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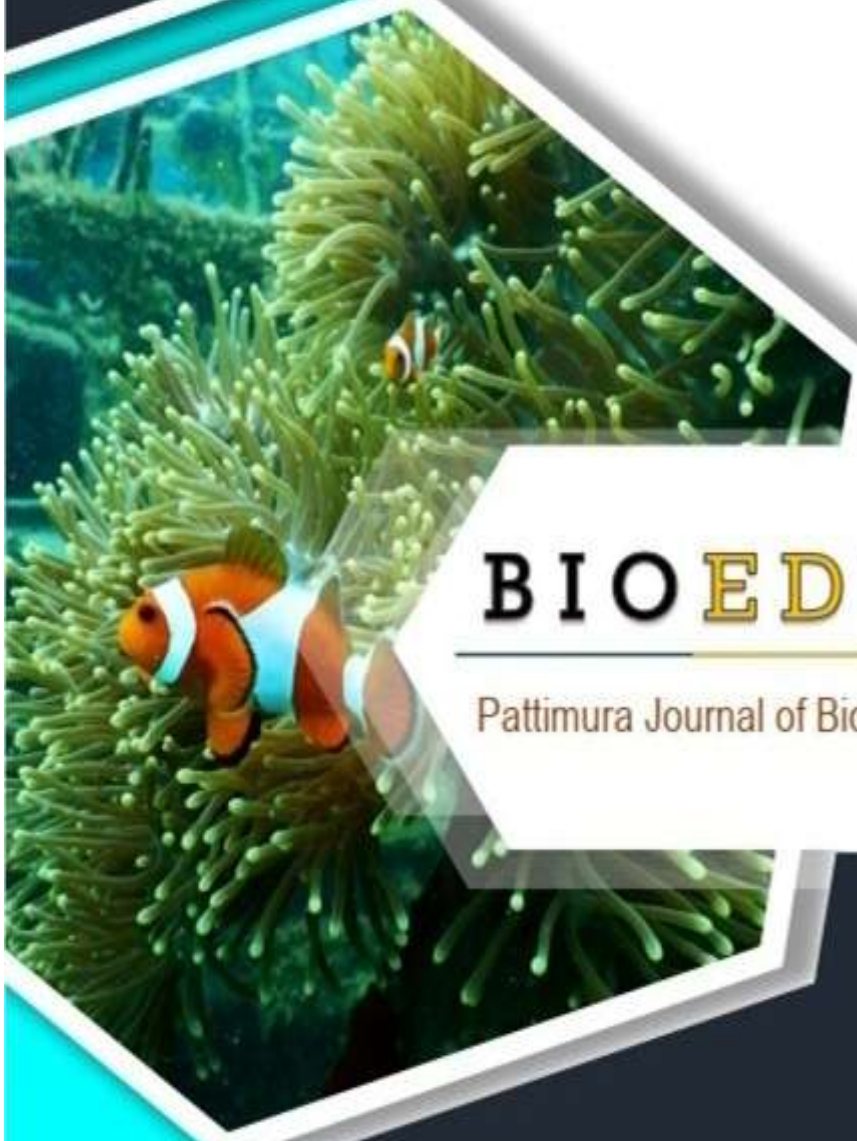

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Research Article

Prevention of breast cancer with the breast self-examination method (BSE) in the village of Negeri Lima Leihitu District, Maluku Province

Theopilus Wilhelmus Watuguly[1], Fredy Leiwakabessy[1], Johanis Fritzgal Rehena[1], Windi Mose[2], Syahran Wael[3*]

[1] *Department of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
[2]*Department of Biotechnology, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
[3]*Laboratory of Biology, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
** corresponding author: syahran.waelfkip@unpatti.ac.id*

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ABSTRACT

The number of incidences and deaths from cancer is increasing every year around the world. However, currently available cancer treatment methods still have weaknesses, the discovery of cancer drugs is still very important. The purpose of this study was to determine the effect of the level of public knowledge about breast cancer with BSE behavior on housewives in Negeri Lima Village, Maluku Province. The design of this research is descriptive analytic with a cross-sectional approach. The study was conducted in May 2022. The population in this study were residents of the village of Negeri Lima. Sampling using the method with 50 respondents. The tool used in this research is a questionnaire. The analysis technique used is Chi Square analysis. The results showed that the influence of the level of knowledge about breast cancer on housewives was mostly in the good category of 60.5%. BSE behavior in housewives is mostly in the category of not doing BSE by 40%. The results of the Chi Square analysis obtained the calculated X^2 value of 55.40 with a p value of 0.000 ($p < 0.05$). The close relationship between the level of knowledge of breast cancer with conscious behavior has a strong category indicated by a coefficient of 0.50. The conclusion of this study is that there is a relationship between the level of knowledge of mothers about breast cancer and the BSE behavior.

Keywords: knowledge, breast cancer, self-examination

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INTRODUCTION

Cancer is still a global health problem that cannot be cured. Cancer is a disease caused by the uncontrolled growth of abnormal cells in the body (Safarzadeh, et al. 2014). This abnormal cell growth can damage normal cells around it and in other parts of the body. To date, there is no effective and efficient cancer

treatment. The number of deaths from cancer continues to increase from year to year throughout the world. Cancer is the first cause of death for women in Indonesia (Hasanah, S.N et al. 2016). WHO estimates that more than 6 million new cancer cases occur every year. One of the leading causes of cancer death is breast cancer. This cancer causes cells and breast tissue to change shape to become abnormal and multiply uncontrollably. This causes great concern for researchers to look for new cancer drugs (Mulyasari, et al. 2017). The National Cancer Institute (NCI) has studied about 500 plants each year, and found most of the plants obtained from tropical rain forests (Hermanto, 2011).

Breast cancer is found in an early stage, namely stage I or II, the life expectancy is high, ranging from 85 to 95%, but it can also be said that 70-90% of patients come to the hospital after a severe illness, which is in an advanced stage. Another factor is the patient's delay. Patients do not realize and do not know about the disease. All types of breast cancer can be prevented, another third can be cured if found at an early stage or an early stage. Therefore, efforts to prevent and find breast cancer at an early stage are important efforts. Every woman aged 20 years and over, the government recommends doing BSE regularly at least once a month. BSE is done one week after the end of menstruation. BSE on a regular basis is expected for women to be well acquainted with normal breast conditions, thus being able to find out as early as possible if abnormalities occur. The lack of awareness of women to immediately check themselves due to several factors including ignorance, anxiety and fear if they find abnormalities (Mulyasari, et al. 2017).

The most common cancer-causing factors are heredity or genetics, excessive alcohol consumption, obesity, and hormones. The discovery of cancer drugs is by exploring medicinal plants or herbs that have been traditionally used by the community or ethnopharmacology which is suspected to have anticancer compounds. Herbal plants are plants that have value that are usually used in medicine. Some of the plants that are often used by the community in the treatment of cancer are vinca rosea, taxus sp, zingiber zerumbet, boesenbergia pandurata, annona muricata, eleutrine americana, rat taro, propolis from honey bees, cloves, and other types of comedity Kurnia et al (2019).

Most herbal plant ingredients in cancer treatment consist of eugenol, simple phenols, phenolic acids, phenyl acetic acid, cinnamic acid, coumarins, lignans, flavonoids, lignins, tannins, benzophenones, stilbenes, quinones and betacyanins. These compounds can be used in first-line therapy for the majority of breast cancer patients. Most of these compounds contain antiestrogen tamoxifen which is a selective estrogen receptor modulator (Mohtar et al. 2021). Eugenol exposure can contribute to amino acid deficiency so that it is promising as an anticancer therapeutic drug (Tulungen, F.R. 2019). Research on potential anticancer compounds has been carried out by Mohtar, K et al (2021) suggesting that clove eugenol compounds have the potential as anticancer against ER-α, ER-β and HER-2 receptors in breast cancer. Another study by Kurnia, H et al (2019), suggested that clove oil had a pro-apoptotic effect related to p53 protein levels in cervical cancer cells in vitro. In the discovery of new drugs, it is necessary to isolate and identify medicinal plants that are herbal. Identification is very important to know the potential compounds contained in herbal plants that are treating breast cancer.

METHODS

This type of research is descriptive analytic. Analytics is research that tries to explore how and why health phenomena occur. This research is an observational research method using a cross sectional approach, which is a method of data collection that is carried out at a moment's time or one measurement. This method aims to obtain complete data in a relatively fast time. The study was conducted in Negeri Lima Village, Leihitu District, Maluku Province, from April - May, 2022.

The population in this study were housewives in Negeri Lima Village. Sampling was selected by means of quota sampling, namely sampling based on a specified number of 50 respondents. The instrument used in this study was a questionnaire. Data analysis using correlation was carried out to state the strength of the relationship between the two variables, namely the independent and dependent variables. The statistical test carried out was the Chi Square test with a 95% confidence level.

RESULTS AND DISCUSSION

Breast cancer is a malignant tumor that grows in the breast tissue. Cancer can grow in the mammary glands, milk ducts, fat tissue, and connective tissue in the breast (Sjamsuhidajat, R. and De Jong, W. 2004). Tumor or neoplasm is a group of cells that change with the characteristics of excessive and useless cell proliferation that does not follow Variations in breast size depending on variations in the amount of fat and

connective tissue and not on the actual glandular amount Breast cancer is a malignant tumor that grows in the breast tissue. Cancer can grow in the mammary glands, milk ducts, fat tissue, and connective tissue in the breast.

The results showed that as many as 50 respondents who had good knowledge of 60.5% and did not perform BSE behavior as much as 40%. The results of the Chi-square Test analysis obtained the X^2 value of 55.40 with a p value of 0.000. This means that there is a relationship between the knowledge of mothers in the village of Negeri Lima about breast cancer with conscious behavior. The result of the analysis of the contingency coefficient of 0.50 which has an understanding of the relationship between knowledge and conscious behavior is strong. The results of the analysis showed that the level of knowledge of mothers about breast cancer in Negeri Lima Village was in the good category. The level of knowledge in the category of good enough can be interpreted that they already have a fairly good understanding of breast cancer.

Breast glands are owned by both women and men. These glands become functional at puberty to respond to estrogen in girls and are usually underdeveloped in boys. During pregnancy, the mammary glands reach their peak development and function for milk production (lactation) after giving birth to a baby. Each breast is an elevation of skin-covered glandular and adipose tissue on the anterior chest wall. The breast is located above the pectoralis major muscle and is attached to the muscle through a layer of connective tissue. Variations in breast size depend on variations in the amount of fat and connective tissue and not on the actual number of glands. Anatomical images of the breast can be seen in Figure 1.

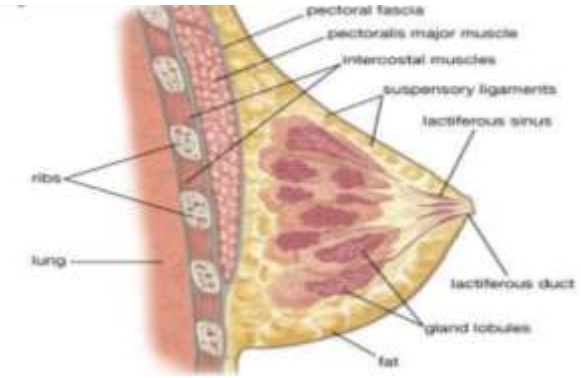


Figure 1. Breast Anatomy

BSE can be done in an upright position by standing facing a mirror or lying down with one hand placed under the head, then observations and palpation of the breast are carried out systematically, so that if a lump is found in the breast (Galih. 2020).

a. Time to do BSE
   BSE is carried out regularly, ie once a month, 7-10 days after menstruation, which is calculated from the first day of menstruation. It is hoped that at the time of the examination the breasts are not swollen or painful when pressed.
b. How to do BSE
   The following are the steps to do BSE according to the Ministry of Health recommended in the context of Breast AwarenessMont:
   1). Stand up and face the mirror, then examine both breasts whether normal or not. Pay attention if there are changes such as fluid coming out of the nipples, wrinkles, peeling skin.
   2). Raise both hands above your head. Pay attention to any changes in the contours of the breasts, whether there are abnormalities in both breasts or nipples.
   3) Place both hands towards the waist and slightly bend towards the mirror while pulling the shoulders back and elbows forward. Pay attention to any changes in the contours of both breasts and nipples. This breast examination can be done when bathing with a shower, if the skin is soapy and splashed with water, massaged with fingers can feel any changes in the breasts.
   4) Raise the left hand with the hand bent behind the head, then use 3 or 4 fingers on the right hand to feel the left breast gently, firmly, carefully and evenly. Starting from the outer edge, press the flat part of the fingers in small circles, moving slowly around the breast gradually toward the nipple. Pay special attention

to the area between the breast and under the arm and feel for any unusual lumps or masses under the skin.

5) Massage the nipples slowly and pay attention to whether there is any discharge or discharge. Repeat the examination, if you find things that are not normal such as discharge from the breast milk within 1 month and occur when you are or are not doing BSE, immediately see a doctor for further examination.
6) Repeat the fourth and fifth steps but in a lying position. Lie flat, with your left arm placed under your head and a pillow or folded towel on your left shoulder. Use the same circular motion as described above, and repeat on the right breast. Step of BSE can be seen in Figure 2.

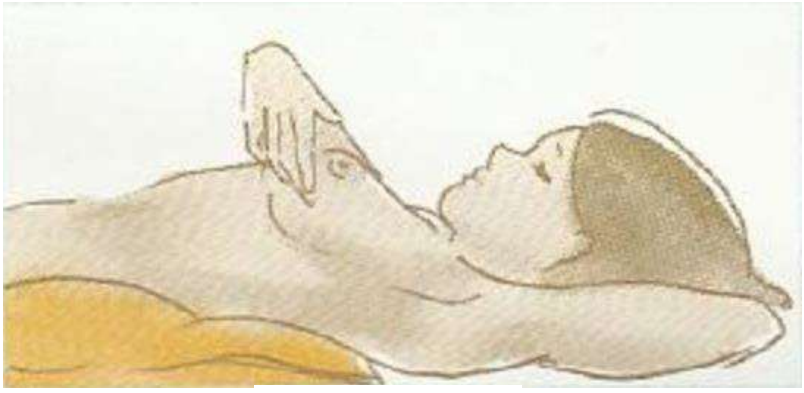
the first step BSE

the second step BSE

the third step BSE

the fourth step BSE

the fifth step BSE



the sixth step BSE

Figure 2. step-by-step procedure BSE

CONCLUSION

Most of the mothers in the village of Negeri Lima have knowledge about breast cancer in the pretty good category of 60.5%, while 40% do not do BSE. There is a relationship between the level of knowledge of mothers in the village of Negeri Lima about breast cancer with BSE behavior. This is indicated by the results of Chi Square analysis obtained by the calculated X^2 value of 55.40 with a p value of 0.000. The close relationship between the influence of the level of knowledge about breast cancer with conscious behavior in the strong category, indicated by the coefficient value of 0.50.

REFERENCES

Cairns, J. 1975. Mutation selection and the natural history of cancer. Nature. 255 (15): 197-200.

Choi, S.W., Jeon, S.H., Kwon, E.B., Zhu, G.Q., Lee, K.W., Choi, J.B., Jeong, H.C., Kim, K.S., Bae, S.R., Bae, W.J., Kim, S.J., Cho, H.J., Ha, U-S., Hong, S.H., Hwang, S.Y., Kim, S.W. 2019. Effect of Korean herbal formula (modified ojayeonjonghwan) on androgen receptor expression in an aging rat model of late onset hypogonadism. *The World Journal of Men's Health.* 37 (1): 105-109

Dewi, G.A., Hendrati, L.Y. 2015. Analysis of breast cancer risk based on history of hormonal contraceptive use and age of menarche. Jurnal Berkala Epidemiologi 3(1): 12-23.

Galih. 2020. The relationship between the level of knowledge of breast cancer with the behavior of early detection of breast cancer BSE method in women of childbearing age in Batu City. Maulana Malik Ibrahim State Islamic University.

Harahap, W.A. 2014. DNA methylation and its role in sporadic breast cancer. MKA (37 (2): 23-29.

Hasanah, S.N., Widowati, L. 2016. Herbal medicine in tumor/cancer patients as complementary therapy. Kefarmasian Indonesia 6 (1): 49-59.

Hermanto, S. 2011. Identification of in vitro anti-breast cancer compounds in three varieties of red fruit (Pandanus conoideus Lamk). Quantum, Jurnal Inovasi Pendidikan Sains. 2 (1): 39-46.

Mulyasari, A.D., Hartati, B., Cece, S. 2017. Analysis of breast cancer risk factors at BahteraMas General Hospital, Kendari City, Southeast Sulawesi Province. Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat 2 (6):123-130

Mohtar, K., Fatimawali., Erladys, M., Rumondor., Olvie, S., Datu, E., Tellei. 2021. In silico study of clove eugenol compounds (Syzygium aromaticum L.) on ER-α ER-β and HER-2 receptors in breast cancer. Pharmacon. 10 (3): 1001-1008.

Kurnia, H., Ihda Dian, K., Elly, M. 2019. Clove (Syzygium aromaticum) oil induces an apoptotic effect in HeLa cervical increasing p53 protein level. Jurnal kedokteran Brawijaya 30 (3): 185-190.

Kartawiguna, E. 2021. Factors influencing carcinogenesis. Journal Kedokteran Trisakti 20 (1) 16-26.

Safarzadeh, E., Shotorbani, S.S., Baradaran, B. 2014. Herbal medicine as inducers apoptosis in cancer treatment. Advanced Pharmaceutical Bulletin. 4 (1): 421-427.

Sjamsuhidajat, R., De Jong, W. 2004. Relationship of Knowledge Level with Breast Self-Examination Behavior (Aware) in Women of Childbearing Age. Journal Kebidanan dan Keperawatan. 7 (2): 239-249.

Sartono, S., Terati, T., Nazarena, Y. (2014). Analysis of nutrient (Energy, Protein), antioxidant (Vitamins A and C) with nutritional status of cervical cancer patients undergoing chemotherapy in RSUP Dr. Mohammad Hosein Palembang. Jurnal Kesehatan Poltekkes Palembang. 1 (13): 132-135.

Stratton, M.R., Campbell, P.J., Futreal A. 2009. The cancer genome. Nature 458 (9): 719-724.

Sumardika I.W.A., Sudarsa, I.W. Management of breast cancer with BRCA gene mutations. Kedokteran Universitas Udayana.

Wuyung, P.E. 2016. Induction of DMBA in breast gland carcinogenesis. Pratista Patologi 5 (1): 44-51.

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Research Article

Study of the abundance and diversity of crustacea in the ecosystem mangrove forest of Ambon Island

Yulviany Latuihamallo[1], Dominggus Rumahlatu [2], Sriyanti Imelda Aksamina Salmanu [2*]

[1] Graduate of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia
[2] Department of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia
** corresponding author: salmanusriyantifkip@unpatti.co.id*

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ABSTRACT

Crustaceans are very abundant in mangrove forest ecosystems and are still poorly documented. Therefore, this study aims to reveal the abundance and diversity of crustaceans in the mangrove forest ecosystem of Hutumuri Beach and Suli Beach, Ambon Island. Crustacean data collection was done by determining the plot using random sampling method. Determination of crustacean abundance using individual formulations per unit area or per unit volume, while crustacean diversity was calculated using the Shannon-Wiener equation. The crustaceans found in the mangrove forest ecosystem of the Hutumuri and Suli beaches were 56 individuals, consisting of 7 families and 11 species. The abundance of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the coast of Suli was 0.29 ind/m2 and 0.27 ind/m2, respectively. For the diversity of crustacean species in the mangrove forest ecosystem of the Hutumuri coast and the Suli coast, respectively, 1, 176807 in the medium category and 0.78526 in the low category.

Keywords: crustacea, mangrove forests, diversity, abundance

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INTRODUCTION

Mangrove forest is a typical forest type that grows in areas that are affected by tides, especially in coastal areas, lagoons, river estuaries that are flooded and free from inundation at low tide where the plant community is tolerant of salt levels (Sofian et al., 2019 ; Haumahu et al., 2018; Rahayu et al., 2017). This ecosystem forms a system consisting of organisms both plants and animals that interact with environmental factors that exist in the mangrove ecosystem (Rahayu et al., 2017). Mangrove ecosystems have an important role in coastal areas, namely 1) physically acting as a barrier to abrasion, sea waves, strong winds for land areas, controlling sea water intrusion, and building land through the sedimentation process, 2) ecologically acting as producers (providers). nutrients), spawning ground, nursery ground and feeding ground for various types of animals such as fish, shrimp, and crabs and 3) economically, mangroves can be used as firewood, paper materials, and construction materials (Putriningtias et al., 2019). As a specific ecosystem, mangroves have strong associations with the biota that live around them.

The existence of mangroves is very important for every biota in the ecosystem (Hogarth, 2007 & Pratiwi, 2007). Therefore, the mangrove ecosystem is often called a transitional ecosystem which has an important role in balancing the surrounding aquatic (marine) and terrestrial (terrestrial) ecosystems (Pratiwi, 2007). As a transitional area for the two ecosystems, mangroves have the characteristics of fauna that live in the environment, namely vertebrates such as amphibians, reptiles, aves and mammals, while the invertebrates that live in mangrove ecosystems are crustaceans and mollusks. The existence of these two phyla is the most conspicuous and abundant (Hogarth, 2007 & Pratiwi, 2007). The mangrove ecosystem has optimum temperature, light, pH, oxygen, salinity, rich in nutrients (organic matter content), sediment characteristics and calm water conditions. This fulfills the criteria for a suitable habitat for crustaceans (Pratiwi, 2007 & Checon et al., 2017). Crustaceans consisting of shrimp and crabs have an important role in the mangrove ecosystem and there are several species that have high economic value. In addition, there are several species identified as high protein sources, for example Panurilus spp., Scylla spp., and Portunus pelagic (Hamid & Wardiatno, 2018).

Several studies show that the diversity of crustacean species varies in all locations and in Maluku, research on crustacean diversity is rarely carried out, even though Maluku has waters that are rich in various kinds of marine life. Suli and Hutumuri beaches are the locations used for research on crustacean diversity. These two locations are rarely used for crustacean research, therefore, in this study, these two beaches were used to identify the diversity of crustaceans on both coasts. In addition, there are many biological aspects that become criteria for suitable habitats for crustaceans, namely abundant mangrove populations as a place of reproduction, rich in nutrients, calm water conditions, and others. The purpose of this study was to reveal the diversity and abundance of crustacean species on Hutumuri Beach, South Leitimur District, Ambon City, Maluku and on Suli Beach, Salahutu District, Central Maluku Regency, Maluku.

METHODS

This research is a descriptive study that describes the diversity and abundance of crustacean species in the Mangrove area, Hutumuri village, South Leitimur sub-district, Ambon city and Suli village, Salahutu sub-district, Central Maluku district in March 2020. Sampling was carried out at low tide (lowest low tide). The location for sampling is based on the availability of mangrove vegetation that represents the research area. Each location (station) consists of 3 plots. The plot was determined based on the random sampling method. In each sampling squared (10 x 10 m), crustaceans on the substrate surface were picked by hand (hand picking). The crustaceans contained in the hole were taken by digging a hole and using a trofol/shovel. Samples that can be cleaned with water to remove traces of sediment attached to the crustacean sample. Samples were anesthetized with 70% alcohol, then stored in jars and labeled for identification.

Crustacean abundance is calculated using the following equation:

$$\mathbf{N} = \frac{\mathbf{\Sigma ni}}{\mathbf{A}}$$

Explanation:

- **N** = Abundance of *crustacea* (ind/m^2)
- **Σni** = Number of individuals of type I (ind)
- **A** = Sampling box area (m^2)

The Diversity Index (H') of Crustaceans is determined by the equation of Shannon-Wiener (Krebs, 2016) :

$$\mathbf{H'} = -\sum_{\mathbf{i=1}}^{s} \mathbf{(pi)ln(pi)}$$

Explanation:

- H' : Diversity index Shannon-Wiener
- S : Number of species
- pi : The proportion of the number of individuals of type I to the total number of individuals
- pi : ni/N
- ni : Number of individuals type -i
- N : Number of individuals of all types

Table 1. The value of the diversity index benchmark (Indraswari et al., 2018)

Benchmark Value	Explanation
H' < 1,0	Low diversity, poor, very low productivity as an indication of heavy pressure and unstable ecosystem
1,0 < H' < 3,322	Moderate diversity, sufficient productivity, moderately balanced ecosystem conditions, moderate ecological pressure
H' > 3,322	High diversity, stable ecosystem stability, high productivity, resistant to ecological stress

RESULTS AND DISCUSSION

Based on the results of a comprehensive study at the location of the mangrove forest ecosystem, Hutumuri beach and Suli beach, 56 individuals were found consisting of 7 families and 11 species. In the coastal mangrove forest ecosystem of Hutumuri, 6 families, 8 species and 29 individuals were found. In the Suli coastal mangrove forest ecosystem, 2 families, 3 species and 27 individuals were found (Table 2).

Table 2. Types of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the Suli coast

Family	***Species***	**Number of Individuals**	
		Hutumuri	**Suli**
Grapsidae	*Metopograpsus frontalis*	-	2
Ocypodidae	*Austruca* (*Uca*) *perplexa*	-	11
	Gelasimus (*Uca*) *hesperiae*	-	14
	Paraleptuca (*Uca*) *boninensis*	1	-
	Tubuca (*Uca*) *dussumieri*	2	-
Penaeidae	*Penaeus* sp.	3	-
Pilumnidae	*Pilumnus vespertilio*	1	-
Porcellanidea	*Pterolisthes scabriculus*	1	-
Potamidae	*Geothelphusa cilan*	1	-
	Geothelphusa hesperiae	9	-
Xanthidae	*Etisus dentatus*	11	-
Number of Types		**8**	**3**
Number of Individuals		**29**	**27**

Crustacea families found in the coastal mangrove forest of Hutumuri were quite large compared to those found in the mangrove forest of the Suli coast. The species in the two research locations were also different, where the species in the Hutumuri coastal mangrove forest ecosystem did not exist in the Suli coastal mangrove forest ecosystem. This is because the mangrove forest ecosystem on the Hutumuri beach is still in good condition and there is no human-caused disturbance that can damage the mangrove forest ecosystem, therefore species diversity is found there. In the mangrove forest ecosystem on the Suli coast, the condition has been under pressure caused by the presence of garbage disposal and has become a place for community settlements. This greatly affects the existence of crustaceans so that the number of species and families found is not too many (Pratiwi, 2007). Overall diversity and abundance of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the coast of Suli have differences, especially for the abundance of certain species in the Ocypodidae, Potamidae and Xanthidae families. This situation is in line with the opinion of Odum (1993) that in a community that contains many species, some of which are pre-dominant groups. The number of species including pre-dominant decreases if an environment becomes extreme caused by environmental disturbances both physically, biologically and chemically (Pratiwi, 2002).

The crustaceans found in the mangrove forest ecosystem of Hutumuri village consisted of 8 species belonging to 6 families, namely Paraleptuca (Uca) boninensis and Tubuca (Uca) dussumieri (Ocypodidae), Penaeus sp. (Penaeidae), Pilumnus vespertilio (Pilumnidae), Pterolisthes scabriculus (Porcellanidae), Geothelphusa cilan and Gheothelphusa hesperiae (Potamidae) and Etisus dentatus (Xanthidae). Crustacean species that are most often found are species from the Xanthidae family, while the less common are species from the Pilumnidae and Porcellanidea families. The Xanthidae family has a species composition of 39% in the Hutumuri coastal mangrove forest ecosystem. The number of species from the Xanthidae family that were found was due to several factors, including the first factor, the crabs in the Xanthidae family have "lazy moving" behavior so that their roaming area is

limited (Wahyudi, 2013). The second factor, Xanthidae crabs are the dominant group in coral reef ecosystems and rock fragments (Pratiwi, 2012). The third factor is the possible influence of the sampling method (handpicking) used for sampling because the sampling process is carried out by taking sediment, so that crabs that have lazy behavior such as Xanthidae will be obtained more than crabs that are actively moving (Pratiwi, 2019). The types of crabs found in the mangrove forest ecosystem of Suli village consist of 3 species which are divided into 2 families, namely Austruca (Uca) perplexa and Gelasimus (Uca) hesperiae (Ocypodidae) and Metopograpsus frontalis (Grapsidae). The most common type of crustacean found is the type of crustacean in the Ocypodidae family, while the less common is the Grapsidae family.

Two species in the Ocypodidae family are crab species that live in holes when the tide is low and are found (dominant) in mangrove forest ecosystems (Suprayogi, 2014). This is because the habitat occupied is in accordance with the way of life of the crab and the availability of food in the form of abundant mangrove leaf litter, so this type of crab is the most abundant. This is because, the habitat occupied is in accordance with the way of life of the crabs and the availability of food in the form of abundant mangrove leaf litter, so that this type of crab is most often found (dominant) with a percentage of 93%. Two species in the family Ocypodidae dig holes and live in them to protect their bodies against high temperatures, because the water in the dug holes can help regulate body temperature through evaporation (Murniati, 2009). While the Grapsidae family has a composition of 7% for the location of the Suli village mangrove forest ecosystem. Crabs from this family are found in mangrove areas, however, not as many as Ocypodidae because Metopograpsus frontalis is a climbing species so it is difficult to find this species.

Crustacea abundance in the mangrove ecosystem of Hutumuri and Suli coasts

In general, the two study sites had relatively similar abundances of crustaceans because the differences were not too significant. The location of the mangrove forest ecosystem in Hutumuri village has a greater abundance than the location of the mangrove forest ecosystem in Suli village, which is 0.29 ind/m2 while the abundance of crustaceans in the mangrove forest ecosystem location in Suli village is 0.27 ind/m2. There are several factors that affect the abundance of crustaceans, namely, the availability of a high content of organic matter (food), organic matter serves to provide nutrients for the crustaceans that live in it. temperature, salinity, pH, and substrate type. If the required element values are below or above the threshold, the species will not be found in these waters (Redjeki et al., 2017).

Table 3. Crustacea abundance at the study site

Family	***Species***	**Number of Individuals**	
		Hutumuri	**Suli**
Grapsidae	*Metopograpsus frontalis*	-	0,02
Ocypodidae	*Austruca* (*Uca*) *perplexa*	-	0,11
	Gelasimus (*Uca*) *hesperiae*	-	0,14
	Paraleptuca (*Uca*) *boninensis*	0,01	-
	Tubuca (*Uca*) *dussumieri*	0,02	-
Penaeidae	*Penaeus* sp.	0,03	-
Pilumnidae	*Pilumnus vespertilio*	0,01	-
Porcellanidea	*Pterolisthes scabriculus*	0,01	-
Potamidae	*Geothelphusa cilan*	0,01	-
	Geothelphusa hesperiae	0,09	-
Xanthidae	*Etisus dentatus*	0,11	-
	Amount	**0,29**	**0,27**

Diversity of crustaceans in the mangrove ecosystem of Hutumuri coast and Suli coast

Based on the number of individual crustaceans from the two research locations, namely the mangrove forest ecosystem of Hutumuri village and Suli village, it shows that the number of individual crustaceans found in each location is different and the diversity index of the two locations is also different.

Table 4. Diversity of crustaceans in the mangrove forest ecosystem of the Hutumuri coast and the Suli coast

Family	***Species***	**Number of Individuals**	
		Hutumuri	**Suli**
Grapsidae	*Metopograpsus frontalis*	-	2
Ocypodidae	*Austruca* (*Uca*) *perplexa*	-	11
	Gelasimus (*Uca*) *hesperiae*	-	14

	Paraleptuca (*Uca*) *boninensis*	1	-
	Tubuca (*Uca*) *dussumieri*	2	-
Penaeidae	*Penaeus* sp.	3	-
Pilumnidae	*Pilumnus vespertilio*	1	-
Porcellanidea	*Pterolisthes scabriculus*	1	-
Potamidae	*Geothelphusa cilan*	1	-
	Geothelphusa hesperiae	9	-
Xanthidae	*Etisus dentatus*	11	-
	Number of Individuals	**29**	**27**
	Number of Species	**8**	**3**
	H'	**1,176807**	**0,78526**
	Σ H'	**1,96207**	

The diversity index (H') of the location of the mangrove forest ecosystem in Hutumuri village 1.176807 belongs to the medium category, which means that this location is in fairly stable environmental conditions, crustaceans live well in these environmental conditions. The concept of species diversity can be used to measure the ability of a community to keep itself stable (community stability), even though it gets disturbed. H' is in a fairly stable condition, the ecosystem is quite balanced and is under moderate ecological pressure (Handayani et al., 2016). The diversity index (H') at the location of the Suli coastal mangrove forest ecosystem, which is 0.78526, is included in the low category, it means that the Crustacean community is in an unstable condition. Not many species live in this location and there are dominant species such as Gelasimus (Uca) hesperiae and Austruca (Uca) perplexa). In addition to these types, other types are obtained but in very small quantities. This is related to the condition of the location which is close to community settlements and there is a lot of waste from the surrounding community. .

CONCLUSION

Based on the results of the study, the crustaceans found in the coastal mangrove forest ecosystem of Hutumuri and Suli coast consisted of 7 families with 11 species, namely Paraleptuca (Uca) boninensi, Tubuca (Uca) dussumieri, Austruca (Uca) perplexa and Gelasimus (Uca) hesperiae (Ocypodidae). Metopograpsus frontalis (Grapsidae), Penaeus sp. (Penaeidae), Pilumnus vespertilio (Pilumnidae), Pterolisthes scabriculus (Porcellanidae), Geothelphusa cilan and Gheothelphusa hesperiae (Potamidae) and Etisus dentatus (Xanthidae). In all, 56 individuals were identified. The abundance of the two locations is relatively similar, namely at the location of the coastal mangrove forest ecosystem of Hutumuri 0.29 ind/m2 and at the location of the coastal mangrove forest ecosystem of Suli 0.27 ind/m2, the abundance is influenced by tidal factors, food availability and environmental factors. The value of the diversity index (H') at the location of the mangrove forest ecosystem on the Hutumuri coast is 1.176807 with a medium category indicating moderate diversity, sufficient productivity, fairly balanced ecosystem conditions and moderate ecological pressure and at the location of the mangrove forest ecosystem in Suli village of 0, 78526 with low category with indications of low diversity, poor, very low productivity as an indication of heavy pressure and unstable ecosystem.

REFERENCES

Checon, H. H., & Costa, T. M. (2017). Fiddler crab (Crustacea: Ocypodidae) distribution and the relationship between habitat occupancy and mouth appendages. Marine Biology Research, 13(6), 618-629.

Hamid, W., & Wardiatno, Y. (2018). Diversity of decapod crustaceans in Lasongko Bay, South-East Sulawesi, Indonesia. Biodiversity Journal, vol. 9(3), p. 303-311.

Handayani, O. T., Ngabekti, S., & Martuti, N. K. T. (2016). Diversity of crustaceans in the mangrove ecosystem in the Tugurejo Village area, Semarang City. Life Science, 5(2), 100-107.

Haumahu, S., Uneputty, P. A., Tuapattinaja, M. A., & Rijoly, F. (2018). Biology of coastal and marine organisms. Alphabeta: Bandung.

Indraswari, I. G. A. D., Dirgayusa, I. G. N. P., & Faiqoh, E. (2018). Study of the abundance and diversity of crabs in mangrove forests and seagrass beds on the Mertasari coast. Journal of Marine and Aquatic Sciences, 4(1), p. 167-170.

Krebs, C. J., O'Donoghue, M., Taylor, S., Kenney, A. J., Hofer, E. J., & Boutin, S. (2016). Predicting white spruce cone crops in the boreal forests of the southern and central Yukon. Canadian Journal of Forest Research, 47(1), 47-52.

Murniati, D. C. (2009). Comparison of the cover area of the second maxiliped spoon toped setae in Uca spp, (Brachyura: Ocypodidae). Zoo Indonesia, 18(1), 1-8.
Odum EP. 1993. Basics of ecology. Translated by Tjahjono Samingan. Third Edition. Gadjah Mada University Press, Yogyakarta.
Pratiwi, R. (2002). Study of community structure and some biological aspects of crustacean macrobenthos in the mangrove community of Ajkwa Island and Kamora Island, Mimika Regency, Papua. Undergraduate Thesis in Marine Science, Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang
Pratiwi, R. (2007). Study of mangrove crabs in the Mahakam Delta, East Kalimantan. Oceanographic Research Center-LIPI, 12(2), 92-99.
Pratiwi, R. (2012). Types and distribution patterns of crustacean fauna in the seagrass beds of Tikus Island, Seribu Islands. Oldi, 38(1), 43-55.
Pratiwi, R. (2019). Tikus island brachyura crab, Thousand Islands. Biosphere Biosphere Scientific Magazine: A Scientific Journal, 36(1), 63-70.
Putriningtias, A., Faisal, T. M., Komariyah, S., Bahri, S., & Akbar, H. (2019). Diversity of crab species in the mangrove forest ecosystem of Kuala Langsa, Langsa City, Aceh. Journal of Tropical Biology, 19(1), 101-107.
Rahayu, S. M., Wiryanto., & Sunarto. (2017). Diversity of crustacean species in the mangrove area of Purworejo Regency, Central Java. Journal of Basic Science, 6(1), 57-65.
Redjeki, S., Arif, M., Hartati, R., & Pinandita, L. K. (2017). Density and distribution of crabs (Brachyura) in the mangrove forest ecosystem of Segara Anakan Cilacap. Journal of the Tropical Ocean, 20(2), 131-139.
Sofian, A., Kusmana, C,, Fauzi, A., & Rusdiana, O. (2019). Ecosystem services-based mangrove management strategies in Indonesia: A review. AACL Bioflux 12(1), 151-166.
Suprayogi, D., Siburian, J., & Hamidah, A. (2014). Diversity of violin crabs (Uca spp.) in Tungkal I village, Tanjung Jabung Barat. Biospecies, 7(1), 22-28.
Wahyudi, A. J. (2013). Poisonous crab. In: Hasdeo EH, Bisri SZ, Ningrum A, Ayuandari S, Kurnia F, Syamsurnarno MR, Heryani P & Premono Eds. Thousand Teachers Magazine, 29, 11-13

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Research Article

Analysis of leaf cellulose in gayam (*inocarpus vagiver*) based on different altitudes

Adelheid Adonia Erubun[1], Alwi Smith[2], Ine Arini[2*]

[1] *Graduate of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
[2] *Department of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
** corresponding author: ine.arinifkip@unpatti.ac.id*

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ABSTRACT

Gayam (*Inocarpus vagiver*) contains natural chemicals in the form of primary metabolites that play an important role in plant survival. The primary metabolites are directly involved in the growth of the Gayam plant. Cellulose is the main component of plant cell walls .Cellulose is a natural material that can be renewed and its uses are very broad. This is because cellulose is widely used for the manufacture of paper and products with various properties. The purpose of this study was to determine the cellulose content of the leaves of the Gayam plant based on different altitudes. The method used in this research is descriptive quantitative and qualitative with the sampling technique using purposive sampling. Based on the iodine test, Gayam leaves in Ema vilage and Airlouw both have cellulose compounds. The average cellulose content in Ema vilage is 0.23315% while Airlouw is 0.20008% which means the higher cellulose content is in Ema.

Keywords: gayam, cellulose.

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INTRODUCTION

Indonesia is one of the world's centers of biodiversity and is known as a megabiodiversity country. This high biodiversity is a natural wealth that can provide versatile benefits as a basic capital for development and is the lungs of the world that is absolutely needed both now and in the future (Suhartini, 2009). With high biodiversity, especially local plants, it can also have great potential to meet the needs of human standards and produce high chemical diversity, but in Indonesia there are still many plants that have not been cultivated optimally, and have not been studied much, one of which is the Gayam plant (Inocarpus vagiver). Gayam plant (Inocarpus vagiver) is a native plant from the eastern part of Malesiana, especially in Indonesia which has a height of up to 20 m (Falanruw, 2015). This plant is also called the archipelago tree because Indonesia is one of the distribution areas of the Gayam plant that lives at an altitude of 500 m above sea level (Setyowati & Wawo, 2015). This plant

usually lives in swampy areas or environmental areas where there are abundant water sources (Heyne, 1987). Gayam plant (Inocarpus vagiver) has many benefits including being used as an alternative food ingredient and traditional medicine, to treat dysentery and urinary tract infections (Segatri in Sukadana, 2017). The old Gayam stems can be used as building materials and processed as furniture products, such as beds, cabinets, and photo frames. The old Gayam leaves can be used to wrap tempeh and animal feed. Gayam leaves can also be processed into vegetable pesticides to kill insects on plants (Wawo, Setyowati, and Utami 2011).

Cellulose is the basic component of cell walls and fibers that give fiber strength (Moniriqsa, 2012). Based on research that has been done according to Norman (1937) there are 62% - 79% cellulose in pineapple leaves, while Hidayat (2008) states that pineapple leaves contain 69.5% - 71.5% cellulose. Furthermore, research that has been carried out from processing for Gracilaria sp produces cellulose content of 20.17%. While Septiany (2013), produced cellulose content of Gracilaria verrucosa of 13.04% and Eucheuma cottonii of 9.51%. The potential utilization of cellulose can meet almost all aspects of standard human needs, ranging from conventional materials, such as the wood and paper industry, to advanced materials, such as energy sources, composites, biomedical applications, and drug delivery (Fernandes, Pires, Mano & Reis, 2013).

METHODS

This type of research is a descriptive study to see or reveal the cellulose compounds in Gayam leaf (Inocarpus vagiver) and the cellulose content of Gayam leaf (Inocarpus vagiver) at different altitudes. The research location was in Negeri Ema, South Leitimur District and Airlouw Hamlet, Nusaniwe District on August 13, 2021 – June 16, 2022. The object in this study was the leaves of the Gayam plant (Inocarpus vagiver) which were found at the research location. Observational data analysis technique in this study is quantitative descriptive data. The qualitative and quantitative observation data obtained were then analyzed descriptively.

Tools and Materials

Tools: scissors, blender, sieve, scale, Erlenmeyer flask, measuring cup, Dessicator, stirring rod, dropper, test tube, oven, porcelain cup, camera, label, stopwatch, water bath, and basin.

Ingredients: Gayam (Inocarpus vagiver) leaf, aquadest, H_2SO_4 72%, NaClO 10%, NaOH 12%, Iodine, water, plastic.

Research procedure

1. Stage of preparation of Gayam leaf sample (Adinugraha et al, 2005 with modification)
   a. Gayam leaf (Inocarpus vagiver) samples were taken from the area of Negeri ema and Dusun Airlouw
   b. Gayam leaf (Inocarpus vagiver) samples were put into plastic that had been labeled according to strata with tree branches.
   c. The Gayam leaf (Inocarpus vagiver) sample was then cleaned of adhering dirt using clean water
   d. The Gayam leaf (Inocarpus vagiver) sample was again washed with 1000 ml of distilled water, to remove the remaining dirt that was still attached.
   e. Gayam leaf (Inocarpus vagiver) sample that has been cleaned and then dried
   f. After that, the Gayam (Inocarpus vagiver) leaf sample was cut into small pieces using scissors with a size of ± 1 cm after which the sample was aerated to dry.
   g. Furthermore, the sample of Gayam leaf (Inocarpus vagiver) that has been baked, then blended and sieved with a size of 90 mesh to obtain Gayam leaf powder.
2. Cellulose Isolation Stage Gayam leaf sample (Adinugraha et al, 2005 with modification)
   a. Gayam leaf delignification (Inocarpus vagiver)
      Gayam leaf powder (Inocarpus vagiver) was weighed as much as 50 g and then heated with 500 ml of 12% NaOH for 3 hours at 80ºC. After 3 hours, the solution was filtered and then dried at room temperature to dry.
   b. Bleaching (Purification)
      Delignification of Gayam leaf powder (Inocarpus vagiver) was then heated with 10% NaClO for 1 hour at 60ºC using a hot plate. Then the solution was filtered and then dried in an oven at 100ºC for 2 hours and the residue was rinsed with distilled water until the pH was neutral
3. Qualitative test of cellulose content of gayam leaves (Inocarpus vagiver) Using Iodine test:
   a. a gram sample of Gayam leaf powder was dissolved in 10 ml of distilled water into a beaker, then put into a test tube and added 3 drops of Iodine reagent while shaking.
   b. Observe the color changes that occur. A brown color change indicates a positive reaction for cellulose.
4. Quantitative test of cellulose content of gayam leaf (Inocarpus vagiver)

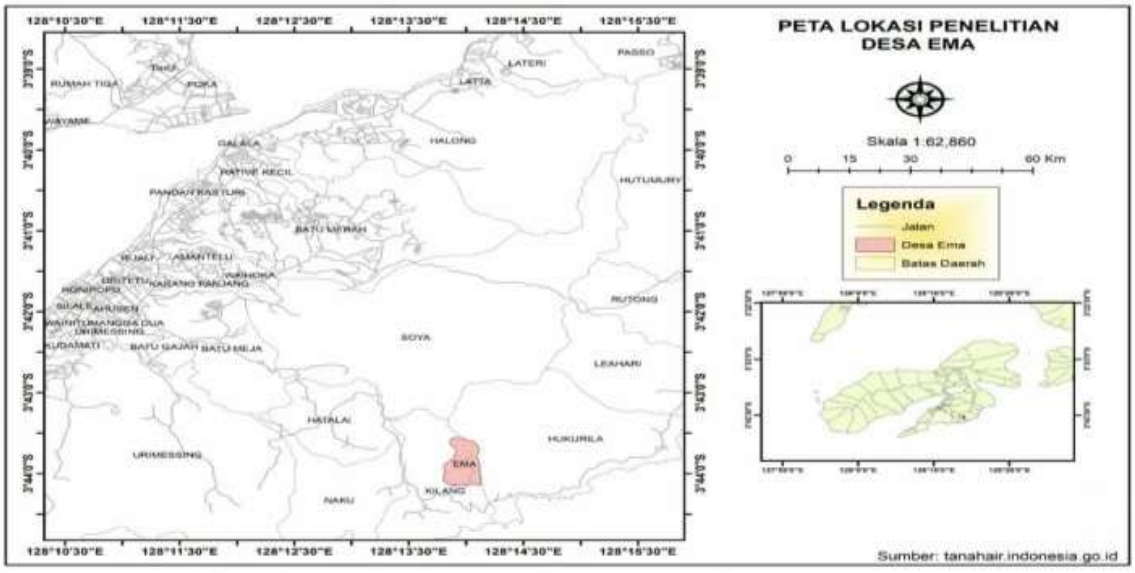
a. 500 ml Erlenmeyer which is symbolized by (x) was weighed and 1 gram of the residue of Gayam leaf was added, and 200 ml of distilled water was added.
b. For 2 hours the solution in the Erlenmeyer was heated while stirring several times. Next, the filter paper denoted by (k) is weighed and the solution is filtered using filter paper. The remaining filter on the filter paper is heated using an oven at a temperature of 105°C to a constant weight which is denoted by (l).
c. After that, 200 ml of 0.5 M H2SO4 was added to a 500 ml erlenmeyer which had been filled with residue, using filter paper the residue was filtered again and 25 ml of 72% H2SO4 was added and then left for 3 hours in a 500 ml erlenmeyer.
d. Furthermore, for 2 hours it was heated using a water bath at a temperature of 100°C to which 150 ml of distilled water had been added into the erlenmeyer.
e. Then add distilled water until the volume is 300 ml. The filter paper is weighed which is denoted by (i) and the residue is filtered using filter paper.
   Furthermore, the constant weight symbolized by (j) and the cellulose content can be calculated using the formula from Denyita et al, (2018), which is as follows:
   % Cellulose Content : $\frac{(l-k)-(i-j)}{x}\ x\ 100\%$
   Information:
   x: Erlenmeyer's initial weight
   l: Constant weight after oven temperature of 105ºC
   k: Weight of initial filter paper
   i: Weight of final filter paper
   j: Final constant weight

RESULTS AND DISCUSSION

1. Description of Sampling Location

Gayam leaf sampling was carried out at two places with different heights, namely Negeri Ema, South Leitimur District and Airlouw Hamlet, located in Nusaniwe District. Ema Country is located on the island of Ambon, South Leitimur District, at an altitude of 600 meters above sea level with an area of 13 hectares of Ema Country. In general, Ema Country is bordered to the north by Soya Country, to the south by Hukurila Beach, to the east by Leahari Country and to the west by Kilang Village. The research location can be seen in Figure 1 below

Picture 1. Research location



This Nusaniwe country consists of two hamlets, namely Dusun Erie and Dusun Airlouw. The location of Airlouw Hamlet is at an altitude of 200 meters above sea level. In general, Airlouw Hamlet is bordered by the outer Ambon Bay, to the south by the Banda Sea, to the west by Latuhalat and Seilale States, to the east by Amahusu and to the State of Seilale Urimesing

2. Environmental Characteristics

Environmental characteristics at the sampling location are shown in Table 1 as follows.

Table 1. Environmental Characteristics

NO.	Parameters	Ema Vilage	Dusun Airlouw
1	Place elevation	600 m dpl	200 m dpl
2	Light intensity	17.000 Lux	20.000 Lux
3	Humidity	8 RH	4 RH
4	Temperature	28°C	38°C

In Table 1. It can be seen that the environmental characteristics in the sampling location of Ema vilage for a light intensity of 17,000 lux and is a low light intensity category compared to the light intensity in Airlouw Hamlet, this is due to the presence of several plants around the sampling location in the land of Ema, where Gayam plants grow such as langsa trees, mangosteen, and coconuts. According to Fatchurrozak, et al., in Tanamal, (2013) said that the higher a place is, the more content of compounds produced. Ema vilage with an altitude of 600 m above sea level has a higher humidity of 8 RH with a temperature of 28ºC compared to Airlouw Hamlet which has an altitude of 200 m above sea level with a lower humidity of 4 RH with a temperature of 38ºC. Differences in temperature and humidity in the environment greatly affect plant metabolic processes related to enzymatic reactions while light intensity affects the rate of photosynthesis, transpiration and plant respiration (Yuliani et al, 2015).

3. Qualitative Analysis

Based on phytochemical tests in Ema Vilage and Dusun Airlouw both have cellulose compounds which can be seen in Figure 2.

Figure 2. Phytochemical test of cellulose compounds

Gayam Leaf Powder before being given Iodine reagent

Gayam Leaf Powder after being given Iodine reagent

The results of the analysis of the cellulose content carried out in two areas showed a change in color from the previous yellowish to brown color. The color change that occurs indicates a positive reaction to cellulose compounds in the leaves of the Gayam (Inocarpus vagiver) plant.

4. Quantitative Analysis

The results of the calculation of the average cellulose content in Ema vilage and Airlouw Hamlet can be seen in Table 2.

Table 2. Calculation of Average Cellulose Content

Reapet	Cellulose Content (%)	
	Ema	Dusun Airlouw
1	0,23434	0,18666
2	0,23196	0,21350
mean (%)	0,23315	0,20008

The results showed that the average cellulose content in Ema Country was 0.23315% greater or higher than Airlouw Hamlet 0.20008% and the location was lower.

DISCUSSION

At both locations, leaf samples were taken from Gayam (Inocarpus vagiver) plant in Ema and Dusun Airlouw. The aim was to determine the presence of cellulose compounds in the leaves of the Gayam plant which were tested qualitatively and the levels were carried out quantitatively. Moniriqsa (2012) stated that cellulose is the main component of biomass, and is also a basic component of cell walls and fibers that give strength to fibers. Cellulose is never found in a pure state in nature, but is always associated with other polysaccharides such as lignin, so it is necessary to isolate cellulose. The delignification process in this study used 100 ml of 12% NaOH which was used to dissolve the non-cellulose components present in Gayam (Inocarpus vagiver) leaves and to reduce lignin because it could increase the stiffness of a compound. Then through a bleaching process (purification) using 10% NaClO which aims to the bleaching process and remove the remaining lignin contained in the cellulose extract (Susana, 2011).

The test was carried out by adding 3 drops of Iodine reagent in the test solution. The presence of cellulose compounds can be seen from the color change from the initial yellowish color to brown. According to Desyanti (2013), the iodine test aims to identify polysaccharides. For quantitative tests, the determination of total cellulose content was carried out by weighing constant weight of cellulose compounds which referred to the Chesson (1978) procedure in Datta (1981) using the Gravimetric method. Based on the results of this study, the total cellulose content of Gayam leaves in Negeri Ema was 0.23315% while the cellulose content in Airlouw Hamlet was 0.20008%. The cellulose content in the sample from Ema was higher than that of the sample taken from Dusun Airlouw, which had lower levels. Like that according to Laily (2012), which suggests that altitude is one of the factors that affect the growth of a plant. The results of cellulose content at different altitudes indicate that altitude can affect the cellulose content of Gayam (Inocarpus vagiver). It is evident from the results of the analysis carried out, the cellulose content in Negeri Ema is greater than the cellulose content in Airlouw Hamlet which is dominantly less.

CONCLUSION

Gayam leaf (Inocarpus vagiver) in Negeri Ema which is an area with an altitude of 600 m asl contains cellulose with an average cellulose content of 0.23315% which is considered higher. Meanwhile, Gayam leaf (Inocarpus vagiver) in Airlouw Hamlet with an altitude of 200 m asl contains cellulose with an average cellulose content of 0.20008% which is relatively low.

REFERENCES

Adel, A. M. and El-Shinnawy, N. A. (2012). Hypolipidemic applications of microcrystalline cellulose composite synthesized from different agricultural residues, Int. J. Biol. macromole. 51 (5): 1091-1102.

Chadijah, S. (2012). Makassar's Basics of Analytical Chemistry. Alauddin university press.

Chesson, A. (1978). The maceration of linen flax under anaerobic conditions. Journal of Applied Bacteriology 45 (2): 219-230.

Datta, R. (1991). Acidogenic fermentation of lignocellulose–acid yield and conversion of components. Biotechnology and Bioengineering 23 (9): 2167-2170.

Indonesian Ministry of Health. (2000). General Standard Parameters for Medicinal Plant Extracts, Ministry of Health of the Republic of Indonesia, Jakarta, pp. 10-11.

Elanthikal, S., Gopala, K.U., Varghese, S., Guthrie, J. (2010). Cellulose microfibres produces from banana plant wastes: Isolation and Characterization. Carbohyd Polym. 80 (2): 852-859.

Falanruw. (2015). Trees Of Yap: A Field Guide. Washington: United States Department of Agriculture.

Fatchurrozak., Suranto., Sugiyarto. (2013). Effect of Altitude on the Content of Vitamin C and Antioxidants in Carica pubescens Fruit in the Dieng Plateau, El-Vivo, 1 (1): 24-31.
Heyne. (1987). Useful Plants of Indonesia Volume II. Jakarta: Forestry Research and Development Midwife.
Karamoy, L. (2009). Relationship of Climate with Soybean Growth (Glicine max L Merrill). Soil Environment. 7(1): 65-68.
Karlsson, H. (2006). Fiber guide: fiber analysis and process applications in the pulp and paper industry. Sweden: AB Lorentzen and Wettre.
Laily, A.N, Suranto., Sugiyarto. (2012). Characteristics of Carica pubescens of Dieng Plateau, Central Java according to its morphology, antioxidant, and protein pattern. Nusantara Bioscience 4 (1) 16-21.
Merci, A., Urbano, A., Grossmann, M. V. A., Tischer, C. A., Mali, S. (2015). Properties of microcrystalline cellulose extracted from soybean hulls by reactive extrusion, Food Res. int. 73 (7): 38-43
Norman, A.G. (1937). The Composition of Same Less Common Vegetable Process. Biochemistry Section, 1575-1578.
Nuringtyas, Tri, Rini. (2010). Carbohydrate. Gajah Mada University Press, Yogyakarta.
Pandey J, Takagi H, Nakagaito A, Kim H. 2015. Handbook of polymer nanocomposites. Processing, performance and application, Springer.
Septiany, I. (2013). Production of bioethanol from red algae cellulose by a two-stage fermentation system using the fungus Trichoderma viride and the bacterium zymomonas mobilis. Thesis. Makassar: Hasanuddin University postgraduate program.
Tjitrosoepomo, G. (2007). Taxonomy of Plants (Spermatophyta). Yogyakarta: Gajah Mada University Press.
Wang, Guibin. (2015). Role of Temperature and Soil Moisture Conditions on Flavonoid Production and Biosynthesis-Related Genes in Ginkgo (Ginkgo Biloba L.) Leaves.
Wawo, A. H., N. Setyowati., N. W. Utami, and P. Lestari. (2019). Getting to Know Gayam: Multipurpose Plant. Biological Research Center. Jakarta: Indonesian Institute of Sciences.
Wijanarka, A. (2017). Gayam Flour (Inocarpus vagiver Forst.): Glycemic Index, Functional Properties, Modification of the Autoclaving-Cooling Cycle and In Vitro and In Vivo Nutritional Properties." Dissertation, Gadjah Mada University.
Xie J X, Yun C Y, De Hoop C F, Hu T, Qi J, Shupe, T. F. (2016). Isolation and characterization of cellulose nanofibers from bamboo using microwave liquefaction combined with chemical treatment and ultrasonication. Carbohyd Polym.
Zhou Y, Stuart-Williams H, Farquhar GD, Hocart CH. (2010). The use of natural abundance stable isotopic ratio to indicate the presence of oxygen-containing chemical linkages between cellulose and lignin in plant cell walls. Phytochemistry 71 (3):982-993.

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Research Article

The effect of web-based blended learning echaced course on cognitive learning outcomes, scientific attitudes and learning interests of class VIII students Junior High Schools of gwamar Dobo and Negeri 1 Dobo

Meike Ocktavia Lawalata[1], Fredy Leiwakabessy[2], Alwi Smith[2*]

[1]*Junior High School* Gwamar Dobo, *Street. Pemda Siwalima, Pulau-Pulau Aru,* 97662*, Indonesia*
[2] *Department of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
** corresponding author: alwi.smithfkip@unpatti.ac.id*

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ABSTRACT

One of the learning problems is the integration of computer technology into learning activities that can trigger students to be able to develop learning and innovation skills, skills to use technology and information media, and be able to work and survive using life skills. The appropriate learning model that can be applied is the blended learning model that combines traditional face-to-face learning with computer-based learning with web (web enhanced) utilization. This study aims to see the effect of the web-enhanced blended learning model on cognitive learning outcomes, scientific attitudes and student learning interest in the human digestive system material. on the results of scientific attitudes and student interest in learning. The results showed that there was an effect of the web-enhanced blended learning model on cognitive learning outcomes, scientific attitudes and student interest in learning.

Keywords: blended learning, enhanced WEB, cognitive thinking, scientific attitude, student interest in learning.

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INTRODUCTION

The learning paradigm emphasizes the ability of students to think critically, be able to connect knowledge with the real world, master information technology, communicate and collaborate. Learning is becoming increasingly important to ensure that students have the skills to learn and innovate, the skills to use technology and information media, and can work and survive by using life skills. One of the subjects that is an important element in a school or madrasa curriculum is natural science. In science lessons, it is not only looking at the learning outcomes obtained by students but the scientific attitude is something that must be prioritized.

The problem of 21st century learning is the integration of computer technology in learning activities. Blended learning is learning that combines traditional learning with face-to-face and computer-based learning (online). One form of learning Blended learning is the use of the Website (Web). One form of utilization of the use of the Web in learning activities is the Web Enhanced Course (WEC). Web media is very well used as a learning medium for Natural Sciences. This media can attract students' attention to science lessons (Irwandani, 2014).

WEB Echaced Course-based learning that is integrated into the learning process using the Blended Learning model is very helpful for students in finding learning resources by using the internet as a support for students to improve understanding and knowledge of students (Putriana, 2021). The use of WEB Echaced Course media in the implementation of the Blended Learning model aims so that students can understand the material easily in the learning process and can improve learning outcomes. The use of WEB Echaced Course-based media has an effect on learning outcomes in the application of the Blended Learning learning model. According to Susanti (2016), Blended Learning is said to be effective because it has proven to be successful in improving learning outcomes for students, besides that it can also be seen from the interest of students in following learning models that utilize the internet so that greater learning motivation arises which then affects understanding of the material. learning and also learning outcomes.

METHODS

The research was carried out at SMP Negeri Gwamar Dobo and SMP Negeri 1 Dobo on January 14 – March 11, 2022. The population in this study was class VIII students at SMP Negeri Gwamar Dobo and SMP Negeri 1 Dobo. The samples in this study were class VIII SMP Negeri Gwamar Dobo and SMP Negeri 1 Pulau Aru. The instruments used were observation sheets on the implementation of learning, tests, student scientific attitude questionnaires and student learning interest questionnaires.

RESULTS AND DISCUSSION

1. Student Pre-Test

The results of the initial test describe the initial abilities of students before participating in the learning process on the material of the human digestive system by applying the WEB Echaced Course-based Blended Learning learning model. Based on the research data, the students' initial test scores can be seen in Table 1 below.

Table 1. Qualifications of student achievement scores in the pre-test

Interval	Class	Frequency	Presentation	Qualification
SMP Negeri Gwamar Dobo				
> 70	VIII-1	-	-	Complete
< 70		30	100%	Fail
> 70	VIII-2	-	-	Complete
< 70		30	100%	Fail
SMP Negeri 1 Dobo				
> 70	VIII-1	-	-	Complete
< 70		30	100%	Fail
> 70	VIII-2	-	-	Complete
< 70		30	100%	Fail

Based on the table above, it can be seen that at intervals >70, it shows that there are no students who have grades with complete qualifications, and at intervals <70, it shows that all students in each class VIII-1 and VIII-2 at SMP Negeri Gwamar Dobo and SMP Negeri 1 PP Aru have scores with less qualifications in mastering the learning indicators to be studied.

2. Post-Test

After the learning process is complete, a final test (Post-Test) is carried out to determine the students' ability to understand the concept according to the learning model that has been applied. Based on the research data, the students' final test scores can be seen in Table 2 below.

Table 2. Qualification of Student Achievement Scores in the post test

Interval	Class	Frequency	Presentation	Qualification
SMP Negeri Gwamar Dobo				
> 70	VIII-1	26	87%	Complete
< 70		4	13%	Fail
> 70	VIII-2	29	97%	Complete
< 70		1	3%	Fail
SMP Negeri 1 Dobo				
> 70	VIII-1	14	47%	Complete
< 70		16	53%	Fail
> 70	VIII-2	28	93%	Complete
< 70		2	7%	Fail

Based on the table above, it can be seen that at intervals >70 at SMP Negeri Gwamar Dobo it shows that in class VIII-1 there are 26 students who are in the complete category and there are 4 students who are in the less category. At SMP Negeri 1 Dobo it shows that in class VIII-1 there are 14 students who are in the complete category and there are 16 students who are in the less category and in class VIII-2 there are 28 students who are in the complete category and there are 2 students. students who are in the less category.

3. Cognitive Learning Outcomes

The results of the ancova calculation on students' cognitive learning outcomes are shown in Table 3 below.

Table 3. Ancova Cognitive Learning Outcomes

Dependent Variable: Posttest Class VIII-1 and VIII-2 SMP Negeri Gwammar Dobo

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3438.294[a]	1	3438.294	56.414	.000	.493
Intercept	424772.376	1	424772.376	6969.529	.000	.992
Kelas	3438.294	1	3438.294	56.414	.000	.493
Error	3534.930	58	60.947			
Total	431745.600	60				
Corrected Total	6973.224	59				

a. R Squared = .493 (Adjusted R Squared = .484)

Dependent Variable: Posttest Class VIII-1 and VIII-2 SMP Negeri 1 Dobo

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3903.968[a]	2	1951.984	36.251	.000	.543
Intercept	26380.284	1	26380.284	489.916	.000	.896
Pretest	465.674	1	465.674	8.648	.005	.132
Kelas	3644.385	1	3644.385	67.681	.000	.543
Error	3069.256	57	53.847			
Total	431745.600	60				
Corrected Total	6973.224	59				

a. R Squared = .560 (Adjusted R Squared = .544)

The table above shows that the independent variables of the learning model are significantly. Based on these results indicate that there is an influence of the learning model on students' cognitive learning outcomes. The next stage is to carry out further tests to find out the differences in the learning model used, namely the Independent Sample T-Test which is shown in Table 3 below.

Table 4. Sample t-test

Group Statistics		**SMP Negeri Gwammar Dobo**				
		Class	N	Mean	Std. Deviation	Std. Error Mean
Posttest	Learning	Control class	30	76,570	9,3516	1,7074
Kognitif		Experiment class	30	91,710	5,8686	1,0715

Group Statistics		**SMP Negeri 1 Dobo**				
		Class	N	Mean	Std. Deviation	Std. Error Mean
Posttest	Learning	Control class	30	68,667	8,7053	1,5894
Kognitif		Experiment class	30	91,143	5,6138	1,0249

The table above shows that there is a difference in notation between the control class and the experimental class. Classes taught using the WEB Echaced Course-based blended learning model have a higher average score than the control class average. This proves that students who are taught using the WEB Echaced Course-based Blandend learning model have better cognitive learning outcomes than students who are taught using the ordinary learning model.

4. Student Interest and Learning

The results of Anova calculations on student interest and learning outcomes are shown in Table 4 below.

Table 4. Anova Results of Student Interest in Learning

Interest to learn	**SMP Negeri Gwammar Dobo**				
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.001	1	.001	.000	.985
Within Groups	231.584	58	3.993		
Total	231.586	59			
Interest to learn	**SMP Negeri 1 Dobo**				
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	.037	1	.037	.009	.925
Within Groups	243.168	58	4.193		
Total	243.206	59			

The table above shows that there is an influence of the learning model on the students' interest and learning outcomes.

5. Student Scientific Attitude

The results of the ANOVA calculation on the results of students' scientific attitudes are shown in Table 5 below

Table 5. Scientific Attitude Anova test

Scientific Attitude	**SMP Negeri Gwamar Dobo**				
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4437.600	1	4437.600	60.274	.000
Within Groups	4270.179	58	73.624		
Total	8707.779	59			
Scientific Attitude	**SMP Negeri 1 Dobo**				
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4253.784	1	4253.784	59.665	.000
Within Groups	4135.092	58	71.295		
Total	8388.876	59			

The table above shows that there is an influence of the learning model on students' scientific attitudes.

DISCUSSION

WEB Echaced Course-based Blended Learning that is applied affects students' cognitive learning outcomes on the material of the human digestive system, this is in accordance with Puspitasari's (2022) research on the effectiveness of using the Blended Learning model on learning motivation and student learning outcomes where this learning model is effective for increasing student learning outcomes on the material provided. This blended learning model provides opportunities for students to be able to integrate technological advances, namely online learning with face-to-face learning directly in WEB Echaced Course-based classes so that the learning process that takes place is optimal (Thorne, 2003).

The blended learning model applied in the classroom is combined with WEB Echaced Course-based learning where during the learning process students can use their digital technology to access the internet as a learning resource. Daheri, Juliana, Deriwanto, & Amda (2020) further explained that this learning model can provide high flexibility for students to learn anytime and anywhere without space and time limitations or what can be called Learning beyond Classroom Walls (Amin, 2017). The increase in scientific attitude in students occurs because the learning process based on WEB Echaced Courses based learning on the human digestive system material is carried out through student worksheets activities and discussion on presentations of work in class. Through work activities and presentation of results, students can improve their ability to organize, communicate and interpret student work. Work can train scientific thinking skills and can find or solve new problems through the scientific method. According to Karhami (2000) states that scientific attitudes can be developed by making

students as young scientists. Research by Hermidayani and Khoirun (2018) which explains that the average learning outcomes of economics who receive the blended learning model treatment are higher than those who learn by direct or face-to-face learning. This is because the use of blended learning combines conventional learning (face to face) with e-learning. In this learning, it does not replace face-to-face learning in class, but e-learning can strengthen the provision of learning materials so that students can exchange opinions and learn online. In addition, blended learning can make students position themselves as active learners in understanding their needs and trying to achieve understanding independently.

CONCLUSION

1. There is an effect of the application of the WEB Echaced Course-based Blended Learning learning model on the cognitive learning outcomes of students in each class VIII-1 and VIII-2 SMP Negeri Gwamar Dobo and SMP Negeri 1 Dobo with a significance of 0.493 and 0.543 <α = 0.05. The Independent Sample T-Test test showed that the class taught using the WEB Echaced Course-based Blended Learning learning model had a higher average score than the control class average.
2. There is an effect of the application of the WEB Echaced Course-based Blended Learning learning model on the interest and learning of students in each class VIII-1 and VIII-2 SMP Negeri Gwamar Dobo and SMP Negeri 1 Dobo.
3. There is an effect of the application of the WEB Echaced Course-based Blended Learning learning model on the scientific attitude of students in each class VIII-1 and VIII-2 SMP Negeri Gwamar Dobo and SMP Negeri 1 Dobo.

REFERENCES

Amin, A. K. (2017). Conceptual Study of Web-Based Blended Learning Model to Improve Learning Outcomes and Learning Motivation. Edutama Journal of Education. 4 (2): 51–64.

Daheri, M., Juliana, J., Deriwanto, D., & Amda, A. D. (2020). The Effectiveness of Whatsapp as an Online Learning Media. Journal of Basicedu, 4 (4): 775–783.

Estika, W. (2017). Development of Blended Learning with Flipped Classroom Strategy in Multimedia Design Subjects at Pgri Ploso Vocational High School, 2 (2): 141–148.

Karhami, K. A. (2000). Scientific Attitude as a Vehicle for Developing Character Elements (Study through the point of view of teaching science). Journal of Education and Culture. No.27, Year 6, November 2000.

Puspitasari, S., Hayati, K. N., & Purwaningsih, A. (2022). The Effectiveness of Using Blended Learning Models on Learning Motivation and Social Studies Learning Outcomes. Journal of Basicedu, 6 (1):1252-1262.

Putriana, M., & Adistana, G. A. Y. P. (2021). Meta-Analysis of Blended Learning Application and Selection of Online Media Used on Learning Outcomes. Edumaspul: Journal of Education, 5 (2): 310-320.

Rohman, N. (2015). Analysis of the factors that cause students to be lazy in the learning process of measuring instruments at SMK Negeri 1 Pariaman. Journal of Mechanical Engineering Education, No. 1 Volume 1.

Sukanto, I.S. (2009). The Effect of Pre-Tests and Student Interests on Learning Achievement in Practice Laboratory Skills for the Third Stage of Childbirth Care. Thesis. Postgraduate Program at Sebelas Maret University, Surakarta.

Susanti. (2016). The Effectiveness of Blended Learning Web Enhanced Course Model on Learning Outcomes of Class XI Students at SMK Gunung Sari 1 Makassar, 5, 23–32.

Thorne, K. (2003). Blended Learning: How to Integrate Online And Traditional Learning. London: Kogan Page. Fourth Printing.

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Research Article

The effect of light on the early growth wheat *(Triticum aestivum L)*

Novia Destiana[1], Einstivina Nuryandani[1], Sri Kurniati Handayani[1], Diki[1]*

[1]Department of Biology, Faculty of Science and Technology, Universitas Terbuka, Jl. Cabe Raya, Pemulang, Tangerang Selatan, Banten 15437, Indonesia
** corresponding author: diki@ecampus.ut.ac.id*

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ABSTRACT

Triticum aestivum L is a plant that grows optimally in a subtropical climate, so that its development in the tropics experiences various obstacles such as high air temperature and humidity, and abundance of light. Knowledge of the right conditions for the growth of this plant in tropical areas such as Indonesia is needed. This study aims to determine the role of light on the germination, growth, and early development of wheat . The research conducted is experimental research with two treatments, namely administrated light and without light. Each treatment was carried out using 30 replications. The analysis was carried out by comparing the average value of plant length and plant morphology from eight days of observation on two kinds of treatments. The results showed that there were differences in plant height in the two treatments. The average plant height on the 8th day administrate the light treatment was 9.76 cm, while the average plant height with the treatment without light was 10.1 cm. Observations of growth on the morphology of wheat plants showed that plants with no light treatment experienced a slowdown in the opening of the second leaf, had a paler color and thinner leaf blades, compared to plants grown with light treatment. The absence of light accelerates the germination process and increases the height of wheat plants, but at a later stage it can slow down the development of these plants.

Keywords: triticum aestivum, light, germination, growth, development.

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INTRODUCTION

Wheat *(Triticum aestivum)* is a plant from the cereal group that is widely consumed in Indonesia. Wheat consumption in Indonesia continues to increase, even as Indonesia is the largest wheat importer in the world. The high consumption pattern of Indonesian people for processed wheat products, such as noodles, bread, and biscuits, has an effect on the high import of Indonesian wheat. These conditions move botanists to develop wheat cultivation in Indonesia (Balitsereal, 2012). Wheat is a type of C3 plant (Balitsereal, 2012). In C3 type plants, the initial product of CO_2 reduction is 3-phosphoglyceric acid, which consists of a series of chemical reactions that take place in the stroma of the chloroplast that do not require energy from direct sunlight. C3 plants can grow well in the shade or a place with low light intensity (Wiraatmaja, 2017). In Indonesia, wheat can grow and produce well at locations >1,000 above sea level, or low land with dry climates and temperatures <25°C, such as parts of NTT (Balitsereal, 2012).

Wheat is a plant that grows optimally in subtropical climates. Indonesia, with its tropical climate, can still cultivate wheat in the highlands. However, upland land use is generally used for horticultural crop cultivation, so

that wheat cultivation is in competition with horticultural crops in terms of land (Balitsereal, 2012). In addition to utilizing wheat that has been in the form of flour for various processed foods, wheat plants can also be used to make health drinks by way of juice. Wheatgrass juice contains antioxidants, namely vitamins A, C, E and chlorophyll. The wheat plants used are young wheat plants measuring about seven inches (Albaar, 2015). The growth phase of wheat plants is generally the same as the growth phase of other seed cereals (Large, 1954) with different times, this depends on the variety, nutrients, temperature, humidity and pests and diseases. Andriani (2017) in his writing describes in general the growth phase of wheat plants is divided into ten phases. Light is an external factor that affects plant growth. All plant organs have different responses to light. Some of the responses to light include influencing the direction of root growth, leaf area (because leaves will try to get more light for photosynthesis), and stem length. Stems exposed to light will have a longer size. Plants placed in the dark will grow faster than those placed in a place exposed to light, but plants will look pale due to lack of chlorophyll (Silvikultur, 2007). In conditions without light, the hormone auxin stimulates cells to experience elongation so that they grow longer, while in conditions of a lot of light auxin is damaged so that growth is inhibited. The light causes the damaged auxin to be dispersed to the dark side. This causes the stems to become shorter, and the plant to become firm, fully developed and green leaves. Meanwhile, if the light received by plants is too high, the chlorophyll will be damaged (Silvikultur, 2007).

Light is needed by plants for the process of photosynthesis. Photosynthesis is the process of making food in green plants with the help of light and enzymes. Photosynthesis is carried out by leaves. The ability of plants to absorb light is due to the presence of chlorophyll pigments. Chlorophyll pigments make plants green. Chlorophyll is located inside the chloroplast organelle. Leaves have a layer of cells called mesophyll. In this mesophyll there are half a million chloroplasts in every square millimeter. Light will pass through the epidermal layer, this epidermal layer is a transparent layer to get to the mesophyll, the mesophyll is where most photosynthesis occurs. Light in plants affects vegetative and generative growth (Wiraatmaja, 2017). The use of the right light intensity for wheat growth has an impact on optimal wheat product yields. In this study, observations of wheat plant height and development in morphology were carried out. Research on the effect of light intensity on wheat plants has been previously carried out by Pratiwi (2010) in the form of shading treatment. In this study, a different treatment was carried out from previous studies, namely using 100% treatment without light.

METHODS

This research is an experiment with completely randomized design. The number of samples for each treatment was 30 wheat seeds planted on cotton which were kept wet at all times. The treatment is given light and not light (dark). Plant height measurements and morphological observations were carried out every day in the afternoon for eight days. The analysis was carried out by comparing the average value of plant length and plant morphology from eight days of observation on two kinds of treatments.

RESULTS AND DISCUSSION

Germination of wheat seeds in the light treatment (with light) was slower than the germination of wheat seeds in the dark treatment (Figure 1). On the first day, the seeds in the light treatment did not show any germination, while the seeds in the dark treatment showed germination. On the second day, the seeds with the light treatment showed germination, but the size of the sprouts was smaller than the seeds with the dark treatment (Figure 1). To see the germination of wheat seeds in light and dark, it can be seen in the image below

Figure 1. Germination of wheat seeds in light and dark.

(a) (b) (c) (d)

Explanation: the first day (a) and second day (b) in the light treatment (with light), and seed germination on the first day (c) and the second day (d) in the dark treatment (without light). Bars = 0.5 cm.

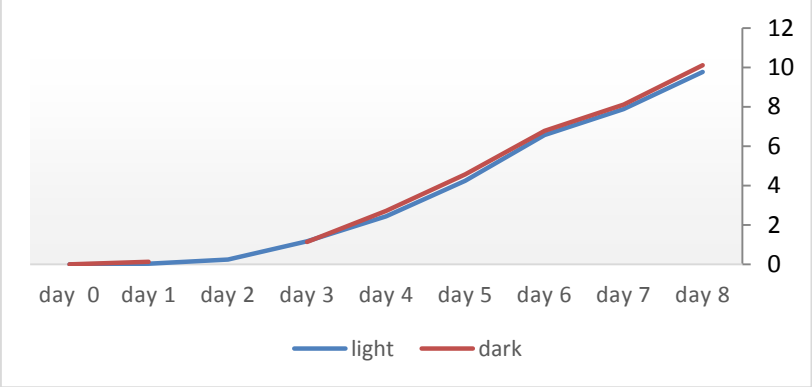
The observation data on wheat plant height from the first day to the eighth day showed differences in the growth of the two treatments (Table 1).

Table 1. wheat plant growth differences

Treatment	wheat plant height (cm) on day								
	0	1	2	3	4	5	6	7	8
Lighted	0	0.02	0.23	1.17	2.44	4.23	6.57	7.88	9.76
No light	0	0.13	0.32	1.13	2.71	4.56	6.78	8.1	10.01

The table on the average height of wheat plants above shows that the plants treated with no light (dark) were relatively taller than the plants treated with light (light). The light treatment given can affect the growth of wheat plants.
The graph of the growth of wheat plant height from the first day to the eighth day is shown in Figure 2.

Figure 2 Graph of the average height of wheat plants (in cm) with and without light treatment.



The results of the graph show that the treatment of plants without light or in dark conditions showed higher plants on almost all observation days compared to plants that were given light treatment. This condition indicated that the stems of wheat plants in the dark treatment were etiolated, so that they were higher than the plants in the light treatment. Light is a key determinant in plant metabolism and photosynthesis. Light is also needed by plants from the seed germination process to maturity (Linda, 2007). Wheat plants are included in C3 plants. Pratiwi (2010) stated that C3-type plants can experience a decrease in yield if the intensity of sunlight received by plants is high. Williams (1976) stated that the reduced light obtained by plants will affect root growth, as well as the occurrence of etiolation in plants, which can be seen from the length of stem growth at low light intensity. This condition was shown by soybeans in the treatment without light (dark), the stem growth was longer than the growth in the light treatment. In plants treated with light, although shorter, the stems of wheat plants were strong, green and looked healthier than those without light. This is in accordance with what Bahrsyah (1985) explained that light plays a major role in physiological processes, especially in the process of photosynthesis, growth, respiration and plant development.

There are several growth phases that occur during the eight days of sowing wheat seeds. The initial phase that can be observed is the germination phase, where in this phase a radicle will appear which is then followed by the growth of coleoptiles. The results showed that the germination time of the treatment without light was faster than the light treatment. This happens because in the absence of light, the hormone auxin stimulates the elongation of cells so that they grow longer. On the other hand, in the presence of light, the auxin hormone is damaged so that plant growth is inhibited (Silvikultur, 2017). After the appearance of a coleoptile with a length of 2.5 cm, its growth stops and at the end of the coleoptile appears the first leaf that grows at the growing point or called the growing point (Andriani, 2017). The coleoptile serves as the first leaf guard during the process of penetrating the soil surface. The first leaves appeared at the same time, namely on the fourth day in two different treatments. The first leaf in the light treatment had a green color while the first leaf in the no light treatment had a pale yellow color. This shows that light affects the process of photosynthesis.

Plants that are not exposed to light cannot form chlorophyll so that the leaves look pale, while in plants exposed to light auxin is damaged and causes a reduced growth rate, causing the stems to be shorter but stronger, the leaves fully developed and green (Maghfiroh, 2017). The development of plants on the eighth day of observation showed that the treatment of wheat plants that were given light experienced development in the form of opening the second leaf while in the treatment without light the plants were taller but the second leaf was still not open. Observation of growth on the morphology of wheat plants showed that plants with no light treatment experienced a slowdown in the opening of the second leaf, had a paler color and thinner leaf blades than plants grown with light treatment. The absence of light accelerates the germination process and increases the height of wheat plants, but at a later stage it can slow down the development of these plants.

CONCLUSION

The light treatment inhibited the early germination of wheat seeds and plant elongation in the early stages of germination, but had a positive effect on the development of wheat seed germination at the time of leaf development.

REFERENCES

Andriani, A. (2017). Wheat morphology and growth phase. Cereal Crops Research Institute.

Albaar, N.M. (2015). Antioxidant activity of wheat Grass (Triticum aestivum) juice as a health drink using the DPPH Method. Journal of MKMI: 197-202.

Arief, R. (2013). Wheat seed management. Cereal Research Institute. Journal of wheat seed management.

Azrai M., Andayani., Talanca. (2010). The origin and taxonomy of wheat crops. Cereal Crops Research Institute. Anthesis on Grain Yield and Biomass of Field-grown Crops of Wheat. Annals of Botany 82:631-639.

Balitsereal. (2012). Cereal crops research highlights. Research Institute, Maros.

Baharsyah, J. S., Suwardi, D. and Irsal L. (1985). Climate relationship with soybean growth. Agency for research and development of food crops. Center for research and development of food crops. Bogor.

Large, E.C. (1954). Growth stages in cereals illustration of the feekes scale. Plant Pathology. 3(4): 128-129.

Linda, R. (2007). Effect of light on plant growth. Pontianak: Tanjungpura University.

Nazir, M. (2003). Research methods. Salemba four, Jakarta 63.

Nevo, E., Korol, V.A., Beiles, and Fahima, T. (2002). Evolution of wild emmer and wheat improvement: population genetics, genetic resources, and genome organization of wheat's progenitor, triticum dicoccoides. Springer, Berlin. p. 364.

Pratiwi, GR. (2010). Wheat crop growth response to shade. Center for Food Crops Research and Development. Agricultural Data Center and Information System. Food Consumption Statistics. Jakarta.

Silviculture. (2007). Sunlight Source. Jakarta.

Wiraatmaja, I W. (2017). Solar energy temperature, and water in relationship with plants. Faculty of Agriculture. UNUD

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Research Article

Inhibition of methanol extract snail gonggong *(Strombus urturella)* to pathogenic bacteria *Vibrio alginolyticus*

Frans Selfanay[1], Syahran Wael[2], Theopilus Wilhelmus Watuguly[3*]

[1] *Graduate of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
[2] *Laboratory of Biology, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*
[3] *Department of Biology Education, Pattimura University, Street. Ir. M. Putuhena, Ambon 97233, Indonesia*

** corresponding author: theopilus.watugulyfkip@unpatti.ac.id*

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ABSTRACT

The purpose of this study was to determine the methanol extract of snail gonggong (Strombus turturella) and the inhibition of methanol extract of gonggong snail meat (Strombus turturella) against the pathogenic bacterium Vibrio alginolyticus. The study used a completely randomized design. The treatment was giving the extract of snail gonggong meat with concentration of 100%, 50%, 25%, positive control using amoxcillin and negative control using distilled water with three replications. The identification of bioactive compounds included alkaloids, saponins, flavonoids, steroids and triterpenoids. The antibacterial activity of the methanol extract of snail gonggong meat (Strombus turturella) was tested by the diffusion method at concentrations of 100%, 50% and 25%. The data collected is then analyzed descriptively qualitatively. The results showed that the antibacterial activity of the 100% concentration of the methanol extract of the gonggong snail meat had moderate inhibition against Vibrio alginolyticus (diameter 7,833 mm). while the concentrations of 50% and 25% did not have an inhibition zone. The identified bioactive compounds included alkaloids, saponins, flavonoids and steroids, while the terpenoid and phenolic compounds were not identified. Thus, the methanol extract of gonggong snail meat has antibacterial potential that can be used to overcome the attack of pathogenic bacteria.

Keywords: antibacterial, bioactive compounds, snail gonggong

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INTRODUCTION

Vibrio is a Gram negative bacteria that has different characteristics from other pathogenic bacteria. Because these bacteria have the ability to survive without oxygen or with oxygen. These bacteria live in watery places such as rivers and bays, therefore these bacteria are very commonly found in seawater (Scoendstadt, 2013). Vibrio alginolyticus is able to act as primary and secondary pathogenic bacteria. Through secondary pathogens, Vibrio alginolyticus attacks organisms previously infected with other diseases, while primary

pathogens Vibrio alginolyticus attack organisms directly which can cause vibriosis (Sukenda et al, 2012). Vibrio alginolyticus infection in humans through foodborne or consumption of seafood products such as raw or undercooked shrimp and fish can result in contamination of Vibrio alginolyticus (Centre for Health Protection, 2010), and damage to blood vessels (Thomson et al, 2004).

The Centers for Disease Control and Prevention in the United States and the states of Alabama, Florida, Louisiana, and Texas report that every year about 30-40 people are infected with Vibrio alginolyticus (Daniels et al, 2000). Arisanti et al (2018), in 2003, 2004 and 2005 found 82 cases of food poisoning in humans through the consumption of seafood products and 60% were caused by contamination of the pathogenic bacterium Vibrio alginolyticus. Data from the Directorate of Food Safety Surveillance and Counseling of the POM Agency of the Republic of Indonesia in 2008, the number of victims of food poisoning through foodborne contamination due to Vibrio alginolyticus in Indonesia reached 25,268 people (Mirawati et al, 2013). Extraordinary events that occurred in Indonesia in 2015 due to contamination of Vibrio alginolyticus in foods such as seafood products consumed resulted in poisoning in humans as many as 1,176 people (Ekawati, 2017). Antibiotics used to inhibit or treat Vibrio alginolyticus infection are chloramphenicol (CP), oxytetracycline (OTC), and furazolidone (FZ). If the use of antibiotics is not effective in inhibiting Vibrio alginolyticus infection, then one alternative used to overcome the problem of resistance due to Vibrio alginolyticus infection is the use of secondary metabolic compounds and bioactive compounds found in plants or animals (Ali, 2006).

Snail 'gonggong' (Strombus turturella) is a marine biota and belongs to the mollusc phylum of the gastropod class which has a very useful function for the aquatic environment in the food chain and acts as an indicator of water quality (Arianti et al, 2013). According to Arularasan et al. (2010) snail meat gonggong is a functional food for Indian society because it has low cholesterol and can treat heart disease. According to (Yoswaty & Zulkifli, 2016) the ethanol extract of the type of snail gonggong (Strombus canarium) contains antibacterial ingredients that can inhibit the growth of pathogenic bacteria A. hydrophila, C. perfringens and Vibrio sp. The groups of bioactive compounds identified were alkaloids and saponins, while the groups of compounds that were not identified were flavonoids, steroids, and triterpenoids. Empirically, the spread of barking snails in Aru Islands Regency is only found in Aru Tengah Timur District, Koijabi Village. The use of snails gonggong by local people as food because in addition to having a very distinctive aroma and texture, it also has the ability to increase endurance and treat diarrhea attacks. This is the main indicator, because so far there has been no exploration of the bioactive content contained in the snail meat gonggong in Koijabi Village and the increase in the use of barking snail meat as a functional food ingredient because it has antioxidant compounds or has antibacterial bioactive content.

The results of this study can be developed for educational development in the form of practical instructions in microbiology courses as a tool to describe the identification of bioactive compounds found in animals and how to see the inhibitory power of these compounds against pathogenic bacteria. The development of this practicum guide aims to direct the microbiology practicum process in the laboratory so that it is more focused on achieving the expected competencies, such as students having to master basic microbiology techniques or procedures in the laboratory.

METHODS

This research is a experimental laboratory, which aims to see the bioactive compounds in the flesh of the snail gonggong *(Strombus turturella)* and to test its antibacterial activity against *Vibrio alginolyticus* bacteria and to measure the diameter of the inhibition zone for each concentration. This research was conducted at the Laboratory of Basic Chemistry, Faculty of Mathematics and Natural Sciences, Pattimura University, Ambon and the Laboratory of Fishery Products Technology, Pattimura University, Ambon. The subjects in this study were pure cultures of the pathogenic bacterium *Vibrio alginolyticus* obtained from the Fisheries Product Technology Laboratory, Pattimura University, Ambon. The objects in this study were extracts of snail gonggong 100%, 50%, 25%, bioactive and antibacterial compounds of snails gonggong and the diameter of the inhibition zone.

Tools and materials

The tools used in this research are oven, rotary evaporator, ice box, petri dish, paper disc, test tube, measuring pipette, tweezers, measuring cup, 0.5 mm ose needle, spirit lamp, lighter, scale, marker, laminar flow, cotton, syringe, autoclave, incubator, blender, paper. The materials used in this study were Vibrio alginolyticus bacteria, Methanol, barking snail extract, Amoxilin, NaCl 0.9%, Farland 0.5, Dragendorf reagent, Mayer, Wagner, H2SO4, Amyl alcohol, concentrated HCL, Acetic anhydride, distilled water, Alcohol 70%, DMSO.

Research procedure

1. Sterilization of tools and materials
   Glass utensils were sterilized using an oven at 170^{0}C for 2 hours, media were sterilized using an autoclave at 121^{0}C for 15 minutes. Ose and tweezers are sterilized by bunsen. Luminar air flow cleaned using 70% alcohol, then sterilized by UV lamp for 15 minutes.
2. Extraction
   a. Sampling of snails gonggong from their habitat.
   b. The snail gonggong is separated from its shell using a hammer.
   c. The snail gonggong meat is washed using clean water and then weighed with a base weight of 5 kg and dried under the hot sun until it is completely dry.
   d. The dried snail gonggong meat was then weighed to determine the dry weight. Then sliced or cut and in a blender until it becomes a powder then weighed at 300 grams.
   e. The gonggong snail meat powder weighing 300 grams was soaked using 96% methanol solvent in a 500 ml Elenmeyer container, stirred carefully until evenly distributed and soaked for 48 hours until the solvent above the powder became clear.
   f. The extract is then separated or filtered using a filter cloth between the sample and the solution so that the remaining sample is stored while the 400 ml solution will be evaporated using an evaporator.
   g. Evaporation at a temperature of 50^{0}C and the evaporation time can be adjusted until there is a separation between the methanol solution and the pure compound in the sample.
   h. The resulting percholate was concentrated with rotary evaporate to become a thick extract and put in a mini bottle and then tested for antibacterial activity.
3. Resistance Test
   a. Take the pure isolate that has been prepared using an ose needle, then put the isolate into a test tube containing aquadest.
   b. Homogenize the isolate in a test tube using a vortex.
   c. Prepare a petri dish that already contains TSA medium
   d. Scrape the isolate on the entire surface of the TSA media using a stick that has been given a cotton swab.
   e. Dip the paper disk into each treatment with a concentration of 100%, 50%, 25% then put it into a petri dish.
   f. Mark each treatment with label paper and wrap the edges of the petri dish using plastic warp.
   g. Put the petri dish into the incubator for 24 hours at 37˚C
4. Inhibition zone diameter measurement
   After 24 hours, remove the petri dish from the incubator and measure the clear zone that has formed around the paper disk using a caliper and record the diameter of each treatment into a table.
5. Identification of bioactive compounds snail gonggong
   Bioactive analysis was carried out to determine the active compounds contained in the snail gonggong extract including alkaloid and saponin tests (Yoswaty & Zulkifli, 2016).
   (a) Alkaloids
   The snail gonggong extract was mixed with a few drops of H_2SO_4 and divided into 2 tubes. The first tube was dripped with 2-3 drops of dragendorff's reagent while the second tube was dripped with 2-3 drops of Meyer's reagent. The reaction is positive if an orange precipitate is formed in the first tube and a yellow precipitate is formed in the second tube.
   (b) Saponins (foam test)
   The snail gonggong extract was put into a test tube and added with warmed distilled water, then shaken and added with HCL. The extract contains saponin compounds if a foam is formed which does not disappear for 10 minutes

Data analysis

The data analysis technique used is descriptive qualitative by displaying tables and figures to identify bioactive compounds and test the inhibition of *Vibrio alginolyticus* bacteria.

RESULTS AND DISCUSSION

The bioactive components in the methanol extract of gonggong snail meat were observed by qualitative testing of bioactive compounds. The bioactive tests carried out include; alkaloids, flavonoids, terpenoids,

steroids, phenolics and saponons/tannins. The results of testing the bioactive components can be seen in table 1 below.

Table 1. Bioactive compounds of snail gonggong meat extract

Parameter	Color	Result
Alkaloids	Yellow	+
Flavonoids	Yellow	+
Terpenoids	Red	-
Steroids	Red	+
Phenolic	Yellow	-
Saponins/tanins	Foam	+

Based on the table above, the identification results show that of the six parameters measured, only four groups of bioactive compounds in the methanol extract of snail gonggong meat were identified, namely alkaloids with a yellow color reaction, flavonoids with a yellow color reaction, steroids with brown reactions and saponins or tannins in the reaction that occurs in the form of foam, while terpenoids and phenolics were not identified.

The results of the antibacterial activity test of the snail gonggong meat extract against the growth of Vibrio algonolyticus bacteria can be seen in Table 2 below

Table 2. The results of the power test of snail gonggong meat extract.

Concentration	Replay			mean
	1	2	3	
100%	8,1mm	7,9 mm	7,5 mm	7.833 mm
50%	0 mm	0 mm	0 mm	.000 mm
25%	0 mm	0 mm	0 mm	.000 mm
12,5%	0 mm	0 mm	0 mm	.000 mm
6,25%	0 mm	0 mm	0 mm	.000 mm
3,125%	0 mm	0 mm	0 mm	.000 mm
Amoxilline (+)	32,1mm	29,1 mm	35,1 mm	44.934 mm
Aquades (-)	0 mm	0 mm	0 mm	0 mm

Based on the table above, it shows that each treatment concentration that can inhibit the growth of *Vibrio alginolyticus* bacteria is a concentration of 100% while the concentration of 50%, 25%, cannot have an impact in the form of a clear zone around the petrik dish and can be seen in figure 1 below.

Concentration 100% control (+) and (-)

Figure 1. clear zone growth of *Vibrio alginolyticus*

The picture above is the result of the inhibition test of methanol extract of snail gonggong meat against *Vibrio alginolyticus* bacteria with concentrations of 100%, 50%, and 25%. The 100% concentration treatment with three replications had an impact on the growth of *Vibrio alginolyticus* bacteria with the formation of a clear zone diameter around the petri dish. Each replication gave the diameter of the inhibition zone not too different between them (U1 = 8.1 mm, U2 = 7.9 mm, U3 = 7.5 mm and an average of 7,833 mm including the medium category).

Identification of bioactive compounds is one of the important steps that must be taken to determine whether or not there is a class of bioactive compounds present in a test material (Sa'adah and Nurhasnawati, 2015). This test was carried out qualitatively by dissolving the methanol extract of snail gonggong meat with several reagents in order to obtain the desired bioactive compounds. Snail gonggong meat extract contains bioactive compounds, namely alkaloids, flavonoids, steroids and tannins/saponins. According to Thomas et al. (2014) the diameter of the inhibition zone that can be used as a reference in measuring the effectiveness of a test material in inhibiting bacterial growth is as follows, the inhibition zone 5 mm is categorized as weak, the zone of inhibition is 5-10 mm is categorized as moderate, the inhibition zone is 10-20 mm is categorized as strong and Inhibition zone 20 mm is categorized as very strong. Yoswaty & Zulkifli, 2016, stated that the ethanol extract of the type of snail barking *(Strombus canarium)* contains antibacterial ingredients that can inhibit the growth of pathogenic bacteria A. hydrophila, C. perfringens and Vibrio sp.

The greater the antimicrobial substance in the snail gonggong meat, the greater the opportunity to inhibit the growth of *Vibrio alginolyticus* bacteria by damaging the body's structure and metabolism. In line with the opinion of Rahmawati (2014) that if the concentration of the extract is increased, the diameter of the inhibition zone will also increase because the bioactive components contained in the extract used will also increase. Ajizah (2004) added that the characteristics of the samples used were one of the supporting factors in increasing antibacterial activity. Alkaloids have the ability as an antibacterial by interfering with the peptidoglycan constituent components of bacterial cells, so that the cell wall layer is not fully formed and causes the death of the cell. Polyphenols help fight the formation of free radicals in the body so that it can slow down premature aging. Broadly speaking, polyphenols have antibacterial properties with their mechanism of action by damaging bacterial cell membranes which can induce the formation of complex compound bonds to enzymes or microbial substrates that can increase toxicity (Rachman et al, 2018).

Flavonoids are phenolic compounds that work by denaturing proteins which can cause cell metabolic activity catalyzed by an enzyme which is a protein. Because flavonoids have the ability to form complexes with soluble extracellular proteins and with cell walls, microorganisms cannot attach to and invade cells (Susanti, 2016). Flavonoids are also able to release transduction energy to the bacterial cytoplasmic membrane and inhibit bacterial motility (Manik et al, 2016). In addition, flavonoids can also cause damage to bacterial cell walls through inhibition resulting in the incorporation of glycan chains that are not cross-linked into the peptidoglycan of the cell membrane so that it becomes a weak structure (Sulatstrianah et al, 2014). Nagappan et al (2011) explained that flavonoids will inhibit energy metabolism in bacteria, so that it can inhibit oxygen respiration which then the bacteria will lose the permeability of cell walls, microsomes and lysosomes as an interaction between flavonoids and bacterial DNA. The antibacterial mechanism is to form complexes with cellular and soluble extract proteins and with the microbial wall. Another possibility is that flavonoids play a direct role by interfering with microbial cell function and inhibition of the microbial cell cycle (Ginting et al, 2020). Rimporok et al. 2022, stated that the active compound flavonoid is the largest substance that can act directly as an antioxidant and antibacterial.

Tannins have antibacterial properties. Tannins work as antibacterial by interfering with bacterial surface receptors by binding to the protein adhesin in bacteria which will cause inhibition of protein synthesis for cell wall formation and decrease bacterial adhesion (Mastuti, 2016). Tannins also have chelating properties which are thought to be able to shrink cell walls so that their growth is inhibited and even dead (Sari, 2012). Fitriah et al, 2017, revealed that tannin compounds are known to interfere with peptidoglycan synthesis which causes the formation of bacterial cell walls to be incomplete, resulting in inactivation of bacterial cells in host cells. According to Aisiah (2004), tannins are one type of compound that belongs to the polyphenol group. The mechanism of action of tannins is thought to be able to shrink the cell wall or cell membrane so that it interferes with the permeability of the cell itself. As a result, cells cannot carry out living activities so that their growth is stunted and dies. Steroids act as antibacterial in inhibiting the growth of Porphyromonas gingivalis related to lipid membranes and sensitivity to steroid components that cause leakage in bacterial liposomes (Madduluri et al, 2011). Steroids can interact with cell phospholipid membranes that are permeable to lipophilic compounds, causing decreased membrane integrity and cell membrane morphology to change causing cell brittleness and lysis. The mechanism of action of antibacterial compounds includes inhibiting cell wall synthesis, inhibiting the integrity of microbial cell membranes, inhibiting microbial cell protein synthesis, interfering with microbial cell metabolism and inhibiting nucleic acid and protein synthesis (Rahmadani, 2015).

CONCLUSION

1. The snail gonggong meat extract has bioactive compounds of alkaloids, flavonoids, steroids and saponins/tannins.
2. Concentration of 100% extract snail gonggong meat was able to inhibit the growth of *Vibrio alginolyticus* bacteria with a moderate diameter of inhibition zone.

REFERENCES

Ali, A. (2006). Screening of partial characterization of antimicrobial compounds from mangrove snails and thin layer chromatography profile of the active fraction. Research Journal of the Department of Biology, State University of Makassar 12 (63-68)

Arianti, N.D., Efrizal, T., Fajri, N.El,. (2013). Abundance of dog conch (strombus turturella) in coastal area tanjungpinang city subdistrict, Tanjungpinang City. University of Riau.

Arularasan, S., Lyla, P.S., Kesavan, K. and Khan, S.A. (2010). Recieps for the mesogastropod strombus canarium. Advance J. Food Science and Technology, 2(1) 31-35.

Ajizah, A. (2004). Sensitivity of Salmonella typhimurium to leaf extract of psidium Guajava L. Bioscientiae 1 (1) 31-38.

Aisyah, N. (2016). Microencapsulation of Inferior Cocoa (Theobroma Cacao L) polyphenol extract as antioxidant and antimicrobial.

Good job, Nurul. (2013). Development of 5th grade science teaching materials in elementary schools with a contextual approach. Thesis. Semarang: Unnes Postgraduate Program.

Corvianindya Y., Brotosoetarno S. (2004). Resistance of oral biofilm bacteria to beta-lactam antibiotics. IJD. 11(2) 83-87.

Center for Health Protection. (2010). Scientific committee on enteric infections and foodborne diseases food poisoning parahaemolyticus in Hong Kong–Current Situation and Recommendations. Department of Health for Disease Prevention and Control. 15 p.

Daniels NA., MacKinnon L. and Bishop R. (2000). Vibrio parahaemolyticus infections in the United States, 1973-1998, J Infect Dis. 181 (5).

MCMurry, J and Fay, R.C., (2004). Chemistry 4th Edition. New Jersey: Prentice Hall.

Dessy Yoswaty and Zulkifli (2014). Analysis of antibacterial ethanol extract of snail gonggong (strombus canarium) against pathogenic bacteria.

Ekawati E.R. (2017). Detection of Salmonella sp., Vibrio sp. and Total Plate Count Bacteria on Blood Cockle (Anadara granosa). IOP Conf. Series: Earth and Environmental Science 10 (2), 13-56.

Fitriah F., Mappiratu, M., Prismawiryanti, P. (2017). Antibacterial activity test of johar (Cassia siamea Lamk.) leaf extract from several levels of solvent polarity. Covalent 3: 242–251.

Firdous, M., Koneri, R., Sarvaraidu, CH., Shubhapriya, K.H. (2009). Antidiabetic activity of saponins of Momordica cymbalaria in streptozotocin-nicotinamide mice. Journal of Clinical and Diagnostic Research. 3: 1460-1465.

Ginting., Binawati. And Et, All, Mustanir. (2017). Antioxidant Activity Of N-Hexane Extract Of Nutmeg Plants From South Aceh Province. Journal of Natural 17(1), 39.

Green, R. J. (2004). Antioxidant Activity of Peanut plant Tissues. North Caroline State University: Department of Food Science, Raleigh.

Mirawati., Mega. (2013). Identification of salmonella in snacks sold in canteens and outside elementary school canteens. Jakarta.

MCMurry., J. and Fay, R.C. (2004). Chemistry 4th Edition. New Jersey. Prentice Hall.

Madduluri, S., Rao, KB., Sitaram, B. (2013). In vitro evaluation of antibacterial activity of five indigenous plants extract against five bacterial pathogens of. pp. 679-84.

Mastuti, R. (2016). Secondary Metabolites and Plant Defense. Department of Biology, Faculty of Mathematics and Natural Sciences Universitas Brawijaya.

Manik, D.F., Hertiani, T. and Anshory, H. (2014). Correlation analysis between flavonoid content and antibacterial activity of ethanol extract and fractions of cherry leaf (Muntingia calaburam L.) against Staphylococcus aurues. Khazanah, 6(2), 1-11.

Nagappan, T., Human. (2011). International Journal of Pharmacy and Pharmaceutical Science.

Ramasamy, T.C., Wahid, Segaran. and Vairappan, C.S. (2011). Biological Activity of Carbazole Alkaloids and Essential Oil of Murraya koenigii Aginst Antibiotic Resistant Microbes and Cancer Cell Lines. Molecules. 21 (16), 9651-9664.

Prayitno, T.A. (2017). Development of microbiology practicum instructions for Biology Education study program. Journal of Biota, 3(1), 31–37.

Rosenvinge, E.C., O'May, G.O., Macfarlane, S., Macfarlane, G.T. & Shirtliff, M.E. (2013). Minireview: Microbial biofilms and gastrointestinal diseases. Pathogens and Disease 67 (2013), 25–38.

Ruwandeepika, H.A.D., Jayaweera, T.S.P., Bhowmick, P.P., Karunasagar, I., Bossier, P. & Defoirdt, T. (2012). Pathogenesis, Virulence Factors, and Virulence Regulation of Vibrios Belonging to the Harveyi Clade. Aquaculture, 4(2), 59–74.

Rahman, N., Marliyati, S. A., Damanik, M. R. M., & Anwar, F. (2013). Antioxidant activity and total phenol content of ethanol extract of tatokak fruit (Solanum torvum). Pakistan Journal of Nutrition, 12 (11), 973-977.

Rahmadani, F. (2015). Activity Test of 96% Ethanol Extract of Javanese Bark (Lannea coromandelica) Against Staphylococcus aureus, Eshcerichia coli, Helicobacter pylori, Pseudomonas aerugynosa bacteria. Thesis. Jakarta.