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An Oral Sedation Preparation Based on Pistachio Nuts with Organic Melatonin Content To Support MRI Examination

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KEYWORDS
pistachio, sedation, melatonin, MRI

ABSTRACT
Sedation of propofol, chloral hydrate, midazolam, and ketamine is commonly used in MRI examinations. There are still risky side effects from the previous 4 sedations, so melatonin tablets are a safer option. Melatonin synthesized in tablets can still cause quite adverse side effects. Pistachios processed into milk can be used as an alternative to natural melatonin oral sedation. Research Objective: To determine the potential of pistachio milk as an alternative to oral melatonin sedation to support MRI examinations. Research Method: This research uses the R&D (Research and Development) method with 4 stages, namely finding potentials and problems, data collection, product design, and design validation. The product in the form of 200 mL pistachio milk with concentration variants of 35 g, 45 g, 55 g, 65 g was tested in a laboratory to determine its potential from the test results with a reference to melatonin tablets of 10 mg. Research Results: Laboratory tests showed the presence of melatonin and other accompanying ingredients such as phenolics, carotene, and polyphenols. The melatonin content of the 35 g, 45 g, 55 g, 65 g variants is 5.5 mg, 6.1 mg, 8.7 mg, 10.5 mg, respectively. Conclusion: Pistachio milk with a 65 g variant has a melatonin content of 10.5 mg which is close to the reference for sedation of melatonin tablets of 10 mg, so it has the potential to be an alternative to oral sedation of melatonin to support MRI examinations.

Introduction

Magnetic Resonance Imaging (MRI) is one of the imaging modalities in radiology to examine the internal organs of living things, especially humans, which is carried out using high-strength magnetic technology and radio waves that surround the object of examination. Examination with MRI modalities is fairly safe because there is no X-ray radiation as in conventional radiography and CT modalities Scan (Computed Tomography Scan) (Yousaf et al., 2018).

MRI examination procedures, especially in non-cooperative patients, usually use sedation. The sedation used aims to provide calm and drowsiness. Patients who often need this procedure are sensitive pediatricians and adult patients who are easily anxious or Claustrophobic. The sedation procedure helps to smooth the course of the MRI examination (Copeland et al., 2021; Madsen et al., 2020; Sequeiros et al., 2018) The optimal use of sedation will make the patient relaxed and sleepy (Madsen et al., 2020)(Harrington et al., 2022).

The use of sedation in patients on MRI is generally necessary because the main condition of the MRI examination requires the patient to lie still and calm during the process Scanning last. This is done because MRI is sensitive to movement and takes a long time to examine (Copeland et al., 2021; Madsen et al., 2020)Stress and anxiety can arise from the process Scanning MRI, where the examination is carried out in a narrow room accompanied by noise of up to 132 dB (A) during the acquisition process, coupled with the length of time Scanning about 15-60 minutes for one check (Copeland et al., 2021). The existence of sound suppressors such as earplugs and Headphones It is enough to help minimize these acoustic disturbances, but for hypersensitive patients will still feel uncomfortable (Stores, 2022). Anxiety and stress can be overcome with the use of sedation, so the examination process will run smoothly. Sedation will provide sedation and drowsiness, making it easier for patients to be examined and diagnostics to be more optimal (Pasini et al., 2018).

The types of sedation that are generally used in MRI examinations are propofol, Chloral Hydrate, Midazolamor Ketamine. However, all four sedations have side effects that can cause problems with the heart and lungs (Dave, 2019; Grissinger, 2019; Lingamchetty et al., 2023; Prommer, 2020; Sahinovic et al., 2018; Zanos et al., 2018).

An alternative to sedation with a higher level of safety and can induce sleep naturally is melatonin (Dave, 2019). Melatonin is generally given orally, transdermal, rectal (Savage et al., 2023), as well as intravenous (Zetner et al., 2021). The use of oral sedation of melatonin is one of the safer alternatives because melatonin is a natural hormone. The hormone melatonin is a sedative, anxiolytic, and hypnotic agent that functions to reduce anxiety (Pasini et al., 2018).

Oral melatonin sedation generally uses melatonin tablets (N-acetyl-5-methoxytryptamine) with melamil, tryptophan, phenolic, and chemically synthesized vitamin B6 content (Kukula-Koch et al., 2021; Picone et al., 2019). Oral melatonin sedation can minimize general anesthesia procedures due to its safety, so the anesthesiologist does not need to be present all the time during the examination, as the melatonin procedure can be performed by a radiologist (Cardinali, 2019; Faghihian et al., 2018; Menczel Schrire et al., 2022; Picone et al., 2019). However, there are still side effects that are produced, namely dizziness, headaches, changes Mood irregularities, excessive sleepiness, and nausea (Savage et al., 2023).

Alternative sources of melatonin hormone-triggering ingredients are quite diverse, and nuts are one of the natural ingredients with a fairly high amount of melatonin content. Pistachios have a high melatonin content among other nuts. The use of oral melatonin sedation made from pistachios has still never been done (Paroni et al., 2019). Pistachios can be processed into drinks in the form of pistachio milk and can be used in MRI examinations. The manufacture of oral melatonin sedation made from pistachios needs to be further studied regarding the manufacturing process to produce a viable pistachio milk product. Its potential in reducing anxiety and stress, as well as providing drowsiness, its safety, and dosage of oral sedation use of melatonin will also be studied. Therefore, the author is interested in developing research with the concept of R&D (Research and Development) related to the manufacture of pistachio milk as an oral sedation of melatonin to support MRI examinations.

Current sedation methods for MRI procedures, including propofol, chloral hydrate, midazolam, and ketamine, present significant side effects, such as cardiovascular and respiratory complications. While melatonin has emerged as a safer alternative, its synthetic tablet form can still cause adverse reactions, including dizziness, headaches, and excessive drowsiness. Although pistachios are known to contain high levels of natural melatonin, there is a lack of research on their application as an oral sedative, particularly in the form of pistachio milk. Furthermore, studies comparing the efficacy of pistachio-derived melatonin with synthetic alternatives are limited, highlighting a need for exploration in this area to address safety concerns and clinical applications.

This study introduces pistachio milk as an innovative and natural oral sedation alternative enriched with organic melatonin for MRI procedures. By identifying and quantifying the melatonin content in various pistachio concentrations, this research demonstrates the potential of pistachio milk as a safer and more natural substitute for synthetic melatonin tablets. Additionally, the study emphasizes the dual benefits of pistachio milk, including its rich composition of phenolic compounds, carotene, and polyphenols, which provide added nutritional and antioxidant value. This approach bridges the gap between natural food-based sedation and clinical applications, offering a practical, safe, and organic alternative to existing sedative options.

Although various sedation methods, including propofol, chloral hydrate, midazolam, and ketamine, have been utilized in MRI procedures, these conventional options often pose significant cardiovascular and respiratory risks. While melatonin has been introduced as a safer alternative, its synthetic tablet form still exhibits adverse side effects such as dizziness, headaches, and excessive drowsiness. Furthermore, the exploration of natural sources of melatonin for sedation remains limited. Pistachios, known for their high natural melatonin content, have not been extensively studied as a potential sedation alternative, particularly in the form of pistachio milk. Previous studies have largely focused on synthetic melatonin or other nuts with lower melatonin content. The lack of research on the efficacy of pistachio-derived melatonin compared to synthetic melatonin in clinical settings highlights a critical gap that this study aims to address.

This research introduces the innovative concept of using pistachio milk as a natural oral sedation alternative enriched with organic melatonin for MRI procedures. It is the first study to develop a detailed method for creating pistachio milk with varying concentrations to match the melatonin levels found in synthetic tablets. The study not only quantifies melatonin content but also highlights additional health benefits derived from phenolic compounds, carotene, and polyphenols present in pistachios, making it a dual-purpose sedation option with nutritional value. By leveraging a natural food source, this research pioneers an eco-friendly, safer, and cost-effective alternative to traditional and synthetic sedation methods, bridging the gap between natural food-based solutions and clinical applications.

The objective of this research is to develop pistachio milk as an alternative oral sedation source with organic melatonin content to support MRI examinations. The study aims to determine the optimal concentration of pistachio milk that matches the melatonin level of standard 10 mg synthetic tablets. The benefits of this research include providing a safer, natural sedation option with minimal side effects, improving patient comfort, particularly for children and anxious individuals undergoing MRI procedures.

Additionally, it promotes the development of affordable, accessible, and eco-friendly sedation alternatives that can be integrated into healthcare settings.

Research Methods

This research uses the R&D (Research and Development) method with 4 stages, namely finding potential and problems, data collection, product design, and design validation. The product in the form of 200 mL pistachio milk with concentration variants of 35 g, 45 g, 55 g, 65 g was tested in a laboratory to determine its potential from the test results with a reference to melatonin tablets of 10 mg.

Results and Discussions

A. How to Make Pistachio Peanut Milk as an Alternative to Melatonin Oral Sedation

1. The search for healthy and fresh types of pistachios. Beans are purchased through one of the marketplaces with credible stores (rating 4.5 and above).
2. Differences in pistachio nut variations with a weight of 35 g, 45 g, 55 g, and 65 g were carried out to find a dose that was close to the content of 10 mg of melatonin.
3. The prepared variety has a total weight of 200 g. The total weight is slightly increased to 250 g to account for the net weight loss after going through the washing and boiling process.
4. The 250 g pistachios obtained are without shells, so they are immediately washed in a strainer with running water.
5. All clean beans are put in a pot with 500 mL of water that has been boiling beforehand, the boiling time is 3 minutes on the stove over medium heat, then the stove is turned off.
6. The boiling water is discarded and separated from the pistachios. Pistachios are weighed based on the set variation.

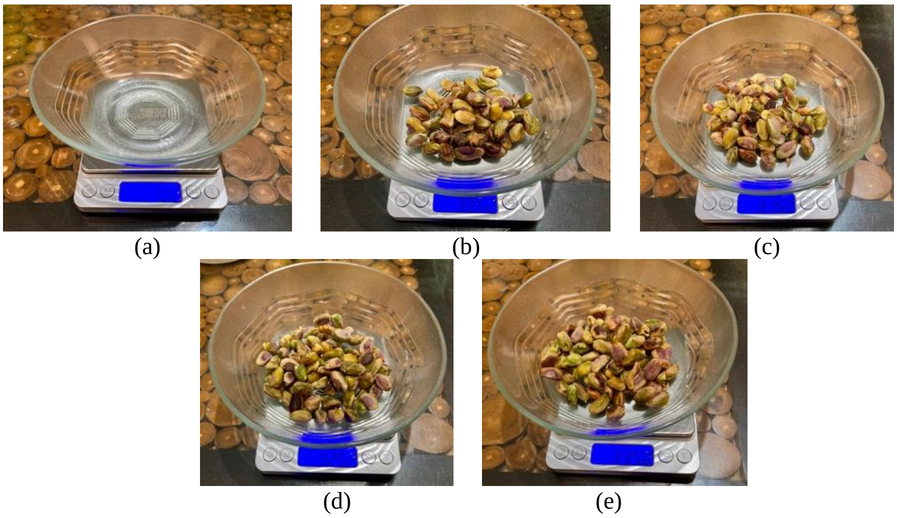

Figure 1. Pistachio nut measurements start from the weight of the bowl without nuts (a), gramation of 35 (b), 45 (c), 55 (d), and 65 g (e)

7. Pistachios that have been varied into 4 samples are mashed separately with a blender and given the same mixture of boiled water as 200 mL as a solvent. The smoothing time lasts for 3 minutes.

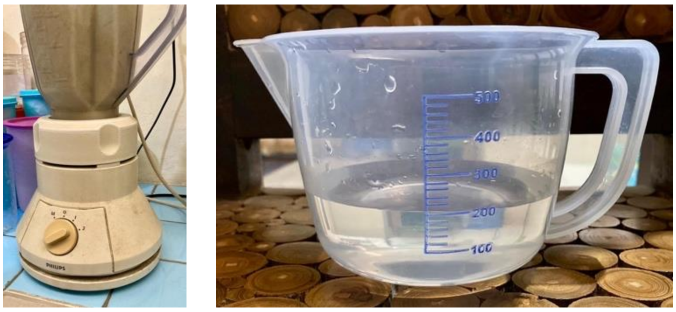

Figure 2. 200 mL boiling water refining and mixing process for the preparation of pistachio milk solution

8. Each sample was filtered with a muslin bag on a measuring cup. Each variation of the sample is squeezed until it meets a solution volume of approximately 200 mL.

Figure 3. Pistachio bean filtering process to obtain pistachio juice

9. The four variants of pistachios in the measuring cup were transferred into a 250 mL bottle for laboratory test evaluation as a test sample. The target test sample is assisted by a control sample, namely melatonin tablets 10 mg to facilitate the assessment of the melatonin content of the specified variant against the control sample.

Figure 3. Pistachio milk test sample and melatonin tablet control sample 10 mg

10. Samples of pistachio milk and 10 mg melatonin tablets were put into styrofoam and given ice gel packs before being taken to the laboratory.
11. The samples were taken to the UKSW Salatiga laboratory to be tested for melatonin and other useful accompanying substances.
12. Each sample that has arrived at the laboratory is made a series of sample concentrations of 50, 75, 100, 125, and 150 ppm in methanol solvents.

13. A sample of 10 mg melatonin tablets was cut in half to weigh 5 mg of sample only, then dissolved in 5 mL of methanol.
14. Samples of pistachio milk of 4 variants were taken 0.5 mL of samples each, then diluted to 5 mL with methanol.
15. Samples of 4 variants of pistachio milk and melatonin tablets that have been dissolved in 5 mL of methanol were taken 1 mL of each sample concentration plus 3 mL of DPPH 0.1 mM reagent, then placed in a light-tight test tube.
16. The samples were incubated at 20ºC-24ºC for 30 minutes.
17. Absorbance was measured with a Shimadzu U-1240 Mini UV spectrophotometer at a wavelength of 517 nm using methanol as a blank.
18. The absorbance value is used to calculate the % of inhibition.
19. The remaining percentage of inhibition indicates DPPH compounds that have not been suppressed by melatonin. Melatonin levels are determined from a difference between 100% and the remaining % of inhibition.

The percentage unit of melatonin levels is converted to milligram form so that it is known that the content value is more concrete, adjusting the unit of melatonin tablets 10 mg.

B. Results of Composition and Mixture of Pistachio Bean Milk Ingredients as Melatonin Oral Sedation

Table 1. Laboratory Test Results

Sample	Melatonin (%)	Phenolic (mg/mL)	Carotene (µg/100 mL)	Polyphenols (µg/mL)
35 g/200mL	24	0.1953	7.5749	1.8448
45 g/200mL	27	0.2133	15.1760	0.4830
55 g/200mL	38	0.3391	17.1056	ND
65 g/200mL	46	0.3391	19.3023	0.3551
10 mg	44	8.7942	*0.2202	ND

* : The unit of melatonin tablets for total carotene is µg/g
ND : Not Detected (substance content not detected)
10 mg : Control sample of melatonin tablets 10 mg

1. Melatonin, expressed in % value for each successfully suppressed inhibition.

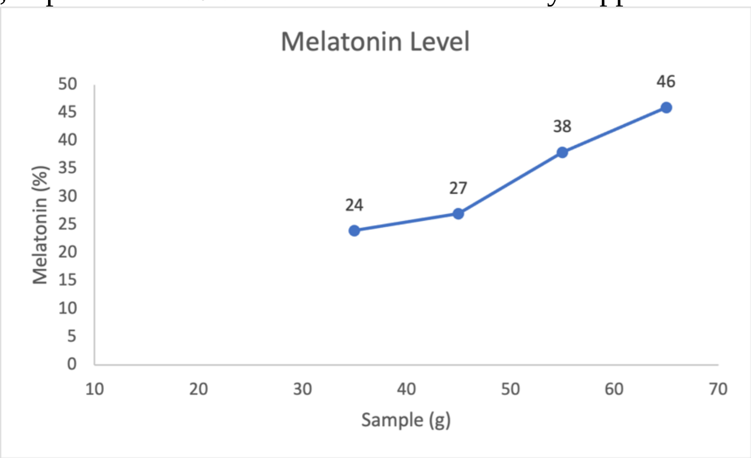

Figure 4. Melatonin Levels Graph

2. The phenolic composition is expressed in mg units for each mL of sample solution.

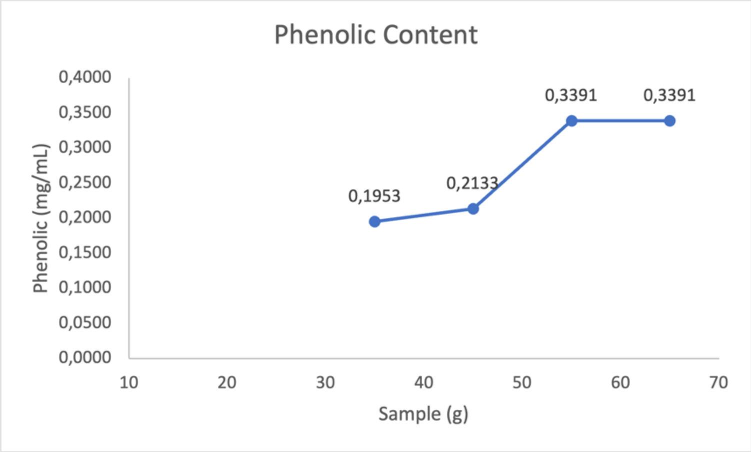

Figure 5. Graph of Phenolic Content

3. The composition of carotene is expressed in µg units for each mL of sample solution.

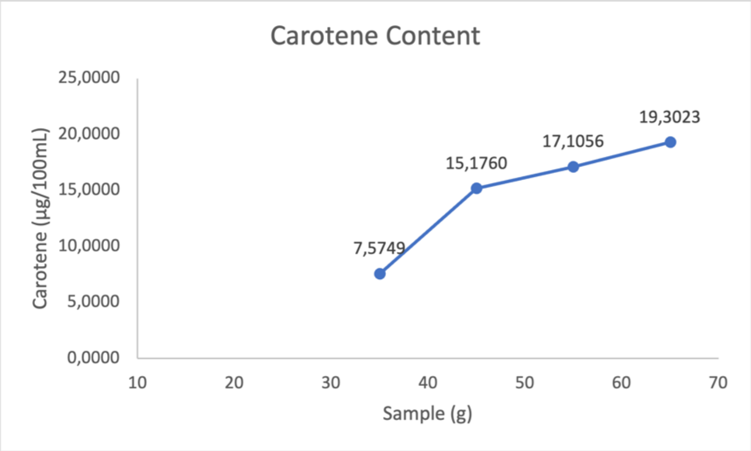

Figure 6. Caroten Content Graph

4. The composition of polyphenols is expressed in µg units for each mL of sample solution.

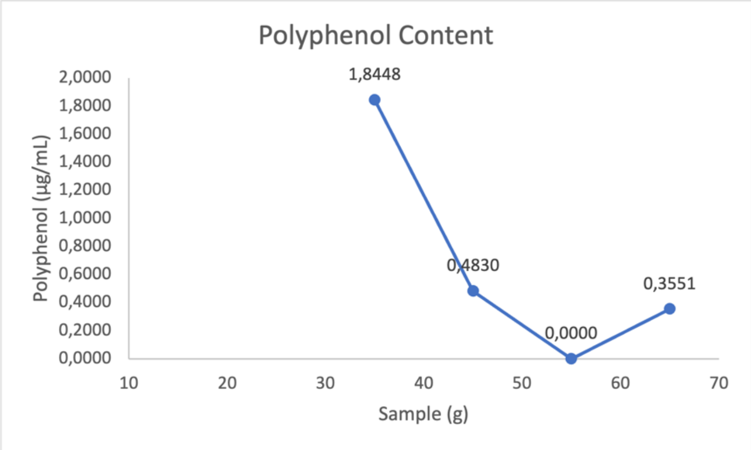

Figure 7. Polyphenol Content Graph

C. Total Grammation Results of Melatonin Content from Pistachio Peanut Milk as Oral Sedation

Table 2. Value of Melatonin in Samples

Sample	Melatonin content (%)	Melatonin content (mg)
35 g/200mL	24	5.5
45 g/200mL	27	6.1
55 g/200mL	38	8.7
65 g/200mL	46	10.5
10 mg melatonin tablets	44	10.0

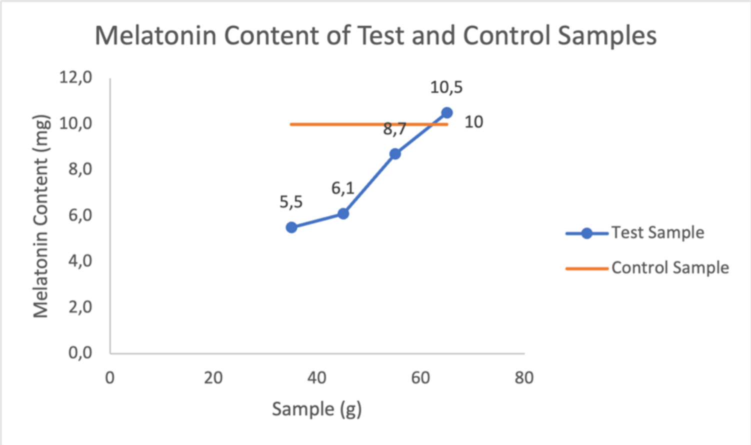

Figure 8. Melatonin Content Chart of Test and Control Samples

Based on the table and graphic figures, it is known that the melatonin levels in pistachio milk variants of 35 g, 45 g, 55 g, and 65 g respectively in percentages are 24%, 27%, 38%, and 46%, and the content in milligrams is 5.5 mg, 6.1 mg, 8.7 mg, and 10.5 mg, respectively. The 10 mg melatonin tablet sample that was the reference test (control sample) had a melatonin level of 44% and its content in milligrams was 10 mg. The calculation of melatonin content in milligrams uses the following formula.

$$Sample\ content = \frac{\text{Control sample value} \times \text{Test sample rate (\%)}}{Control\ up\ to\ sampel\ (\%)}$$

Therefore, from this formula, it can be seen that the calculation of melatonin content in milligrams with a reference to melatonin tablets of 10 mg is as follows.

1. Sample 35 g

$$Sample\ content = \frac{10\ mg \times 24\ \%}{44\ \%} = 5.5\ mg$$

2. Sample 45 g

$$Sample\ content = \frac{10\ mg \times 27\ \%}{44\ \%} = 6.1\ mg$$

3. Sample 55 g

$$Sample\ content = \frac{10\ mg \times 38\ \%}{44\ \%} = 8.7\ mg$$

4. Sample 65 g

$$Sample\ content = \frac{10\ mg \times 46\ \%}{44\ \%} = 10.5\ mg$$

Discussion

How to Make Pistachio Peanut Milk as an Alternative to Melatonin Oral Sedation

1. Pistachios are varied by weight of 35 g, 45 g, 55 g, and 65 g to find the expected melatonin standard, because in the literacy obtained about 43 g of pistachios produce 10 mg of melatonin (Meng et al., 2017). The standard to be achieved is 10 mg of melatonin according to the sedation of melatonin tablets commonly used in MRI (Madsen et al., 2020; Picone et al., 2019)
2. The total weight of the pistachios to be processed is 250 g cleaned in a strainer with running water to remove impurities, solids or chemicals adhering to the pistachio shell layer (Oniciuc et al., 2019).
3. The next stage is boiling to reduce allergens and bacteria (Bulló et al., 2015; Gorji et al., 2018) Based on the article that the author obtained, boiling is more recommended than the grilling technique because it does not produce acrylamide or carcinogenic substances (Lim et al., 2023). The boiling process can reduce acrylamide triggering substances and increase phenolic levels in natural food ingredients, but it can reduce antioxidant levels (Zhao et al., 2019), which in this case is melatonin.
4. Clean pistachios are placed in a saucepan with 500 mL of pre-boiling water, the boiling time is 3 minutes. Based on the literacy obtained, the length of boiling time is appropriate for ripening pistachios (Lim et al., 2023).
5. The next process is to make pistachio bean weight variations of 35 g, 45 g, 55 g, and 65 g as solute. This variation needs to be done for an estimated content of 10 mg of melatonin. Based on the theoretical reference, 45 g allows the content of 10 mg of melatonin, but in the tests carried out in theory it does not go through the boiling process (Meng et al., 2017). Therefore, the range of variation is widened with a minimum limit of 35 g, and a maximum limit of 65 g. Between 45 g and a maximum limit of 65 g, a considerable difference (20 g) is made because it is estimated that the melatonin content is quite reduced during the boiling process (Zhao et al., 2019).
6. The next process is refining and filtering. Refinement is carried out by Blender for 3 minutes with mixing 200 mL of boiled water as a solvent. The panyaringan process is carried out by muslin bag to obtain pistachio nut juice which is later referred to as pistachio milk. This process is a simple way to get juice from pistachios, this is in line with the article obtained by the author (Lim et al., 2023).
7. The results of 4 variants of pistachio milk with a solution volume of 200 mL from pistachio nut juice are packaged in 250 mL bottles. Four variants of pistachio milk became test samples along with 10 mg melatonin tablets as control samples prepared to be sent to the UKSW Salatiga laboratory.
8. Whole sample is put inside Styrofoam and given Ice Gel Pack before being taken to the laboratory. Use Styrofoam and Ice Gel Pack to keep the condition of the sample good and the content in it stable. Based on the article that the author can get, Styrofoam has the advantages of being lightweight, not easily damaged, waterproof and chemical resistant (Febriansya et al., 2024). Ice gel pack It is also useful for maintaining the temperature of the sample and inhibiting the growth of bacteria so that the content in the sample is maintained (Laguerre et al., 2019).
9. Samples were sent to the UKSW Salatiga laboratory. The distance from the author's location to the destination is about 40 km with a travel time of about 60 minutes.
10. Samples that have arrived in the laboratory are stored in the refrigerator, and wait for the turn of the laboratory test. The samples to be tested are grouped into types of

liquids or solids. Liquid samples as well as test samples, namely 4 variants of pistachio milk, each took 0.5 mL of samples, then diluted to 5 mL with methanol. The solids sample as well as the control sample, namely 10 mg melatonin tablets, were cut in half to weigh only 5 mg of the sample, then dissolved in 5 mL of methanol. All samples were made in a series of sample concentrations of 50, 75, 100, 125, and 150 ppm in methanol solvents.

11. The four variants of pistachio milk and melatonin tablets that had been dissolved in 5 mL of methanol were taken 1 mL of each sample at a concentration plus 3 mL of DPPH 0.1 mM reagent, then placed in a light-tight test tube. DPPH reagents serve to assess the levels of the antioxidant melatonin in samples shown in % of inhibition. If there is an antioxidant melatonin in the sample, then the DPPH reagent will undergo a color change from dark purple to yellow. The yellower the color of the sample solution, the higher the level of the antioxidant melatonin. The color change is assessed in % inhibition. If the % of inhibition is lower, it means that the level of the antioxidant melatonin is higher, because the DPPH reagent is suppressed more and more. The pure value of melatonin antioxidant levels is shown from the difference between 100% and the value of % inhibition. This is in accordance with the literacy obtained by the author related to the function of DPPH reagents, indications of color change of DPPH reagents, and the remaining difference between the maximum value of inhibition (100%) and the value of % inhibition as an indicator of melatonin antioxidant levels (Dawoud et al., 2018; Yeligar et al., 2021)
12. The samples were incubated with a room temperature setting of 20ºC-24ºC for 30 minutes. The incubation process on the sample is carried out to obtain stable sample results without germs. This is in line with the article obtained by the author that incubation was carried out with the aim of obtaining pure samples without the presence of unwanted microbes (Sekeon et al., 2018).
13. Absorbance was measured with a Mini Shimadzu U-1240 type UV spectrophotometer at a wavelength of 517 nm using methanol as a blank. A UV spectrophotometer is an instrument that functions to measure the absorbance power of a liquid that has a chromophore group to a certain wavelength of light. This is in accordance with the explanation of the literacy obtained by the author, where the UV spectrophotometer is used to determine the concentration, maximum absorption wavelength, and absorbance or light transmittance value in the solution sample. The results of spectrophotometer measurements are the function of absorbance or transmitance to the wavelength of light (Afandi & Purwanto, 2018). UV spectrophotometers are also used to test specific samples (generally liquids) that are oriented towards qualitative and quantitative analysis (Yohan et al., 2018).
14. The absorbance value is used to calculate the % of inhibition. The absorbance value is the ratio of the intensity of the absorbed light to the intensity of the incoming light. The magnitude of the absorbance value depends on the substance content in the sample. A large absorbance value indicates that the intensity of the absorbed light is increasing. Based on the literacy obtained by the author, the explanation is appropriate, where absorbance is the comparison of the intensity of the light that comes with the intensity of the absorbed light (Purnamasari et al., 2022).
15. The percentage of inhibition is generated from the calculation of the absorption value formula. The remaining percentage of inhibition indicates DPPH compounds that have not been suppressed by melatonin. Melatonin levels are determined from a difference between 100% and the remaining % of inhibition.

16. The melatonin level in percent is converted to milligram form, so it can be known that the melatonin content is precisely adjusted to the unit of 10 mg melatonin tablets.

Results of Composition and Mixture of Pistachio Bean Milk Ingredients as Melatonin Oral Sedation

The results of the composition of pistachio milk in this study contain beneficial substances including melatonin, phenolic, carotene, and polyphenols. Melatonin is beneficial as an antidepressant agent to reduce anxiety (Pasini et al., 2018), phenolic is beneficial for reducing stress and protecting cells (Dhurhania & Novianto, 2019), carotene can prevent inflammation (Silaa et al., 2019), as well as polyphenols are useful as anticancer (Dewantoro et al., 2022).

The composition results in this study have several obstacles. These obstacles are related to the instability of substance values in test samples. First, the phenolic value in the 65 g variant is the same as the phenolic value in the 55 g variant, which is 0.3391 mg/mL, the 65 g variant should be able to obtain a slightly higher phenolic value than the 55 g variant. Second, the polyphenol value in each variant seems to have decreased, and there is one variant that does not have a polyphenol value. The 35 g variant had the highest polyphenol value and then the value got lower along with the increase in the concentration of the variant, which means that the 65 g variant had the lowest polyphenol value. A high concentration of the sample should result in high polyphenol values as well under normal circumstances. The 55 g variant is also constrained, where no polyphenol values are detected.

According to the laboratory, some of these obstacles can be caused by contamination, metabolic processes in the sample, evaporation, the influence of room temperature, and exposure to sunlight. These factors can occur during the process of making samples or in the laboratory. This is most likely to occur during sample making, as the sampling environment is not suitable for the laboratory environment, where there is no room temperature controller or special streil chamber available. This can lead to some random contamination that is not unknowingly occurring in some specific samples. The laboratory also added that phenolic substances and polyphenols are quite susceptible to damage due to light contamination, so that the impact only occurs in phenolic substances and polyphenols, and does not affect melatonin and carotene.

The laboratory statement and assumptions from the author are strengthened by the literacy obtained by the author, where the constraints of inappropriate score results can occur due to 2 types of errors, namely systematic errors (sourced from tools, environment, or humans) and random errors (sourced from reagents, standards, inconsistency, temperature fluctuations, and environmental conditions). The test sample can produce a fixed value even if the sample concentration increases, the test sample value may be inversely proportional to the sample concentration, or even the test sample does not produce a value (Amani et al., 2019). This is in accordance with the phenolic test of the 65 g sample variant which produces constant values such as the 55 g variant, as well as the polyphenol test where each sample produces a value that is inversely proportional to the sample concentration and the zero sample value of the 55 g variant.

The literacy obtained by the author also states that phenolic and polyphenols are interrelated substances because they are formed from the same hydroxyl group and have a fairly high level of sensitivity (Alara et al., 2021). Phenolic substances and polyphenols are vulnerable and easily damaged by environmental conditions (De Resende & Da Costa, 2019). Therefore, from the laboratory results, the constraints are seen only in phenolic and polyphenol tests.

The overall composition results that have been obtained from the results of laboratory tests along with the constraints in it, are formed from a fairly simple mixture of ingredients. The ingredients made are by extracting pistachios from each sample variant of 35 g, 45 g, 55 g, and 65 g as solutes that have gone through the cleaning and cooking process. Extraction was carried out by giving a mixture of 200 mL of boiled water as a solvent. The extracted solution of 200 mL becomes pistachio milk without the addition of other sweeteners to maintain the natural content of pistachio milk. Packaged pistachio milk can be an alternative to oral melatonin sedation to support MRI examinations.

Total Grammation Results of Melatonin Content from Pistachio Peanut Milk as Oral Sedation

The results of melatonin levels from pistachio milk were based on variations of 35 g, 45 g, 55 g, and 65 g respectively in percentages of 24%, 27%, 38%, and 46%, and their content in milligrams respectively of 5.5 mg, 6.1 mg, 8.7 mg, and 10.5 mg. The sample of 10 mg melatonin tablets had a percentage of melatonin content of 44% and its content in milligrams of 10 mg.

The target melatonin content to be achieved is 10 mg in accordance with the use of sedation of melatonin tablets 10 mg which is commonly used in MRI examinations (Madsen et al., 2020; Picone et al., 2019). Based on this, the melatonin content of pistachio milk samples that are close to the target is a variant of 65 g with a melatonin content of 10.5 mg. The concentration of 65 g of pistachios in pistachio milk can only produce 10.5 mg of melatonin due to the boiling process. This is in line with the article obtained by the author, where the boiling process can reduce melatonin levels (Zhao et al., 2019). The theory obtained by the author states that 43 g of pistachios can produce 10 mg of melatonin, but without the boiling process. Uncooked pistachios are immediately mashed into powder and then tested for melatonin levels (Meng et al., 2017).

The boiling process is still carried out in this study to reduce allergens and bacteria, according to the article obtained by the author (Bulló et al., 2015; Gorji et al., 2018). Pistachio milk with low or zero levels of allergens and bacteria can be used as an alternative to melatonin oral sedation. Based on this, the 65 g variant of pistachio milk can be considered as an alternative to oral sedation of melatonin used to support MRI examinations.

Conclusion

The process of making pistachio milk involved collecting, cleaning, and boiling pistachios for 3 minutes, followed by grinding different weight variants (35 g, 45 g, 55 g, and 65 g) with 200 mL of water in a blender, filtering the solution using muslin bags, and packaging it into 250 mL bottles for laboratory testing. The analysis revealed that pistachio milk contained melatonin, phenolic, carotene, and polyphenols, with the 65 g variant yielding the highest melatonin content (10.5 mg), which closely aligns with the target of 10 mg found in synthetic melatonin tablets used for MRI sedation. Phenolic content was highest in the 55 g and 65 g variants (0.3391 mg/mL), while carotene peaked in the 65 g variant (19.3023 μg/100mL), and polyphenols were highest in the 35 g variant (1.8448 μg/mL), although some inconsistencies occurred due to environmental factors during processing. Overall, the 65 g pistachio milk variant, with its optimal melatonin content, shows strong potential as a natural alternative to oral melatonin sedation for MRI procedures.

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