phantom

From Figure 4 above, the results show that the highest average HU value is green bean juice with skin with a concentration of 5:10 (500 gr of green beans with skin: 1000 ml of water). The second highest order is mung bean extract with a skin concentration of 3:10 (300 gr mung bean with skin: 1000 ml of water). The third order is green bean extract with a skin concentration 1:10 (100 gr green beans with skin: 1000 ml of water). The fourth order is green bean extract without skin concentration 5:10 (500 gr green beans with skin: 1000 ml of water). The fifth order is green bean extract without skin concentration 3:10 (300 gr green beans with skin: 1000 ml of water). The lowest HU value was obtained, namely mung bean extract without skin at a concentration of 1:100 (100 gr mung bean without skin: 1000 ml of water).

After measuring the HU value at the top of the green bean juice on the acrylic phantom, continue measuring the HU value at the bottom of the acrylic phantom, which contains the green bean juice. The measurement results are obtained in Table 4 below:

Table 4. Average results of measuring HU values in Mung Bean Extract Bottom Acrylic *Phantom*

Concentration	Average No Skin	With Leather
1: 10	15.22	30.14
3: 10	19.02	30.76
5: 10	29.64	31.62

Table 4 shows the average results of measuring HU values at each concentration of green bean juice without skin and with skin with concentrations of 1:10, 3:10, and 5:10 at the base of the acrylic phantom. Then, the average is displayed in a graphic image as shown in Figure 5 below:

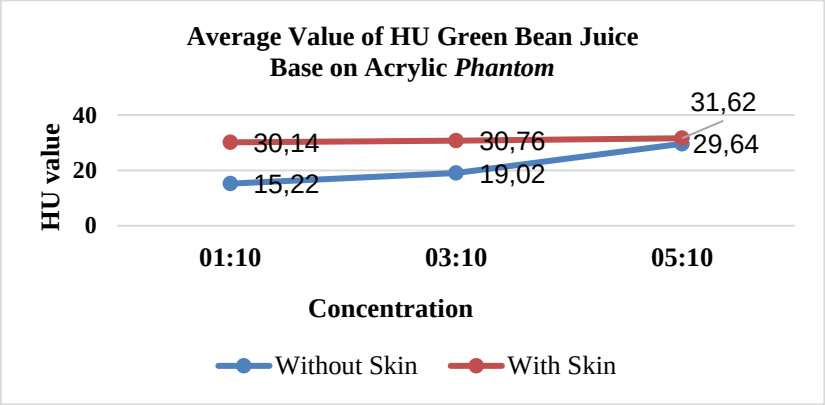

Figure 5. Graph of the Average HU Value of Green Bean Juice on the Acrylic Phantom

Analysis of Research Results

Data Normality Test

The measurement data for MSCT image enhancement in this study is quantitative. The MSCT image enhancement measurement data obtained was then tested for data normality. The data normality test uses Shapiro Wilk because the data in the study is less than 30. The data normality test results are as follows:

Table 5. Data Normality Test Results

Water	0.268
Skinless Green Bean Juice 1:10	0.577
Skinless Green Bean Juice 3:10	0.098
Skinless Green Bean Juice 5:10	0.181
Green Bean Juice With Skin 1:10	0.789
Green Bean Juice With Skin 3:10	0.707
Green Bean Juice With Skin 5:10	0.289
Iodine Contrast Media	0.228

From the data normality test results, it can be concluded that normally distributed data is characterized by a significance value of p> 0.05.

1. Difference Test

The difference test in this study was using the *One-Way ANOVA test*. In this study, the *One-Way ANOVA test* was used to test the difference in mean (average) in various concentrations of mung bean extract. The statistical test in this study used a computerized data processing program. The

following are the results to determine the difference in improving the MSCT image of water, green bean juice, and contrast media containing *iodine* as oral contrast media in the abdominal MSCT protocol:

Table 6. MSCT Image Enhancement Difference Test Results

	F	Sig.
Water, Green bean juice without skin 1:10, Green bean juice without skin 3:10, Green bean juice without skin 5:10, Green bean juice with skin 1:10, Green bean juice with skin 3:10, Green bean juice with skin 5:10, and Contrast Media containing *iodine*	671,200	0.000

Based on Table 6 above, it can be seen that there are differences in MSCT image enhancement from water, green bean juice without skin, and with skin at concentrations of 1:10, 3:10, 5:10, and contrast media containing iodine seen from the significance value namely 0.000 which means p <0.05.

2. Advanced Test (Post Hoc Test)

After carrying out the one-way ANOVA test, it was continued with a further test, namely Least Significance Difference (LSD). This LSD test is used to determine which green bean extracts differ significantly. Here are the results of the LSD test.

Table 7. LSD Test Results

	Mean difference							
Material	Water	No skin 1:10	No skin 3:10	No skin 5:10	With Skin 1:10	With skin 3:10	With skin 5:10	MK iodine
Water	-	-11.6	-14.3	-18.66	-21.98	-28.8	-33.36	-100.86
Skinless 1:10	11.16	-	-3.14	-7.5	-10.82	-17.64	-22.2	-89.7
Skinless 3:10	14.3	3.14	.	-4.36	-7 58	-14.5	-19.06	-86.56
Skinless 5:10	18.66	7.5	4.35	-	-3.32	-10.14	-14.7	-82.2
With Skin 1:10	21.98	10.82	7.68	3.32		-6.22	-11.48	-78.85
With skin 3:10	28.8	17.64	14.5	10.14	6.82	-	-4.56	-72.06
With skin 5:10	33.36	22.2	19.06	14.7	11.38	4.56	-	-67.5
MK iodine	100.86	89.7	86.56	82.2	78.88	72.06	67.5	.

Based on table 7 above, the average difference between water and green bean juice without skin 1:10 is -11.6, water with green bean juice without skin 3:10 is -14.3, water with green bean juice without skin 5:10 is -18.66, water with green bean juice with skin 1:10 is -21.98, water with green bean juice with skin 3:10 is -28.8, water with green bean juice with skin 5:10 is -33.36, and water with contrast media which contains iodine of -100.86.

The average difference between green bean juice without skin 1:10 and water is 11.16, green bean juice without skin 1:10 and green bean juice without skin 3:10 is -3.14, green bean juice without skin 1:10 with green bean juice without skin 5:10 for -7.5, green bean juice without skin 1:10 with green bean juice with skin 1:10 for -10.82, green bean juice without skin 1:10 with green bean juice with skin 3:10 for -17.64, green bean juice without skin 1:10 with green bean juice with skin 5:10 of -22.2, and green bean juice without skin 1:10 with contrast media containing iodine of -89.7.

The average difference of mung bean extract without skin was 3:10 with water of 14.3, mung bean extract without skin was 3:10 with mung bean extract without skin 1:10 3.14, mung bean extract

without skin was 3:10 with mung bean extract without skin 5:10 of -4.36, mung bean extract without skin 3:10 with mung bean extract with skin 1:10 of -7.68, mung bean extract without skin 3:10 with mung bean extract with skin 3:10 of -14.5, mung bean extract without skin 3:10 with mung bean extract with skin 5:10 of -19.06, mung bean extract without skin 3:10 with contrast medium containing iodine of -86.56.

The average difference of mung bean extract without skin was 5:10 with water of 18.66, mung bean extract without skin was 5:10 with mung bean extract without skin 1:10 was 7.5, mung bean extract without skin was 5:10 with mung bean extract without skin 3:10 of 4.36, mung bean extract without skin 5:10 with mung bean extract with skin 1:10 of -3.32, mung bean extract without skin 5:10 with mung bean extract with skin 3:10 of -10.14, essence mung bean without skin 5:10 with mung bean extract with skin 5:10 of -14.7, mung bean extract without skin 5:10 with contrast medium containing iodine of -82.2.

The average difference between mung bean extract and skin is 1:10 with water 21.98, mung bean extract with skin is 1:10 with mung bean extract without skin 1:10 10.82, mung bean extract with skin 1:10 with mung bean extract without skin 3:10 at 7.68, mung bean extract with skin 1:10 with mung bean extract without skin 5:10 at 3.32, mung bean extract with skin 1:10 with mung bean extract with skin 3:10 at -6.82, peanut extract green with skin 1:10 with mung bean extract and skin 5:10 at -11.38, mung bean extract with skin 1:10 with contrast medium containing iodine at -78.88.

The average difference between mung bean extract and skin is 3:10 with water 28.8, mung bean extract with skin is 3:10 with mung bean extract without skin, 1:10 17.64, mung bean extract with skin 3:10 with mung bean extract without skin 3:10 is 14.5, mung bean extract with skin 3:10 with mung bean extract without skin 5:10 is 10.14, mung bean extract with skin 3:10 with mung bean extract and skin 1:10 is 6.82, mung bean extract with skin 3:10 with mung bean extract with skin 5:10 of -4.56, mung bean extract with skin 3:10 with contrast medium containing iodine of -72.06.

The difference between the MSCT images of green bean juice with skin 5:10 with water is 33.36, green bean juice with skin 5:10 with green bean juice without skin 1:10 is 22.2, green bean juice with skin 5:10 with green bean juice without skin 3:10 for 19.06, green bean juice with skin 5:10 with green bean juice without skin 5:10 for 14.7, green bean juice with skin 5:10 with green bean juice with skin 1:10 for 11.38, green bean juice with skin 5:10 with green bean juice with skin 3:10 of 4.56, green bean juice with skin 5:10 with contrast media containing iodine of -67.5.

The average difference between contrast media containing iodine and green bean juice without skin at 1:10 was 100.86, green bean juice without skin at 3:10 was 89.7, green bean juice without skin at 5:10 was 82.2, green bean juice with skin one at ten was 78.88, mung bean extract with skin 3:10 was 72.06, and mung bean extract with skin was 5:10 was 67.5.

Green bean juice can improve the MSCT image as an oral contrast medium in the abdominal MSCT protocol based on *in vitro studies.*

Materials that can be used to produce contrast media for MSCT examinations can come from iodine, gold, bismuth, bromine, tantalum, platinum, ytterbium, yttrium, gadolinium, tungsten, titanium, iron, and other metal elements (Cormode et al., 2015). According to Nazli et al. (2018), green plants with a nanoparticle base, namely green beans (*Vigna radiata L.*), contain the mineral iron. Based on existing literature, green bean juice contains iron, one of the ingredients for producing contrast media in MSCT examinations (Nazli et al., 2018). Therefore, iron (Fe) content was tested in green bean juice to determine how much iron it contains. Iron (Fe) content testing was carried out on green bean juice without skin at 1:10, 3:10, and 5:10, and mung bean extract with skin at 1:10, 3:10, and 5:10. Tests were carried out using the Atomic Absorption Spectrophotometry method. The test results showed an

increase in iron (Fe) levels. The lowest iron (Fe) content is found in green bean juice without skin with a concentration of 1:10 (100 grams of green beans: 1000 ml of water), while the highest iron (Fe) content is in green bean juice with skin 5:10 (500 gr green beans: 1000 ml water).

According to the United States Department of Agriculture, every 100 grams of green beans contains 6.7 mg of iron (Fe) (Yuviska & Armiyanti, 2019). According to the study results, the iron content (Fe) in green bean extract without the skin and with the skin is higher than that with the skin. The highest content of iron (Fe) was found in mung bean extract with skin 5:10, while the lowest iron (Fe) content was in mung bean extract without skin 1:10. The difference in the content of iron (Fe) in mung bean extract without skin and with skin is different because the mung bean skin also contains iron (Fe) (Nazli et al., 2018).

After testing for iron (Fe) levels, an acrylic phantom MSCT scan was performed using the abdominal MSCT protocol according to the existing MSCT tool at the study site (*Siemens Somatom Definition* AS 128 *slice*). The abdominal MSCT protocol used was 35 mA, 120 kV, and 5.3 s according to the adult abdominal MSCT protocol on the MSCT device used in the study. Then, the MSCT *phantom* acrylic image that has been scanned is measured for enhancement (HU) with ROI at 5 points, the result of which is an increase in enhancement in the green bean extract. From mung bean extract without skin 1:10 to mung bean extract with skin 5:10, enhancement is increase*d. The lowest enhancement* measurement was in mung bean extract without skin, 1:10, and the highest was in mung bean extract with skin, 5:10.

When compared to water, green bean juice can be more visibly *enhancing.* However, if green bean juice is compared with contrast media containing *iodine*, it will be less *enhancing.* In terms of materials for producing contrast media for MSCT examination, green bean juice is sufficient because it contains iron and titanium (Cormode et al., 2015) (Nazli et al., 2018). Green bean juice was chosen because it tastes good, is easy to make, and is nutrient-dense (Yuviska & Armiyanti, 2019).

The research proved *in vitro* that mung bean extract can improve MSCT images. The green bean juice chosen is that you can use it with skin 5:1 (500 gr green beans with skin: 1000 ml water) because the enhancement is higher than water, so it can be used as an oral contrast medium in the water substitute abdominal MSCT protocol. However, the lower enhancement of green bean juice with skin compared to contrast media containing *iodine* cannot replace contrast media containing iodine, even though both can produce enhancement from the basic ingredients that produce contrast media in MSCT. According to several kinds of literature, the natural basic ingredients that produce *enhancement* for MSCT examinations are acacia, cinnamon, *centella asiatica*, and dried turmeric, which contains gold (Das et al., 2017); (Shukla et al., 2018); (Smitha et al., 2015). Apart from that, natural ingredients that contain iron besides green beans are tea, eucalyptus plants, aloe vera extract, grapes, and rumex plants (Huang et al., 2017); (Wang et al., 2014); (Njagi et al., 2015). Natural ingredients that contain titanium are srikaya, extracts of spreading plant leaves, hibiscus flowers, and basil leaves (Roopan et al., 2017), (Sahaya et al., 2014); (Ahmad et al., 2022).

Iodine* -Containing Contrast Media as Oral Contrast Media in the Abdomen MSCT Protocol Based on *In Vitro Studies

In this study, the MSCT image enhancement measurement values for green bean juice without skin were 1:10, 3:10, 5:10, and green bean juice with skin 1:10, 3:10, 5:10. A difference test was carried out and the results showed that there was a difference in improving the MSCT image of green bean juice without skin and with skin at concentrations of 1:10, 3:10, and 5:10. The difference in improving the MSCT image is influenced by the presence or absence of skin on the green beans used in the green bean juice and the concentration used (Nazli et al., 2018). The more green beans with skin used, the higher the HU MSCT value. Meanwhile, the smaller the quantity of skinless green beans used, the

lower the HU value. So, green bean juice with skin at 5:10 has the highest MSCT image enhancement value, and green bean juice without skin at 1:10 has the lowest MSCT image enhancement value.

The standard deviation was also observed in the acrylic phantom scanning results on mung bean extract. The standard deviation affects the resulting noise. The *noise* is also high if the standard deviation is high (Seeram, 2016). The highest standard deviation for the upper acrylic phantom containing bean juice is 3:10 for green bean juice with skin, while the lowest is 1:10 for green bean juice with skin. So, *the noise* in mung bean extract with skin of 3:10 is the highest compared to mung bean extract with other concentrations. Then the highest standard deviation for the base part of the acrylic phantom, which contains bean juice, is 1:10 for green bean juice without skin, while the lowest standard deviation is for green bean juice with skin 3:10. So *the noise* in green bean juice without skin is 1:10 the highest compared to green bean juice with other concentrations. The difference in HU and SD values at the top and bottom of the acrylic *phantom* occurs because there is sediment from the green bean juice. The time for the formation of these deposits is influenced by the specific gravity of the green beans without skin and with skin. Apart from *noise*, homogeneity also has an effect. The higher the standard deviation, the less homogeneous the points are (Seeram, 2016).

Given that this research was conducted *in vitro*, there is a weakness, namely that the top and bottom of the deposition are different. Of course, it is applied *in vivo* to humans. In that case, the deposition will also be more different because factors originate from within the human body, so it settles more quickly in the stomach. Therefore, the need for further study is highly recommended. Apart from that, there are other natural ingredients such as acacia plants, cinnamon, *centella asiatica*, dried turmeric, tea, eucalyptus plants, aloe vera extract, grapes, rumex plants, sugar apple, spreading plant leaf extract, hibiscus flowers, and basil leaves according to the literature. It can also enhance MSCT images because it comes from the basic ingredients for enhancing MSCT images in contrast media in MSCT examinations (Nazli et al., 2018). Natural ingredients containing gold, such as acacia plants, cinnamon, *centella asiatica*, and dried turmeric, have high atomic numbers so that they can produce 3.3 times greater *enhancement* than those made from *iodine* (Cormode et al., 2015). Compared to gold-based *enhancement* products, mung bean juice has lower *enhancement. However, when compared with titanium-based enhancement* products, green bean juice has a higher enhancement (Cormode et al., 2015); (Das et al., 2017). The advantage of iron (Fe) in green bean juice, according to research, is that it has a higher atomic value than calcium and phosphorus in bones, so the resulting enhancement is also higher (Cormode et al., 2015). However, there is a need for more iron (Fe) compared to those made from gold and *iodine*, namely that the resulting image is less *enhanced* (Cormode et al., 2015); (Jung et al., 2018). Apart from that, green bean juice is considered to have lower MSCT image enhancement than *iodine* because it has a lower atomic number.

Mung Bean Extract Concentration to Obtain Optimal Results as Oral Contrast Media in Abdominal MSCT Protocol Based on *In Vitro Studies*

A follow-up test was carried out to determine the optimal green bean juice as an oral contrast medium in the abdominal MSCT protocol, namely the *Least Significance Difference* (LSD) test. From the LSD results, it can be seen that the optimal sequence of green bean juice is based on the difference in average HU values. The most optimal green bean juice as an oral contrast medium in the abdominal MSCT protocol based on *in vitro studies* is green bean juice with skin 5:10 with the highest average difference with contrast media, while the lowest is green bean juice without skin 1:10 . Compared with the average difference to water, the most optimal mung bean juice as an oral contrast medium in the abdominal MSCT protocol based on *in vitro studies* is green bean juice with skin of 5:10 with the highest mean difference to water, while the lowest is green bean juice without skin 1:10.

The LSD test states that a rating on mung bean extract is seen from the average difference produced. The order from highest to lowest is green bean juice with skin 5:10, 3:10, 1:10, green bean juice without skin 5:10, 3:10,1:10. In the *enhancement* measurement, green bean juice is higher than water so it can be used as an oral contrast medium, in the water substitute abdominal MSCT protocol. According to Jung et al. (2018), factors that influence the improvement of MSCT images when using contrast media are the material, volume, and concentration used (Jung et al., 2018). Therefore, it is known that the optimal concentration of green bean juice that can be used as an oral contrast medium in the abdominal MSCT protocol based on *in vitro studies* is green bean juice with skin at a concentration of 5:10 (500 gr of green beans with skin: 1000 ml of water).

The optimal concentration of green bean juice that can be used as an oral contrast medium in the abdominal MSCT protocol based on *in vitro studies* is green bean juice with skin with a concentration of 5:10 (500 gr of green beans with skin: 1000 ml of water) because green bean juice with This concentration appears to be the most superior in improving the MSCT image compared to green bean juice with other concentrations and to green bean juice without skin so it is more optimal. If implemented in patients, improving the MSCT image using green bean juice will be in the stomach. Its use is as gastric *marking so that it will be visible if there is a pathology* (Jung et al., 2018).

One of the limitations of this research is that if the concentration of green bean juice is too large, then the green bean juice will be too thick. Apart from that, if the oral administration of contrast media takes too long, there is concern that it will settle so that it will be distinct. Drink a volume of 1000 ml. It will be uncomfortable, especially with the greater concentration of green bean juice in the skin. In patients with clinical achalasia, of course, they will find it increasingly difficult to swallow if the green bean juice produced is too thick and dense if an MSCT examination of the abdomen is required by taking oral contrast media.

Mung bean extract is too thick, resulting in mung bean extract with skin at higher concentrations. So, the greater the concentration of mung bean extract in the skin, the thicker the mung bean extract produced will be. Another limitation is that green bean extract has contraindications when applied to patients. Namely, it is not recommended for patients with green bean allergies. According to Budseekoad (2019), the allergen content comes from proteins and amino acids, which can cause reactions in immunology. In addition, it is also not recommended in patients with hypersensitivity to iron; even though it is rare, it is better not to give it (Budseekoad et al., 2019).

CONCLUSION

The conclusions in this research are: 1) Green bean juice can increase enhancement so that it can be used as an oral contrast medium instead of water in abdominal MSCT protocols based on in vitro studies. 2) There is a difference in enhancement in using green bean juice as an oral contrast medium in the abdominal MSCT protocol based on in vitro studies. 3) The optimal concentration of green bean juice as an oral contrast medium in the abdominal MSCT protocol is based on in vitro studies, namely 5:10 of green bean juice with skin.

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