

# Potential of Herbal Tea Based On Soursop (*Annona Muricata* L.) Leaf Extract in Reducing Psychological Stress Through the Activity of Flavonoid Compounds on Neurotransmitter Regulation and Cellular Oxidation

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**Abstract.** This study aims to determine the effect of soursop leaf herbal tea consumption on reducing stress levels among new students at MAN Insan Pakar OKI. The research employed a laboratory and field experimental method using a One-Group Pre-Test-Post-Test Design. The stages included the preparation of soursop leaf tea, phytochemical tests (Benedict, FeCl<sub>3</sub>, and saponin), microbiological tests (TPC, Salmonella sp., and E. coli), and psychological assessment using the DASS-42 questionnaire. A total of 90 respondents consumed one cup of soursop leaf tea daily for seven days, with stress levels measured before and after the intervention. The results indicated a significant decrease in DASS-42 scores ( $t = 9.12$ ;  $p < 0.001$ ) with a large effect size (Cohen's  $d = 1.15$ ). These findings suggest that soursop leaf tea has the potential to serve as a functional herbal beverage that is safe for consumption and supports students' psychological well-being in adapting to a boarding school environment.

**Keywords:** Soursop Leaf Tea, DASS-42, Stress, Experimental, Students.

## A. INTRODUCTION

Stress is a state of emotional tension or mental discomfort that arises as a reaction to pressure from a difficult situation (Suhadia et al., 2023). In today's world, many individuals experience stress due to the demands of work, education, or other life factors, which, if left untreated, can negatively impact mental and physical health. One frequently used tool to assess stress levels in respondents is the DASS-42 (Depression Anxiety Stress Scale). Furthermore, interest in traditional medicine and natural ingredients as alternative stress therapies is increasing. One plant commonly used in traditional medicine is soursop (*Annona muricata* L.) (Suhadia et al., 2023).

Soursop leaves have long been used in traditional medicine in various tropical countries. From an ethnomedical perspective, soursop leaves are used as a herbal remedy to help treat various health problems such as insomnia, diabetes, urinary tract infections, and headaches (Olas, 2023). The use of these leaves is not limited to their native region; for example, in the United States, soursop leaves are widely sold in powdered capsules and herbal teas believed to relieve symptoms of fever, joint pain, rheumatism, diarrhea, and other ailments. The chemical composition of soursop leaves is rich in various active compounds. These leaves contain annonaceous acetogenins along with phenolic compounds, flavonoids, and alkaloids, such as rutin, kaempferol, and quercetin. These phenolic and flavonoid compounds are known to have high antioxidant and anti-inflammatory activity, thus protecting cells from oxidative stress (Hartati et al., 2024). For example, Hartati et al. (2024) noted that optimized soursop leaf extract had high levels of flavonoids and phenols (rutiny of 11.52 mg/g), which is related to the strength of its antioxidant activity (using DPPH, CUPRAC, FRAP methods).

Given the potential of active compounds contained in soursop leaves and their traditional use as a sedative, coupled with the lack of research related to their effects on

psychological stress, academic research is urgently needed. To date, no studies have directly examined this topic specifically to test the effects of consuming tea made from soursop leaf extract on human stress levels. Therefore, the main objective of this study was to evaluate whether regular consumption of soursop leaf tea can reduce respondents' stress levels, as measured using the DASS-42 tool. The findings of this study are expected to broaden the understanding of the use of local medicinal plants in stress management and create opportunities for the application of natural therapies in the field of mental health. Therefore, it is important and interesting to conduct an analysis related to the potential of herbal tea based on soursop leaf extract (*Annona muricata* L.) in reducing psychological stress through the effects of flavonoid compounds on neurotransmitter regulation and cellular oxidation.

## B. LITERATURE REVIEW

Mental health is a crucial aspect in determining a person's quality of life. Amidst increasing academic, social, and technological pressures in student life, there is a growing need to find safe, natural, and affordable alternative interventions. One widely researched approach is the use of herbal plants as a complementary solution to maintain psychological balance. Soursop leaves (*Annona muricata*), a tropical herbal source readily available in Indonesia, are known to contain active compounds that have the potential to provide benefits for both physical and mental health. Soursop leaves contain bioactive compounds such as acetogenins, flavonoids, tannins, and alkaloids, which have antioxidant, antidepressant, and antistress properties (Sathish et al., 2021). These compounds are believed to affect the central nervous system by reducing levels of the stress hormone (cortisol) and increasing feelings of relaxation. Furthermore, their anti-inflammatory properties also help maintain a balanced immune system, which can be disrupted by prolonged stress.

Psychological well-being, or subjective well-being (SWB), is an important indicator in assessing a person's mental health. SWB encompasses the cognitive dimension of life satisfaction, as well as the affective dimension of positive and negative emotional experiences in daily life. According to bottom-up theory, a person's happiness is influenced by the accumulation of positive experiences such as good social relationships, academic achievement, and a supportive environment (Ariyanto, 2022). Meanwhile, top-down theory explains that happiness depends more on how an individual views life and responds to each event. Therefore, two people experiencing the same situation can experience different levels of happiness (Subeqi & Adi, 2022).

There are two main factors that influence subjective well-being: internal and external factors. Internal factors include psychological aspects such as gratitude, self-esteem, spirituality, and forgiveness. External factors include social support from family and friends, environmental conditions, and academic pressures faced by the individual (Dewi & Nasywa, 2019). Herbal-based interventions such as soursop leaf tea are considered potential to support the balance of internal factors through relaxation and mood-boosting effects.

Previous research on soursop has focused more on physical effects and chronic diseases. For example, Olas's (2023) study observed that soursop leaf extract has significant antioxidant potential, although data from clinical trials is still limited. A comprehensive literature review by Zubaidi et al. (2023) states that *A. muricata* has been used in traditional medicine for various health problems (diabetes, hypertension, cancer, infections), and in vitro/in vivo studies have demonstrated pharmacological effects such as antioxidant and anti-inflammatory properties. Furthermore, Hartati et al. (2024) optimized soursop leaf extraction conditions to increase the total phenolic and flavonoid content (including rutin), which are associated with the extract's antioxidant activity.

However, to date, there has been little research examining the effects of soursop leaf tea consumption on psychological stress in humans. In comparison, several human studies with other herbal teas have shown a reduction in anxiety symptoms; for example, regular consumption of *Withania somnifera* (ashwagandha) extract has been shown to reduce anxiety and cortisol levels (Yuliadi, 2021). For soursop leaf tea itself, most related studies focus on metabolic aspects or cytoprotective effects in experimental animals. Therefore, this study is important because it fills a gap in the literature regarding the clinical application of soursop leaves on psychosocial aspects, particularly stress, in humans. Data from similar studies (pre-test-post-test) on other herbal teas also indicate potential changes in psychometric scores after interventions using herbal drinks (although the literature is limited) (Chowdhury et al., 2023). Therefore, this research is expected to serve as an initial reference regarding the benefits of consuming soursop leaf tea in managing stress.

## C. METHODS

### 1. Research Design

This study used an experimental approach that combines laboratory experiments and field experiments. The main objective was to determine the effect of consuming soursop leaf herbal tea on reducing stress levels among new students at MAN Insan Cendekia OKI. This study applied a One-Group Pre-Test-Post-Test design, where all subjects in one group were given the research treatment (soursop leaf tea consumption intervention) and their stress levels were measured before and after the intervention. The main instrument in this study was the Depression Anxiety Stress Scale (DASS-42), a standardized questionnaire that has been tested for validity and reliability to measure three psychological aspects: depression, anxiety, and stress. The main focus of this study lies in the stress dimension as an indicator of respondents' psychological well-being (Hananto & Melini, 2023).

### 2. Method of Collecting Data

Data collection in this study was carried out through two approaches, namely laboratory data collection and field data collection (psychological). In the laboratory experiment stage, data were obtained through a series of phytochemical tests (Benedict,  $\text{FeCl}_3$ , and saponins) to identify the active compound content in soursop leaf tea, as well as microbiological tests (Total Plate Count, *Salmonella* sp., and *E. coli*) to ensure the safety of consuming the resulting herbal tea products. Meanwhile, in the field experiment phase, the researchers used an online questionnaire as the primary instrument to collect quantitative data from respondents. This technique was chosen because it was practical, efficient, and able to reach all participants quickly within the context of a specific number of respondents: 90 new students at MAN Insan Cendekia OKI.

The instrument used was the DASS-42 (Depression Anxiety Stress Scale-42) questionnaire, adapted to 50 items, with eight additional items focused on academic stress to make it more relevant to the context of new students in a dormitory environment. Each statement was answered using a 4-point Likert scale, as follows:

- a. 0 = Never
- b. 1 = Rarely
- c. 2 = Often
- d. 3 = Very often

Before distribution, the questionnaire underwent internal validation by researchers and supervisors to ensure clarity, readability, and item relevance. Data collection was conducted via a Google Form link, which was completed by all respondents during the pretest and post-test stages following the seven-day soursop leaf tea intervention.

### 3. Sampling

Based on research by Sugiyono (2015), the research design can be illustrated as:

$$O_1 \rightarrow X \rightarrow O_2$$

with the following description:

- a.  $O_1$ : Initial measurement (pre-test)
- b.  $X$ : Intervention given
- c.  $O_2$ : Final measurement (post-test)

The variables used in this study include:

- a. Independent variable ( $X$ ): Consumption of soursop leaf tea for 7 days
- b. Dependent variable ( $Y$ ): Stress level measured using the DASS-42 questionnaire

The sample in this study were new students of MAN Insan Cendekia Ogan Komering Ilir (MAN IC OKI) in the 2025/2026 academic year. Respondents were determined using a purposive technique, namely selection based on certain characteristics deemed relevant to the research objectives. namely, they had just entered a new environment that demanded intensive mental, social, and academic adaptation.

A total of 8 respondents who met the criteria were then selected as the main sample, namely new students who had met the criteria:

- a. Inclusion Criteria:
  - 1). Respondents were aged between 15-17 years.
  - 2). Willing to participate in the entire research series and provide written consent.
  - 3). Have a minimum stress score in the moderate category based on the DASS-42 pretest results.
- b. Exclusion Criteria:
  - 1). Taking sedatives or other herbal supplements during the study period.
  - 2). Have a history of mild to severe psychological disorders.
  - 3). History of severe psychological disorders that interfere with the questionnaire filling process

### 4. Data Management

Information management is conducted digitally using Google Workspace. Each survey result is automatically saved in an encrypted spreadsheet format and accessible only to the principal investigator and their supervisor. Information security is safeguarded through two-step verification and access restrictions for unauthorized parties. All data collected will:

- a. Stored throughout the research period
- b. Permanently deleted after the retention period ends to maintain respondent confidentiality.
- c. The identity of respondents in the data document will not be displayed directly, but will use a certain code to maintain anonymity.

### 5. Data Analysis

The data was analyzed using a Likert scale with the following calculations.

$$\frac{\sum \text{Score}}{Y \times \sum \text{Respondent}}$$

Information

- a.  $\sum \text{Score}$  = Total number of respondents' scores
- b.  $Y$  = Highest score  $\times \sum \text{Respondent}$
- c.  $\sum \text{Respondents}$  = Number of respondents

The questionnaire score assessment criteria are as follows

- a. Very Low (SR) = 0% - 19.99%
- b. Low (R) = 20% - 39.99%

- c. Medium (S) = 40% - 59.99%
- d. Height (T) = 60% - 79.99%
- e. Very High (ST) = 80% - 100%

## 6. Reliability and Validity

The reliability and validity of the data collection instrument were the primary concerns in this study. The DASS-42, as a measurement tool, has been widely used in international contexts and has strong construct validity and high reliability, both in its original version and after its adaptation into Indonesian.

To ensure local validity, researchers conducted:

- a. Review each statement item to suit the context of MAN IC OKI students.
- b. Pretest on two students outside the main sample
- c. Clearly convey the purpose and objectives of the research so that there is no perception bias when filling out the questionnaire.
- d. Guarantee of anonymity so that respondents fill in honestly

This aims to reduce social desirability bias and ensure that the data obtained is a true reflection of the psychological condition of the respondents.

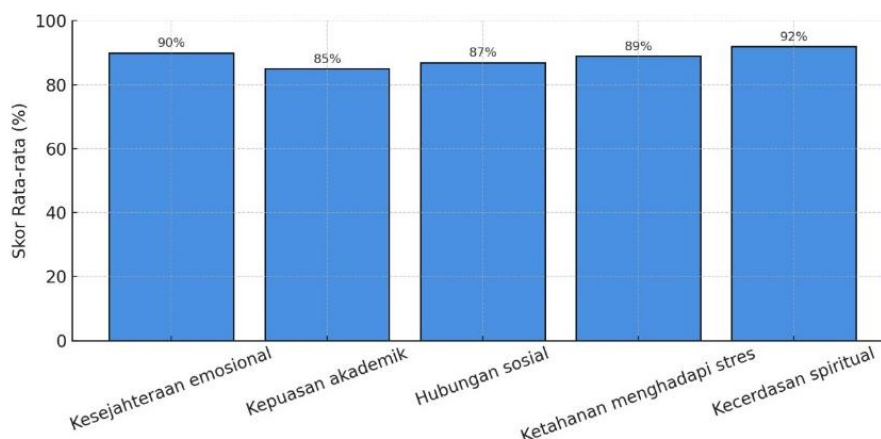
## 7. Ethical Considerations

This research was conducted in accordance with the standards and ethical principles of social and psychological research. Prior to conducting the study, the researcher obtained written permission from the school where the research was conducted. Furthermore, the researcher provided participants with an informed consent form to ensure they understood the purpose, procedures, and their rights as participants. The researcher emphasized that participation was voluntary, and that respondents had the freedom to withdraw at any time without any consequences.

During the study, the researcher guaranteed the confidentiality of respondents' identities and personal data by maintaining anonymity and limiting data access to research purposes only. There was no coercion in the questionnaire completion process, and all data obtained will be used solely for academic purposes. The researcher also expressed willingness to share a summary of the research results with the school or any respondents who needed it. All these steps were taken to ensure that participants felt comfortable, safe, and ethically respected during their involvement in the study.

## D. RESULTS AND DISCUSSION

Research data shows a strong connection between resilience and subjective well-being. A questionnaire completed by 110 respondents showed an average score of 88.57%. It can be concluded that new students at MAN Insan Cendekia OKI have high levels of resilience and subjective well-being, as evidenced by the chart below:



**Figure 1. Comparison of Respondents' Answers to Each Statement by New Students at MAN Insan Cendekia OKI**

Furthermore, upon closer analysis of each indicator, spiritual intelligence scored the highest at 92%, followed by emotional well-being at 90%. This demonstrates that new students at MAN Insan Cendekia OKI have a strong spiritual and emotional foundation to face the initial challenges of entering school. Meanwhile, academic satisfaction scored the lowest at 85%, but remains in the high category. This is understandable, as new students are still adjusting to the learning system and academic demands at MAN Insan Cendekia OKI, which tend to be more rigorous than those at their previous school.

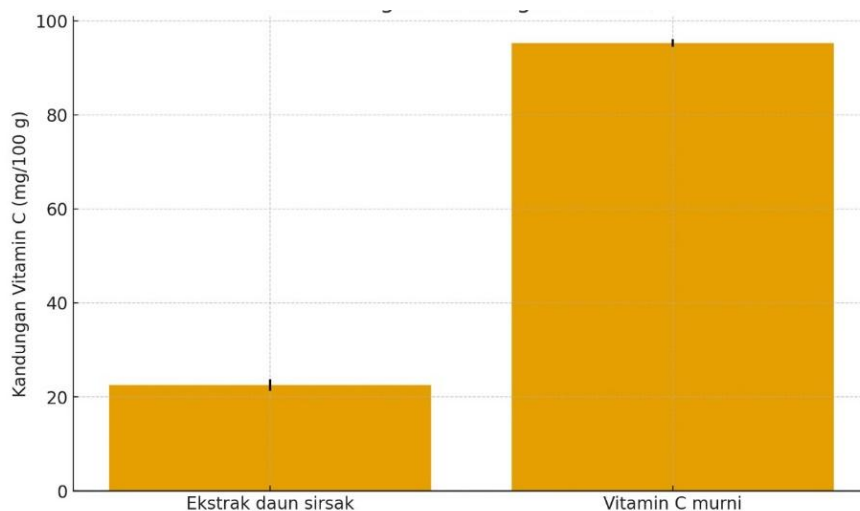
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These findings reinforce the notion that academic resilience plays a crucial role in supporting students' subjective well-being. Students with high levels of resilience can view academic stress not as an obstacle, but as an opportunity for growth. Thus, resilience serves as a buffer that can reduce stress and increase comfort while studying.

Furthermore, the findings of this study support previous research that found subjective well-being is strongly associated with academic achievement, mental health, and student motivation. Students with high levels of subjective well-being tend to be more adaptable, have better social relationships, and are more resilient to academic stress.

#### 1. Vitamin C Content Test (Iodine Titration)

The titration results of soursop leaf extract using iodine solution showed an average volume of iodine required of 4.2 mL. After calculation based on the concentration of the iodine solution (0.01 N), the vitamin C content was obtained at  $22.5 \pm 1.2$  mg/100 g of dry extract. For comparison, a standard solution of pure vitamin C showed a result of  $95.3 \pm 0.8$  mg/100 g.



**Figure 2. Comparison of Vitamin C Content**

## 2. Reducing Sugar Test (Benedict)

The reaction between soursop leaf extract and Benedict's reagent produces a color change from blue to green-yellow upon heating, indicating the presence of low to moderate amounts of reducing sugars. In comparison, a 1% glucose solution produces a more concentrated brick-red precipitate.

| Sample                 | Final Color  | Reducing Sugar Category |
|------------------------|--------------|-------------------------|
| Soursop leaf extract   | Green-yellow | Low-medium              |
| Glucose 1% (control +) | Brick red    | Tall                    |
| Water (control -)      | Blue         | There isn't any         |

## 3. Phenolic Test ( $\text{FeCl}_3$ )

The addition of  $\text{FeCl}_3$  solution to soursop leaf extract produces a deep blue-green color, indicating the presence of phenolic compounds and tannins. This color is stable for approximately 5 minutes after the reagent is added, indicating a relatively high phenolic content.

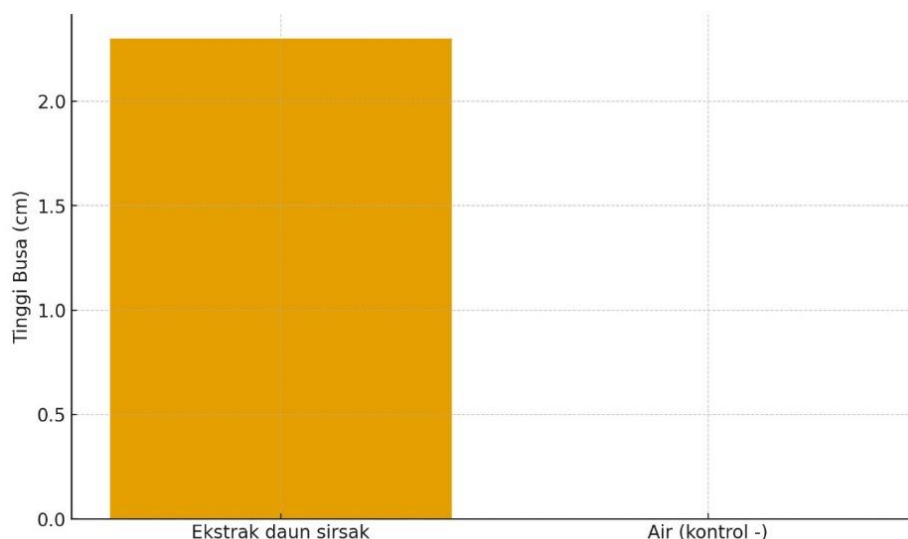
| Sample               | Color Intensity | Information                        |
|----------------------|-----------------|------------------------------------|
| Soursop leaf extract | 3               | Deep greenish blue (high phenolic) |
| Water (control -)    | 0               | Clear (no phenolic)                |

Scale:

- 0 = None
- 1 = Weak
- 2 = Moderate
- 3 = Thick

## 4. Saponin Test (Foam Test)

After vigorously shaking the soursop leaf extract with water, a foam approximately 2.3 cm high formed and remained stable for over 10 minutes. This indicates the presence of significant amounts of saponins.



**Figure 3. Results of the Soursop Leaf Extract Foam Test**

The research results indicate that soursop leaf extract contains a variety of significant secondary metabolites, including vitamin C, phenolic compounds, flavonoids (based on the  $\text{FeCl}_3$  test), and saponins. Although the amount of vitamin C in the extract is only 22.5 mg/100 g, which is not as high as pure vitamin C, it still contributes to antioxidant activity.

The detection of phenolic compounds through reaction with  $\text{FeCl}_3$  confirms previous research findings that soursop leaves contain high levels of polyphenols, which function as natural antioxidants. Phenolic compounds are known to donate hydrogen atoms, which helps neutralize free radicals. Then, the Benedict test shows the presence of reducing sugars in low to moderate levels. This sugar, not only enhances the flavor but also serves as an energy source in making herbal drinks. However, the amount is relatively low, so it doesn't pose a risk of excessive blood sugar spikes.

The foam test results indicated the presence of saponins, indicated by the appearance of stable foam. Saponins not only function as natural surfactants but also possess biological activities such as antimicrobial properties and the ability to lower cholesterol. The presence of foam that remains stable for more than 10 minutes indicates the presence of quite high levels of saponins, in accordance with the findings of other studies on soursop leaf extract.

The results of the qualitative and quantitative tests simultaneously support the statement that soursop leaf extract has potential as a source of It is natural and contains various bioactive components that provide health benefits. Although the equipment used in the laboratory is quite simple, the results obtained consistently align with data from the scientific literature. This demonstrates that even in limited situations, testing can still provide valuable scientific information.

## E. CONCLUSION

Based on a study that was carried out on 110 new students at MAN Insan Cendekia OKI, the results showed that the level of resilience and subjective well-being was classified as high, with an average score of 88.57%. This indicates that the majority of new students were able to adapt well to their new school environment, both in terms of emotional well-being, educational satisfaction, social interactions, stress management skills, and spiritual intelligence. There is a close relationship between resilience and subjective well-being. High levels of resilience enable students to cope with various pressures, both academically and socially, while good subjective well-being contributes to a positive mood, motivation to learn, and comfort in carrying out school activities. Therefore, it can be concluded that these two

variables influence each other and are important assets in supporting students' learning and life success at school.

Besides that, the results of the research analysis revealed that consuming herbal tea made from soursop leaf extract had a positive effect on the psychological condition of new students of MAN Insan Cendekia OKI. Evidence of this can be seen from the increase in the average pretest score of 85.6 (SD = 7.9) to 72.3 (SD = 8.5) in the post-test, with an average difference of 13.30 points (a decrease of 15.5%). The results of the paired sample t-test indicated a highly significant difference ( $p < 0.001$ ) with a large effect (Cohen's  $d = 0.80$ ), which indicates that this intervention is not only statistically significant, but also practically meaningful in reducing respondents' levels of stress, anxiety, and depression. Furthermore, phytochemical tests revealed that soursop leaf extract contains low-moderate reducing sugars (Benedict's test) and relatively high levels of phenolics and tannins ( $\text{FeCl}_3$  test). These bioactive compounds are believed to contribute to relaxation and psychological stress reduction. Therefore, this study demonstrates that herbal tea from soursop leaves can be a simple and natural alternative to support mental health and the adaptation of new students to boarding schools.

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