TESTING OF PHYSICAL CHARACTERS, TOTAL PHENOLIC CONTENT, AND ANTIOXIDANT ACTIVITY IN DATES (*Phoenix dactylifera L.*) VAR.AJWA

THESIS

Submitted in Partial Fulfillment of the Requirements for Degree of Bachelor of Nutrition (S.Gz.)

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RATIFICATION

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DEDICATION

In the name of Allah the Beneficent and the Merciful, this thesis is dedicated to :

1. My beloved mother and father (Mrs. Hj. Sri Murni and Mr. H. Bambang Saneka) who always support me emotionally and materially with pray, guide, and patience. Thanks for the effort and contribution in making my education success and run well.
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As a human being, the writer realizes that she would not be able to complete this final project without the help of others. Many people had helped the writer during writing this thesis and it would be impossible to mention all of them one by one. In this chance, the writer would like to express deep appreciation to :

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Dwi Handayani

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ABSTRACT

Background: Dates (*Phoenix dactylifera L*.) var. Ajwa is the one of favorite fruit of Rasulullah SAW. Dates (*Phoenix dactylifera L*.) var.Ajwa has many benefits for the health of humans and contains various nutrients among others macronutrients and micronutrients. Macronutrient content such as carbohydrates, protein, lipid. Micronutrient content such as zinc, magnesium, iron, magnesium, sodium, *etc*. Dates (*Phoenix dactylifera L*.) var. Ajwa also contains phytochemicals as phenolic and flavonoid. Phenolic and flavonoids act as antioxidants. For this reason, dates (*Phoenix dactylifera L*.) var. Ajwa can be functional food that can increase the health of humans.

Objective: This study aims to know about physical characters, total phenolic content, and antioxidant activity in dates (*Phoenix dactylifera L*.) var. Ajwa.

Method: in the *screening* early potency of dates (*Phoenix dactylifera L*.) var. Ajwa as functional food such as physical characters consist of size with vernier calipers and weight with analytical scale, total phenolic content was tested using the colorimetric method, antioxidant activity using the DPPH method.

Results: testing the physical characteristics of size show results for length 3.4120±0.1532 cm; for width 2.1620±0.1716 cm; for thickness 0.5540±0.0875 cm and weight test show result for whole fruit 11.5712±1.0816730 gr; for flesh 2.4213±1.1024 gr; and seeds 1.2688±0.1753 gr, the total phenolic test of 10.1778±0.9776 mg GAE g extract, for testing the antioxidant activity of date extract (*Phoenix dactylifera L*.) is 2.31095 mg/L.

Conclusion: dates(*Phoenix dactylifera L*.) have the potential to be a functional food with high antioxidants.

Keywords: dates (*Phoenix dactylifera L*.) var.Ajwa; functional food; antioxidant

CHAPTER I
INTRODUCTION

A. Background of the Study

In the development era has an impact on changes in diet and lifestyle. People are more likely to consume fast food so that the intake of saturated fat and sugar increases and the intake of fiber and various other micronutrients decreases. This diet increases the occurrence of degenerative diseases (Dhani and Yamasari, 2014). Especially in adolescents, lifestyle greatly influences diet so that fat intake is high and increases the chance of degenerative diseases in adulthood. This affects the growth and development of adolescents because of unbalanced nutritional intake (Hardiansyah, *et al*. 2015).

Degenerative disease is one of the type chronic disease that has a major impact on a person's quality of life. The Examples of degenerative diseases are hypertension, diabetes mellitus, heart, cancer, tumors, etc. (Hanum and Ardiansyah, 2018). According to WHO, the biggest cause of death is a degenerative disease, about 17 million people die prematurely every year due to a global epidemic of disease degenerative (Handajani, *et al*, 2010). The results of Riskesdas (2018) show that the data death from non-communicable diseases is the highest cause of death in Indonesia at 15,4%. The degenerative diseases result in decreased organ function, cell damage, immunodeficiency (Fadinata and Ernawati, 2020). Degenerative diseases can be caused by oxidative stress (Werdhasari, 2014).

Oxidative stress is a condition with an imbalance between increased free radicals, reduced antioxidant production, or both. Free radicals or ROS (*Reactive Oxygen Species*) are reactive oxygen compounds that are secondary products of aerobic metabolism (Djuanda, *et al*, 2012). Cell damage is triggered by high levels of ROS. *Reactive Oxygen Species* (ROS) include superoxide, peroxyl, hydroxyl, and hydrogen peroxide or H_2O_2 molecules (Susantiningsih, 2015). The mechanism of oxidative stress occurs when the production of free radicals exceeds the antioxidants present as an intrinsic defense. Excessive ROS production in cells that exceeds the existing cellular detoxification system causes oxidative stress. The occurrence of oxidative stress in the body can be minimized by adjusting diet and lifestyle. One way that can be done is by implementing functional food (Adawiyah, *et al*., 2015).

The definition of functional food according to BPOM is food material or has been processed containing one or more compounds that are considered to have certain physiological functions that are beneficial to support health. The functional food consumed does not cause certain indications and provides side effects if the amount of use is by the recommendations (Suter, 2013). One of the nutrients contained in functional food that serves to minimize the occurrence of oxidative stress is antioxidants. Foods that contain antioxidants are dates (*Phoenix dactylifera L.*) var.Ajwa (Primurdia and Kusnadi, 2014).

Dates (*Phoenix dactylifera L.*) var. Ajwa is a special fruit in the Islam religion because it is a favorite food of Rasulullah SAW. dates (*Phoenix dactylifera L.*) var. Ajwa is the best and

softest types of dates in Medina. According to Ibn Atsir, Ajwah is a rather large date and the color tends to be blackish. These dates were planted directly by the Prophet Muhammad himself in Medina. Aliyah is a village at the top of the city of Medina towards Najed. Al Khaththabi explained that dates (*Phoenix dactylifera L*.) var. Ajwa is useful for treating poison and magic due to the blessings of the prayer of the Prophet Muhammad (Al-Asqalani, 2016).

From this benefits mentioned in the hadith:

حَدَّثَنَا أَبُو سَعِيدٍ قَالَ حَدَّثَنَا سُلَيْمَانُ عَنْ شَرِيكِ بْنِ أَبِي نَمِرٍ عَنْ ابْنِ أَبِي عَتِيقٍ عَنْ عَائِشَةَأَنَّ رَسُولَ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ قَالَ فِي عَجْوَةِ الْعَالِيَةِ أَوَّلَ الْبُكْرَةِ عَلَى رِيقِ النَّفْسِ شِفَاءٌ مِنْ كُلِّ سِحْرٍ أَوْ سُمٍّ

> Having told us Abu Sa'id, he said; has told us, Sulaiman, from Syarik bin Abu Namir, from Ibn Abi Atiq, from Aisha, that the Messenger of Allah sallallaahu 'alaihi wasallam said: "On Ajwa dates that grow in 'Aliyah which is eaten early in the morning before breakfast there is a cure for all witchcraft and diseases poison." (HR. Imam Ahmad. No. 24616).

According to Imam al-Qurtubi, explaining the meaning of zhahir hadith is the specialization of Ajwa Medina dates to reject poison and magic. Poison can kill because the temperature is below cold standards. If a person regularly eats dates (*Phoenix dactylifera L*.) var. Ajwa, then the hot temperature will be stable in his body, supported by naturally hot temperatures. According to Ibn al-

Qayyim, Ajwa Medina dates are among the most useful Hijaz dates, they are a good, dense, accurate type, and are among the softest and most delicious dates. Dates (*Phoenix dactylifera L*) are fruits that contain the most nutrients with various types (al-Asqalani, 2016). From the reason, dates have the potential to be a functional food.

The one nutrients contain in dates (*Phoenix dactylifera L*.) var. Ajwa acts as an antioxidant such as phenolic and flavonoid. The Antioxidant can prevent oxidative stress caused by free radicals. Free radicals in the body become a poison that can damage body cells when they are not in a stable state through the process of oxidative stress. The activity of antioxidant compounds contained in dates which have a role to ward off free radicals and form more stable compounds. This antioxidant activity test was carried out using the DPPH method to know the ability of date extracts to provide hydrogen atoms to free radicals to form stable compounds (Cepeda, *et al.,* 2018). In addition, Flavonoid and phenolic content act as an antioxidant. Flavonoid and phenolic compounds are secondary metabolites in plants. Phenolic compounds are one of the good compounds to donate electrons because the hydroxyl groups in phenolic directly play a role in antioxidant activity (Aryal, *et al,* 2019).

The quality of food is a satisfaction (necessity and prices) that consumers get from the integrity of products produced by producers including product forms that can be assessed organoleptic, activities, processes, organizations, or humans that show their ability to meet predetermined needs (Kusuma, *et al*., 2017). The quality factor of foodstuffs is found in the nature of

foodstuffs. The properties of foodstuffs are divided into 3, namely physical, chemical, and biological properties. Physical properties include the appearance of size and shape; texture; taste and aroma. To determine the physical characteritic of dates, observations were made from the average weight and size of dates (Murdiati and Amaliah, 2013).

For testing physical characters consist of size and weight. To measure the size (cm) using vernier calipers and for weight use an analytical balance to measure the average weight (grams). The other test is total phenolic content use colorimetry method and antioxidant activity test was also carried out on dates (*Phoenix dactylifera L*.) var. Ajwa using the DPPH method. All the testing is the early screening to identify potential of dates (*Phoenix dactylifera L*.) var. Ajwa to be a functional food.

B. Research Question

Based on the above background of the study, the research question this study include:

1. What are the physical characteristics of date palm (*Phoenix dactylifera L*.) var. Ajwa?
2. What is the percentage of total phenolic content in dates (*Phoenix dactylifera L*.) var. Ajwa?
3. How is the antioxidant activity of dates (*Phoenix dactylifera L*.) var. Ajwa?

C. The objective of the Study

Based on the formulation of the problem, the above objectives in this study include:

1. Knowing the physical characteristics of dates (*Phoenix dactylifera L.*) var. Ajwa.
2. Knowing the total phenolic content in dates (*Phoenix dactylifera L.*) var. Ajwa.
3. To determine the antioxidant activity of dates (*Phoenix dactylifera L.*) var. Ajwa.

D. Significance of the Study

1. For Society

Provide knowledge related to physical characteristics, total phenolic content, and antioxidant activity in dates (*Phoenix dactylifera L.*) var. Ajwa.

2. For Researchers

Provide research references related to physical characteristics, total phenolic content, and antioxidant activity in dates (*Phoenix dactylifera L.*) var. Ajwa.

E. Research Authenticity

The title proposed by the researcher is: "Testing of Physical Characters, Total Phenolic Conten, and Antioxidant Activity in Dates (*Phoenix dactylifera L.)* Var. Ajwa". The research refers to several previous studies, by modifying the research method.

Table 1 Research Authenticity

No.	Researcher Name, Title and Year	Research methods	Results
1.	Muhibbuddin Abdillah, NR Khoirotun Nazilah, Eva Agustina. Identification of Active Substance In Ajwa Date (*Phoenix dactylvera L.*) Fruit Flesh Methanol Extract. (2017)	UV-Vis Analysis	The results of the phytochemical test of the methanol extract of the Ajwa date palm flesh were analyzed by UV-Vis with an absorption length of 286 nm as an indicator of the presence of flavonoid compounds.
2.	Antioxidant	DPPH method	Flavonoid

	Activity Test of Dates Fruit Ethanol Extract. Umi Nafisa. (2019)		compounds and tannins are compounds identified in the phytochemical test of date fruit extract. The antioxidant activity test was carried out using the DPPH method, the IC_{50} was 9.13 ppm, so that dates have very strong antioxidant activity.
3.	Khalid, Ahmad, Masud, Asad and Sandhu. Nutritional Assessment of Ajwa Date Flesh And Pits In Comparison	Prosimat, Clauster analysis technique	The results of the analysis on Ajwa dates: water content 22.8%, ash (3.22%), glucose (54.5%), fructose (52.03%),

	To Local Varieties. (2016)		maltose (22.5%) and galactose (12.2%). %), fat (7.8%), fiber (51%).
4.	Siddiqi, Sajjad Ahmad, Rahman, Sadik, Khan, Rafiq, Sikander, Inayat, Khurram, Seeranguraya r and Jamil. Potential of dates (*Phoenix dactylifera L.*) as Natural Antioxidant Source and Functional Food For Healthy Diet. (2020)	Determination of moisture content by the oven method, determination of physical characteristics by determining the weight of meat, seeds and whole fruit, analysis of phenolic content by the colorimetrix method, antioxidant activity test by HPLC, sugar content by the calorimetric method, fiber content by the	The average Umsellah and khalas dates weigh: 2.809 g and 4.948 g, ; water content: 22.47% and 19.41%,; total phenolic content: 164.22 and 103.85,; Sugar content (carbohydrates) : 51.37 g/100g and 44.78g/100g.

	gravimetric method and determination of macro-micronutrients by spectrophotometry (AAS). In this study, we compared the aforementioned nutritional content between Khalas and Umsellah dates.	

This study takes several methods from previous research. In addition, this study added physical character tests, including the average weight and size (leght, width and thickness) of dates (*Phoenix dactylifera L.*) var. Ajwa and tested the antioxidant activity by DPPH method and total phenolic by colorimeter method.

CHAPTER II
LITERATURE REVIEW

A. Ajwa Dates

1. Ajwa Dates Classification

Most date palms grow in Arab countries (Satuhu, 2010). Dates come from North Africa or the Middle East which are the staple food of the local population (Naturland, 2002).

The classification of date palms are:

Plant name : Dates
Kingdom : Plantae
Division : Magnoliophyta
Class : Liliopsida
Order : Arecales
Family : Arecaceae
Genus : Phoenix
Species : P. dactylifera
Binomial name: Phoenix dactylifera
(Word Circle, 2019)

The botanical name of the date palm is *Phoenix dactylifera L.* This naming comes from the Phoenician name "phoenix" which means date palm and "dactylifera" comes from the Greek word "daktulos" which means finger, which describes the shape of the fruit (FAO, 2002). Ajwa dates is also called the date of the prophet. Ajwa dates were planted by the Prophet himself in the city of Medina about 14 centuries

ago. According to the story of *asbabul wurud* (the causes of the revelation of the hadith), that is the Prophet Muhammad SAW. breaking the fast with dates, these are called Ajwa dates. The name Ajwa is the name of the son of Salman al-Farisi, a Christian who converted to Islam and made his date plantations as waqf for jihad in Islam. To remember for his services, the Prophet gave the name of the dates he ate when breaking his fast with the name of Ajwa dates. Ajwa dates do not grow much in Saudi Arabia, only about 100 trees, and the supply is also limited so that the market price is known to be more expensive (Supandi, 2014).

2. Ajwa Dates Morphology

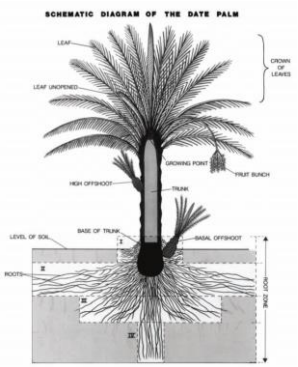

Figure 1 The Morphology of the date palm tree (Schorr, *et al*., 2018).

Dates in Latin *Phoenix dactylifera L*. is a type of palm plant that has fruit with a very sweet taste, tree height of about 15-25 meters, leaf shape with the pinnate length of about 3-5 meters (Satuhu, 2010). Date palms are green plants and grow mainly in hot climates. On the other hand, dates can also adapt in all areas, both tropical and dry. Date palms are one of the best fruit-producing plants that have been used by humans since ancient times, especially in the desert area that stretches from Mauritania in the west to Central Asia in the east. Date palms have extraordinary strength to withstand high temperatures reaching 50 degrees Celsius in the summer, also able to survive in areas that have extreme salinity and drought. Date palms are covered by an old midrib that serves to store large amounts of water. In addition, the lance-shaped leaves are thick and prickly, and in the upper tree, there are only a few leaves (no more than 20 to 40 leaves only) to reduce the rate of transpiration (evaporation) and lack of water (Naik, 2015).

The development of the date palm fruit has five stages of development and formation in approximately six months. The stages of formation and development of dates fruit are as follows:

1. Hababouk

   This phase is formed after pollination, round fruit shape and bitter taste is a candidate for new fruit as a result of successful pollination. The fruit is creamy whitish with green stripes that continue to develop turning green. The fruit is covered with leaf petals (Apriyanti, 2015).

2. Kimri

   The kimri phase occurs from the beginning of the emergence of the fruit until the fruit is 17 weeks old. The color of the fruit is green, the shape is elongated, the texture is hard, the water content in the fruit is about 85%. The taste is astringent or bitter depending on the variety of dates (Apriyanti, 2015).

3. Khalal

   This phase is often referred to as raw dates which have a color change from green to yellow, purplish to dark red, the texture of the fruit flesh is quite hard. This stage is the maximum physiological growth stage of the date palm. The color change that occurs until this phase is from green to yellowish then reddish to dark red. The color changes depending on the variety of dates. This phase lasts about 6 weeks after passing through the chemical phase. Sugar content mostly in the form of sucrose experienced a significant increase. This fruit can be directly consumed in a fresh state and has a short shelf life if you want to last longer it can be stored in the freezer (Apriyanti, 2015).

4. Ruthob

   Dates that are ripe, soft, and taste sweet have a high vitamin content, but when used as a ready-to-use energy source, they are still relatively low compared to tamr dates. Dates have a brown or black color, depending on the variety of dates. Dates require special handling because these dates have the potential to undergo

fermentation so that it will change the taste of dates to become sour. This phase occurs about 4 weeks after the khalal phase. The fruit texture is softer and the water content in the fruit is reduced. It tastes sweeter and the color is light brown. Dates can be directly consumed with a short shelf life of 7-10 days (Apriyanti, 2015).

5. Tamr

   This last phase in the fruit ripening process occurs for 2 weeks. In this phase, the dates have a black color with a wrinkled appearance. This last phase is often used as the name of the date, dates are generally sold in the market and this is also often consumed by the Prophet SAW. Tamr dates are often known as dry dates, the color of dates is black, has a low water content so that the shelf life is long. Tamr dates have a soft texture. The increase in sugar content in dates is because the water content has decreased. With an increase in sugar levels, this phase provides ready-to-use energy but there is a decrease in vitamin C levels (Apriyanti, 2015).

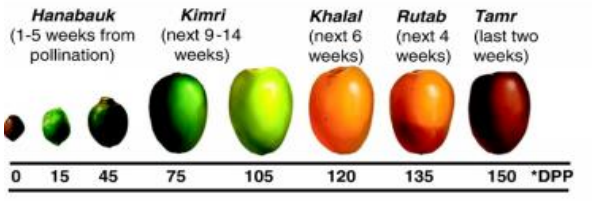

Figure 2 Morphology of date palm fruit development (Ghnimi, *et al.* 2016).

3. Benefits of Ajwa dates

Dates are one of the special fruits that have many benefits, this is evidenced by the mention of dates in the Qur'an 20 times in 16 letters with the words An-Nakhl, An-Nakhil, An-Nakhlah and An Nakhlan which have been described in the book Mu'jam Al Mufahras li A-Fazhil Qur'an (1981) which includes Qs. Ar Rahman: 11 and 68, Qaf: 10, Yasin: 34, As-Syu'ara': 148, Ar-Ra'd: 4. Surah Maryam: 23&25, Surah Al-Baqarah: 266, Surah Al An'am: 99&141, Surah An-Nahl:11 & 67, Surah Al-Isra': 91, Surah AL Kahf: 32, Surah Taha: 71, Surah Al -Mu'minun: 19, Surah Al-Qamar: 20, Surah Al-Haqqah: 7 and Surah 'Abasa: 29 .

One of the privileges described in QS. An Nahl verse 11:

وَسَّخَرَلَكُمُالَّيل والنَّهَارَ ۙ والشَمْسَ والقَمَرَ ۗ والنُّجُومُ مُسَخَّرَتٌ ۢ بأمره

ۗ اِنَّفِي ذَلِكَ لاَيَتٍ لِّقَومٍ يَّعْقِلُونَ

> Meaning: "He grows for you with rainwater plants: olives, dates, grapes and all kinds of fruit. Verily in that, there is a sign (of Allah's power) for a people who think."

In the interpretation of Ar-Razi Q.S An-Nahl verse 11 explains that humans need nutritious food. Nutritious food is divided into two groups, namely

food derived from animals and plants. Foods derived from animals, these foods contain more nutrients and are better consumed to support the growth and development of the human body. Foods of plant origin are divided into two groups: grain and fruit. Fruits, as for the best fruits for consumption, namely olives, dates, grapes. The nutritional content of Ajwa dates varies from macronutrients, micronutrients, to non-nutritive substances (phytochemicals) that can support health (Ar Razi, 1981).

In addition it is mentioned in QS. Maryam verse 25:

وَهُزِيْٓ اِلَيْكِ بِجِذْعِ النَّخْلَةِ تُسَقِطْ عَلَيْكِ رُطَبًا جَنِيًّا

Meaning: "And shake the base of the date palm towards you, surely the tree will abort ripe dates for you." (Surah Maryam: 25).

This verse tells the pain, distress, and weakness of Maryam. In giving birth to his son. Maryam's condition was known by the angel Gabriel gave birth to a son, Prophet Isa. The angel Gabriel said: "Do not, O Maryam, you grieve because of solitude and the absence of food and drink and the worries of gossip from people. Indeed, God, your guardian, and guide have made the child of the river under you. And shake left and right the base of the date palm towards you, surely it will abort ripe dates for you." These ripe dates contain the main nutrients that are easily

digested. Therefore, dates are good food for women after giving birth (partum period) (Shihab, 2012).

Dates are one of the staple foods of the people of Medina. This can be proven in a hadith:

> From Abdullah bin Maslamah bin Qa'nab, we narrated by Ya'qub bin Muhammad bin Tahla from Abi Rijali Muhammad bin Abdul al-Rahman, from his mother Aisyah, Aisyah said that the Messenger of Allah said: "*O Aisyah, a house where there are no dates in it, its inhabitants will be hungry*."

In *Syarah Shahih al-Bukhari's* books be explained this hadith is explained that when in some house not available dates, it is certain that an occupant is a starving person. From this sentence, it can be concluded that dates are one of the staple foods for them if in their house there are enough dates to make them satisfied and they will not feel hungry (Al Asqalani, 2016).

Dates (*Phoenix dactylifera L.*) var. Ajwa has many benefits ranging from fruit, seeds, midribs, stems. In research, Annisa (2015) proved that Ajwa dates can reduce blood triglyceride levels. Ajwa dates can also increase hemoglobin levels in the blood, reduce HbA1c levels in the blood so that they have an antihyperglycemic effect (Ali, Alam & Samrichard, 2020., Maulana, 2020). Dates have benefits as antioxidants and inactivate free radicals. Experimental studies show the role of dietary antioxidants,

as well as endogenous antioxidants as cancer prevention agents through neutralization of ROS (*Reactive Oxygen Species*) (Rahmadi and Biomed, 2019).

In Islam religion be found sunnah to consume Ajwa dates in the morning, this is found in the hadith :

> Sulaiman bin Daud told us, he said: Ismail namely Ibn Ja'far told us, he said: Syarik reported to me, from Abdullah bin Abu Atiq, from Aisha, that the Prophet SAW said, "*In Ajwah dates that grow in 'Aliyah there is medicine, or it is an antidote (if eaten) in the morning*." (HR. Imam Ahmad, No. 24618).

In a hadith narrated by Sa'ad bin Abi Waqqash, from the Messenger of Allah. said:

مَنْ تَصَبَّحَ بِسَبْعِ تَمَرَاتٍ عَجْوَةً، لَمْ يَضُرَّهُ ذَلِكَ الْيَوْمَ سُمٌّ وَلاَ سِحْر

> Whoever eats seven dates in the morning 'Ajwah every day, it will not harm him either poison or magic in the morning. that day. (Narrated by Sahih Bukhari. No. 5327).

According to Ibnu Qayyim quoted by al-Qustullani that the habit of eating dates every day can paralyze and kill disease-causing bacteria. This indicates that what is meant by poison is a certain poison. Many previous research results have proven that dates can neutralize toxins

in the form of free radicals in the body that come from inside (endogenous) and outside (exogenous). In this case, dates have benefits as antioxidants that can capture reactive free radicals to become stable by donating hydroxyl to antioxidant compounds (Saleh, EA., Tawfik, MS., and Tarboush, HM, 2011). In the narrative of Imam Ibn Qayyim Ramallah in the book al-Thibb al-Nabawi : "al-Maf'uud" is a disease that attacks the liver. And with the permission of Allah, Ajwa dates can cure liver disease. The Ajwa dates are also called Ajwa al-Medina dates. These dates are known as the best Hijaz dates of all types, good shape, dense, slightly hard (Mustaqim, 2019).

In a study conducted by Alalwan, *et al.* (2020) dates have a low glycemic index and high antioxidants. In his research proved that dates can reduce LDL and cholesterol levels and increase HDL levels because of their high polyphenol content. Dates do not affect blood glucose levels even though they contain around 70% sugar because they have a low glycemic index. According to research by Ahmed, *et al.* (2016) explained that all parts of dates, namely fruit, seeds, leaves have benefits as antioxidants, antihypertensive, hepatoprotective, antidiabetic, anti-inflammatory, anti-mutagen, anti-diarrhea, anti-fungal, anti-bacterial, anti-proliferative, anticancer, anti-ulcerative male, and female infertility.

4. Nutrient content of dates

Dates (*Phoenix dactylifera L*.) var. Ajwa contains a variety of nutritional content needed by the body including carbohydrates, proteins, fat, fiber, vitamins (thiamin, riboflavin, niacin, ascorbic acid, pyridoxine, and vitamin A), minerals. The pulp of the fruit contains calcium, iron, copper, cobalt, magnesium, fluorine, manganese, phosphorus, and potassium. Dates contain phytochemical compounds such as coumaric acid, ferulic acid, flavonoids, procyanidins, vitamins, and minerals that can act as antioxidants, anti-hyperlipidemic, hepatoprotective, anti-mutagen, anti-inflammatory, and neuroprotective (Saafi, *et al*, 2010 in Ulya, 2018).

Table 2 Nutrition Content in Dates/ 100 gr (Ahmed, al-Jasass, and Siddiqi, 2018

	Wet dates		Dried dates	
	Reach	Average	Reach	Average
Water content (g/100g)	37.9-50.4	42.4	7.2-29.5	15.2
Protein (g/100g)	1.1 -2.0	1.5	1.5-3.0	2.14
Fat (g/100g)	0.1 – 0.2	0.14	0.1-0.5	0.38
Ash (g/100g)	1.0-1.4	1.16	1.3-1.9	1.67
Carbohydrates (g/100g)	47.8 -58.8	54.9	66.1-88.6	80.6
Total sugar (g/100g)	38.8-50.2	43.4	44.4-79.8	64.1
Fructose (g/100g)	13.6-24.1	19.4	14.1-36.8	29.4
Glucose (g/100g)	17.6-26.1	22.8	17.6-41.4	30.4
Energy (g/100g)	185-229	213	258-344	31.4

Besides nutritional value, date fruit was rich in phenolic compounds possessing antioxidant activity. Higher level of phenolic contents and antioxidant activity was reported for date fruits produced in Kuwait (Vayalil, 2002), Algeria (Freha, *et al*. 2016; Mansouri, *et al.* 2005), Oman (Al-Farsi, *et al*. 2005), Iran (Biglari, *et al.* 2008), and Bahrain (Al-Laith, 2008). The importance of antioxidant compounds has been increasing because of their high efficiency in scavenging free radicals related to coronary heart disease, cardiovascular disease, cancer, aging, neurodegenerative, and diabetes diseases (Tang, et al. 2013). The presence of variable active constituents in dates including flavonoids, steroids, phenol, and saponins are postulated to exert anti-diabetic activities mainly by scavenging the free radicals via antioxidant activities and by inhibiting α-amylase and α-glucosidase enzymes (El Abed, *et al*. 2017; Farag, *et al*. 2015; Az Zuhair, *et al*. 2010; Eddine, *et al.* 2014).

In addition to antioxidant activity, diabetes was influenced by the glycemic index in food. The glycemic index is the indexing of the glycemic response of a fixed amount of available carbohydrate from a test food to the same amount of available carbohydrate from a standard food consumed by the same subject (initially, the standard "food" was glucose, but more recently it has white bread (Jenkins, *et al.* 1981; Wolever, *et al*. 1985). The glycemic index is used as a tool in planning diets for diabetic patients and prevention of diabetes (Miyashita, et

al. 2006). The GI is based on the measurement of blood glucose within 2 h from the consumption of a test food containing 15 g of available carbohydrates and comparing it to the blood glucose response to a similar amount of glucose (Jenkins et al., 1981). The GI of foods depended upon their contents from carbohydrates and other chemical constituents (Bjorck et al., 1994). The GI values of common sugars depended on the type of sugars (fructose < sucrose < glucose) (Bantle, 2009). High GI foods cause a rapid and large release of glucose and are associated with hyperglycemia and subsequently diabetes mellitus (Schulze et al., 2004). Phenolic compounds may affect glycemia and GI through different mechanisms, including the inhibition of glucose absorption in the gut or of its uptake by peripheral tissues (Pandey and Rizvi, 2009). Very limited information is available on GI values of different date cultivars, and their relation with other fruit constituents (Miller et al., 2003).

In Al Geffari, *et al*. (2016) show that seventeen varieties of Saudi dates were administered to 19 patients with T2DM for evaluation of glycaemic index and load. Shaqra, Sukkary, and Sag'ai date varieties exhibited that the lowest glycaemic index ranging from 42.8 to 44.0 whereas, Ajwa and Shaqra conferred low glycaemic loads (from 8.5 to 9.2). These date varieties are rich in fructose and fibers, which may be responsible for reducing glycaemic index, glycaemic load, intestinal absorption, and gastric emptying that subsequently reduce the

availability of α-amylase to its substrate, followed by a reduction in blood glucose level (Abiola, *et al.* 2016). Therefore, date varieties with lower glycaemic indices may be incorporated into the diet of diabetic individuals.

5. Metabolites Secondary Dates

Secondary metabolites are compounds synthesized by plants, microbes, or animals that pass through a biosynthetic process that acts as life support but not as vitally as sugars, amino acids, and fatty acids (Saifudin, 2014). Secondary metabolites in dates include carotenoids, phenolics, flavonoids. In the ruthob phase, Ajwa dates contain tannin compounds. In carotene and phenolic compounds (flavonoids and anthocyanins) and act as antioxidants (Ali, *et al*, 2014). In Abdillah's research (2017), it was found that dates contain triterpenoids, flavonoids, and carbohydrates. FTIR analysis confirmed the results of the phytochemical test. UV-Vis analysis proves that the methanolic extract of dates contains flavonoids from the flavone group. Al Madinah Ajwa variety dates contain high levels of flavonoids (2.78 mg/100 g DW). The identified flavonoids include quercetin, luteolin, pigenin, isoquercetin, and rutin (Hariadi & Widodo, 2018).

Secondary metabolites or can also be called the biochemical composition contained in dates such as phenolic compounds, flavonoids (apigenin, luteolin, and quercetin), anthocyanins, tannins, carotenoids (lutein,

neoxanthin, carotene, violaxanthin, antheraxanthin), phytosterols (β-sitosterol), fucosterol iso, stigmasterol, campesterol)(Hussain, *et al.* 2019) .

6. Daily Consume

According to the NHS, daily consumption for dates tamr is 3 dates. In a hadith narrated by Sa'ad bin Abi Waqqash, from the Messenger of Allah. said:

مَنْ تَصَبَّحَ بِسَبْعِ تَمَرَاتٍ عَجْوَةً، لَمْ يَضُرَّهُ ذَلِكَ الْيَوْمَ سُمٌّ وَلاَ سِحْر

> Whoever eats seven dates in the morning 'Ajwah every day, it will not harm him either poison or magic in the morning. that day. (Narrated by Sahih Bukhari. No. 5327).

The hadith describes the recommendation from the Prophet to consume seven dates in the morning before breakfast. Regarding the mention of the number seven items other than in hadith-hadith with the theme of medicine, also found in hadith-hadith non-medicine themed. The other opinion, the number seven is included in the theme of treatment, then meaning that no one knows except Allah SWT. Meanwhile, if the number is other than in the theme treatment, then the number indicates the many (Fahmi, 2018)

According to Nawawi, specificity the seven dates are like the number of seven kinds of zakat assets or

seven prayers whose wisdom cannot be understood but must be believed in. The other opinion, Ibn Qirath as quoted by Ahmad Syauqi Ibrahim, also said that everything in this world is divided into seven parts, like seven the layers of the earth, the seven layers of the sky, the seven of the days, the number of tawaf seven and many more things related to numbers seven that have been determined in the Shari'a without us knowing it means (Fahmi, 2018).

Many people think that eating dates on an odd count is better than even count. If it studied scientifically, al-Nuaimi, *et al*. (2019) show that they compare 2 groups, Fasting glucose levels was measured for all participants; group A (42 participants), who consumed an even number of dates all at Tamer-stage, (net weight about 50 grams); and group B, (42 participants), presumed to consume an odd number of dates (net weight about 40 grams). Two-hrs postprandial blood glucose levels were measured altogether. Blood glucose levels were determined and compared as a means. the result shows that there is no difference between ingestion of the odd and even number of dates fleshes from the glycemic point of view on the glucose level in fasting and postprandial states.

B. Antioxidant

1. Definition of Antioxidant

The antioxidant is one of the compounds that can function to slow down the oxidation process in the body. These antioxidants are formed in a chemical reaction in the body called oxidation. This oxidation is needed to produce energy in the body (Siagian, 2012). Antioxidants are compounds that can delay, slow down and prevent the lipid oxidation process (Yuslianti, 2018). Antioxidants are substances that can neutralize free radicals where atoms and electrons that do not pair get an electron pair and become stable (Tapan, 2006).

2. Types of Antioxidants

There are several kinds of antioxidants: from the enzyme group, for example superoxide dismutase, glutathione, peroxidase, from the mineral group, for example manganese, selenium, and zinc, from the vitamin group, namely vitamin C, and vitamin E, from phytochemical types such as flavonoids, carotenoids, plant pigments, tannins (Bean, 2009). Micronutrients found in plants, vegetables, fruits such as vitamins A, C, E, folic acid, carotenoids, anthocyanins, and polyphenols can capture free radicals so that can be substituted consumption of synthetic antioxidants.

The source of antioxidants that can be used by humans are divided into 3 :

1. Antioxidants that have been produced in the body are usually called endogenous antioxidants or antioxidant enzymes (superoxide dismutase (SOD) enzymes, glutathione peroxidase (GPx), and catalase (CAT) (Parwata, 2016).
2. Synthetic antioxidants used in food production include Butyl Hydroxy Anisole (BHA), Butyl Hydroxy Toluene (BHT), propyl gallate, and Tert-Butyl Hydroxy Quinone (TBHQ) (Parwata, 2016).
3. Natural antioxidants are obtained from plant parts such as wood, bark, roots, leaves, fruit, flowers, seeds, and pollen such as vitamin A, vitamin C, vitamin E, and phenolic compounds (flavonoids) (Parwata, 2016).

3. Antioxidant Function

The antioxidants can inhibit oxidant activity by donating one electron to the oxidant compound. Antioxidants in sufficient quantities can increase the body's defense against diseases caused by free radicals. If consumed in excess, it will also have a negative impact, namely fat accumulation (Damayanthi, *et al*., 2010).

4. The antioxidant mechanism in reducing oxidative stress

Oxidative stress is an imbalance between oxidants and antioxidants in cells or individuals. Oxidative damage is one of the effects of the imbalance and includes cellular

macromolecular oxidative modification, cell death by apoptosis or necrosis, and damage to tissue structures (Lykkesfeldt and Svendsen, 2007 in Min, *et al*., 2018). One of the causes of oxidative stress is the presence of free radicals. Free radicals are molecules, atoms, or groups that have one or more electrons that do not have a partner in their outer shell so they are very reactive. Radical compounds formed react with other molecules to form new radical compounds again, this reaction will take place continuously. This reaction is called a chain reaction (Yuslianti, 2018).

Biological oxidation processes that occur in normal human cells (tissues) form reactive oxygen (oxidants). Oxidants are usually called free radicals. In the process carried out by the oxidase enzyme, several compounds are produced, namely hydrogen peroxide (H_2O_2), superoxide ion (O_2), peroxyl radicals (OH*), and singlet oxygen. Free radicals have high reactivity, namely the tendency to attract electrons and the ability to convert a molecule into a new free radical so that a relaxed reaction occurs and this chain reaction only stops if the free radical is soaked with antioxidants. The stages of formation of free radicals in the body come from biochemical oxidation-reduction reactions with the help of oxygen which are part of the process of normal cell metabolism. There is a response to radiation gamma, ultraviolet rays, pollution environment, smoking, hyperoxide. Furthermore, inflammation is caused by superoxide radicals which are the result of the phagocytosis process by phagocytes that have been active as an inflammatory reaction (such as monocytes,

macrophages, neutrophils, and eosinophils) in large numbers. The physiological process of the emergence of free radicals in the body can be called pro-oxidants. The process of initiating free radicals in body cells is passed by: absorbing radical energy (ultraviolet, X-rays), endogenously occurring in the oxidation process during normal metabolism, enzymatic metabolism in drugs or other chemical substances (Yuslianti, 2018).

Oxidative stress is a condition in which the number of oxidants (free radicals) and the number of antioxidants in the body are not balanced which can cause damage to cells. This oxidative stress causes cell damage so that the pathogenesis of chronic disease processes such as metabolic, autoimmune, cardiovascular, and metabolic disorders, pulmonary, and angina (aging) (Halliwel and Gutteridge, 2007 in Nurdiansyah, 2017). One way to overcome oxidative stress is to fight free radicals with antioxidants. Antioxidants in food are better for use against free radicals. Several reasons are that it can be a protective component and fight oxidative damage, in the absorption process it can have beneficial effects on the body and do not interfere with the digestive system, many antioxidants have anti-inflammatory, anti-ischemic, and anti-thrombotic functions (Cadenas and Packer, 2001).

C. Flavonoids

1. Definition of Flavonoids

A flavonoid is a group of phenolic compounds composed of 5 atoms and carbon as the basic nucleus.

Flavonoids are arranged in a C6-C3-C6 configuration, namely 2 aromatic rings and linked by three carbon atoms that can or cannot be form the third ring (Parwata, 2016). Flavonoids can be found in every type of green plant that has been extracted. Flavonoids are soluble in water, methanol, ethanol, acetone, or acetyl acetate (Andersen and Markham, 2006). In the extraction process, the optimum temperature for taking flavonoid compounds is 65-70^{0}C with an ethanol concentration of 85-90% (Lu, Zhou, and Rong. 2012).

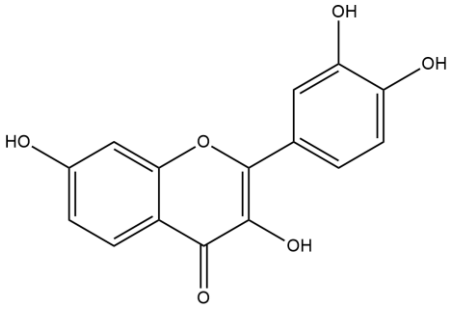

Figure 3 Flavonoid Structure (Ayad & Akkal, 2019).

Flavonoids can be found in plants which are usually called secondary metabolites. Almost all plant parts, namely roots, wood, pollen, nectar, flowers, fruits, and seeds contain flavonoids (Markham, 1988).

2. Flavonoid Properties

Flavonoid compounds have chemical properties that are soluble in alkaline, slightly acidic, including polyhydroxy

compounds (hydroxy groups) which are polar and soluble in polar solvents such as methanol, ethanol, butanol, acetone. The glycoside group in flavonoid compounds causes flavonoids to tend to dissolve in water. Flavonoids are classified as aromatic compounds and act as antioxidants (Harborne, 1987).

3. Flavonoid Mechanism

One of the functions of flavonoids is to act as an antioxidant. When cells and tissues of the body are damaged by free radicals generated from within the body during normal oxygen metabolism or when free radicals are induced from the outside (exogenous) there is a shift in the net charge of the cell, changing the osmotic pressure, causing swelling and cell death. To protect itself from free radicals, the body has a defense mechanism with antioxidants with flavonoid compounds. Flavonoids prevent cell and tissue damage by scavenging free radicals directly. Flavonoids are oxidized by radicals to produce stable and less reactive radicals. This is because the high reactivity of the hydroxyl group of flavonoids makes the radicals inactive. By reaction:

Flavonoids (OH) + r(O) +RH

R is a free radical and O is an oxygen free radical.
(Panche, et al., 2016)

D. Total Phenolic

Phenolics are aromatic compounds containing one or more hydroxyl groups that form a ring. Phenolic compounds are one of the phytochemicals found in plant tissues including fruits and vegetables (Rosa, *et al.* 2019). This compound is produced by plants due to environmental stress and acts as a shield against UV-B and cell death to protect DNA from damage (Lai & Lim, 2011). Phenolic compounds have several classifications including:

1. **Simple phenolic compounds**

   This compound is the result of a substitution of a phenol group, either one group or two groups with ortho, meta, para positions, for example: fluoroglukinol (two groups) and resorcinol (one group) (Nurung, 2016).

2. **Phenylacetic acid and acetophenone**

   Acetophenone and phenylacetic acid are a class of phenolic compounds that are rarely found in nature. Phenylacetic acid has a carboxyl group that does not bind directly to the benzene ring (Nurung, 2016).

3. **Phenolic Acid and other related compounds (aldehydes)**

   Phenolics from the phenolic acid group are phenols substituted by a carboxyl group, for example gallic acid. Gallic acid is a triphenyl that is esterified together with catechins (Nurung, 2016).

E. Extraction Process

Extraction is the activity of withdrawing soluble chemical substances so that they are separated from insoluble materials with liquid solvents. The extracted sample contains soluble active compounds such as essential oils, alkaloids, flavonoids, and others (Ministry of Health, 2000). There are several types of extraction, one of which is maceration. Maceration is a simple dissolving method that is carried out by immersing the material in a solvent for several days at room temperature and protected from light (Astuti, et al. 2017).

The extraction process is divided into 2 types:

1. Cold extraction

a. Percolation process

Percolation is a method of withdrawing the active compound by flowing the solvent through the wetted sample powder. The principle of this extraction is that the sample powder is placed in a cylindrical vessel, where the bottom of the cylinder is given a porous partition, where the solvent liquid flows from the top to the bottom through the sample powder, where the solvent liquid will dissolve the active compound in the sample cell through which the sample passes in saturated condition (Saputra, 2020). The advantage of the percolation method is that there is no need for a filtering process. The weakness of the percolation method is that the contact time between the material and the solvent is limited and the temperature used is low so that the components are not extracted perfectly and the solvent used is cold so that it is less effective in extracting components (Yasni, 2013).

b. Maceration

Maceration is carried out by immersing the whole plant parts or those that have been coarsely ground with a solvent in a closed vessel at room temperature for at least 3 days with repeated stirring until all plant parts are dissolved in the solvent. This mixture is then filtered and the dregs. The advantages of the maceration process include that the plant parts to be extracted do not have to be in a fine powder state, no special skills are needed and there is less loss of alcohol as a solvent such as percolation or sokhletation processes (Endarini, 2016). In addition, in the maceration method, the procedures and equipment used are simple and do not need to be heated so that natural materials do not decompose (Heinrich, 2004 in Puspitasari & Proyogo, 2017).

2. Hot Extraction

Other types of hot extraction include:

a. Reflux

Reflux is one of the extraction methods that is carried out at the boiling point of the solvent, where this process is carried out for a certain duration of time with a constant amount of solvent using reverse cooling (Putri and Fibrianto, 2018).

b. Soxhletation

Soxhletation is an extraction process using a soxhlet where the sample and solvent are placed in different containers, the solvent will evaporate and then condense so that it contacts the sample (Putri and Fibrianto, 2018).

c. Digestion

This technique is a modification of the maceration technique using low-temperature heating between 40-500C (Putri and Fibrianto, 2018).

d. Infusion

This technique is an extraction using water solvent at a temperature of 90oC for a certain time (15 minutes), followed by filtering by giving hot water to the desired volume (Putri and Fibrianto, 2018).

e. Decoction

The technique is almost similar to the infusion technique with a longer process (30 minutes) (Putri and Fibrianto, 2018).

f. Steam distillation

This extraction technique is generally used in compound mixtures with high boiling points (> 200 0C), where the desired compound/component will be evaporated and cooled/condensed again (Putri and Fibrianto, 2018).

F. DPPH method *(1,1-diphenyl-2-picrylhydrazyl)*

DPPH is a stable free radical compound that is used as a reagent insufficient free radical scavenging tests dissolved and when stored in a dry state under storage that is good and stable for years. This method is based on on the reduction of the colored DPPH free radical methanol solution by free radical scavenger. When the DPPH solution the purple one reacts with the donor material electrons then DPPH will be reduced which

causes the purple color will fade and replace with the yellow color that comes from the picryl group (Tristantini, et al, 2016).

This DPPH method has a function to measure single electron, to measure free radical inhibitory activity. The reaction is dissolved sample solution in absolute methanol and incubated at 37 ^{0}C for 30 minutes, the wave read is 517 nm. The discoloration that occurs from purple to yellow is stoichiometric with the number of electrons captured. DPPH method has advantages such as the analytical method which is simple, fast, easy, and sensitive to samples with small concentrations, but testing using DPPH is limited because DPPH can only be dissolved in organic solvents so it is rather difficult to analyze compounds that are organic hydrophilic (Wulansari, 2018). The DPPH solution mixed with the sample extract was measured for light absorption (absorbance) and calculated antioxidant activity by looking for the percentage of inhibition. The percentage of inhibition is how much activity of compounds that function as antioxidants capture DPPH free radicals. IC_{50} is a number that indicates the concentration of the extract that inhibits free radical activity by about 50%. Antioxidant compounds that have very strong activity if the IC_{50} value is 50 mg/L, are said to be strong if the IC_{50} value is between 50-100 mg/L, the IC_{50} value is between 100-200 mg/L including moderate antioxidants and the IC_{50} value is more than 200 mg/L. including weak antioxidants (Tukiran, *et al*, 2019).

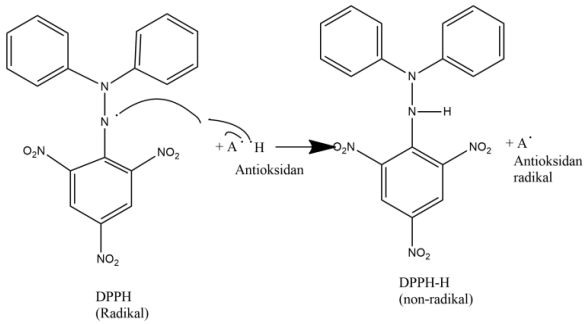

Figure 4 The reaction mechanism of DPPH with Antioxidant (Pasaribu and Setyawati, 2011)

G. UV-Vis Spectrophotometry

UV-Vis spectrophotometry is a spectroscopic analysis technique that uses near-ultraviolet electromagnetic radiation sources (190-380 nm) and visible light (380-780) using a spectrophotometer (Noviyanto, 2020). The results of the spectrophotometer instrument are UV-Vis spectrum bands. This band is the relationship between absorbance (ordinate) and wavelength (abscis). The formation of this spectral band is due to the excitation of electrons in complex molecules. Simple molecules that are given electromagnetic radiation will absorb electromagnetic radiation rays that have the appropriate energy. This interaction can increase the potential energy of electrons in the excited state. The absorbance of UV-Vis energy is produced through 3 kinds of processes, including absorption by bonding and non-bonding electron transitions, absorption by charge transfer, and absorption by electron transitions from complex molecules (Gandjar and Rohman, 2018).

The components of the UV-Vis spectrophotometer include a stable source of radiation energy, cells or cuvettes, monochromators, and detectors connected to a tampering device (Sastrohamidjojo, 2018).

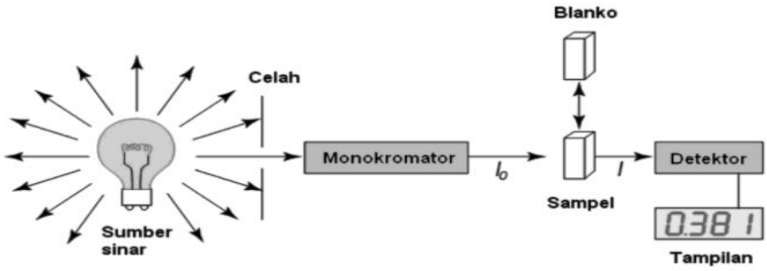

Figure 5 Schematic Diagram of UV-Vis Spectrophotometry (Gandjar and Rohman, 2018)

H. Colorimeter

The colorimeter is a chemical analysis method based on the comparison of the color intensity of a solution with the color of the standard solution by measuring the color intensity of the solution. This method is applied as a detector in determining concentration by analyzing the intensity of light transmitted by the solution, the light source used is white light. This detector can measure the absorbance of samples with a range of 0.05 to 1.0 with the wavelengths used being 635 nm, 565 nm, 470 nm, and

430 nm. The colorimeter works based on the Beer-Lambert law. Lambert-Beer's law states that light acts as a single wavelength.

I. Theoretical framework

Dates (*Phoenix dactylifera L.*) var.Ajwa is one of the dates that have many benefits. The nutritional content contained in Ajwa dates is also diverse, one of which is antioxidants. Where these antioxidants have many important roles in the body. Antioxidants function in controlling free radicals in the body. The type of compound that has an antioxidant role in dates (*Phoenix dactylifera L.*) var. Ajwa is a flavonoid compound. In this study, testing of antioxidant activity, determination of physical properties and water content in dates (*Phoenix dactylifera L.*) var. Ajwa will be carried out. Determination of physical properties includes the average weight of dates and length, width, thickness.

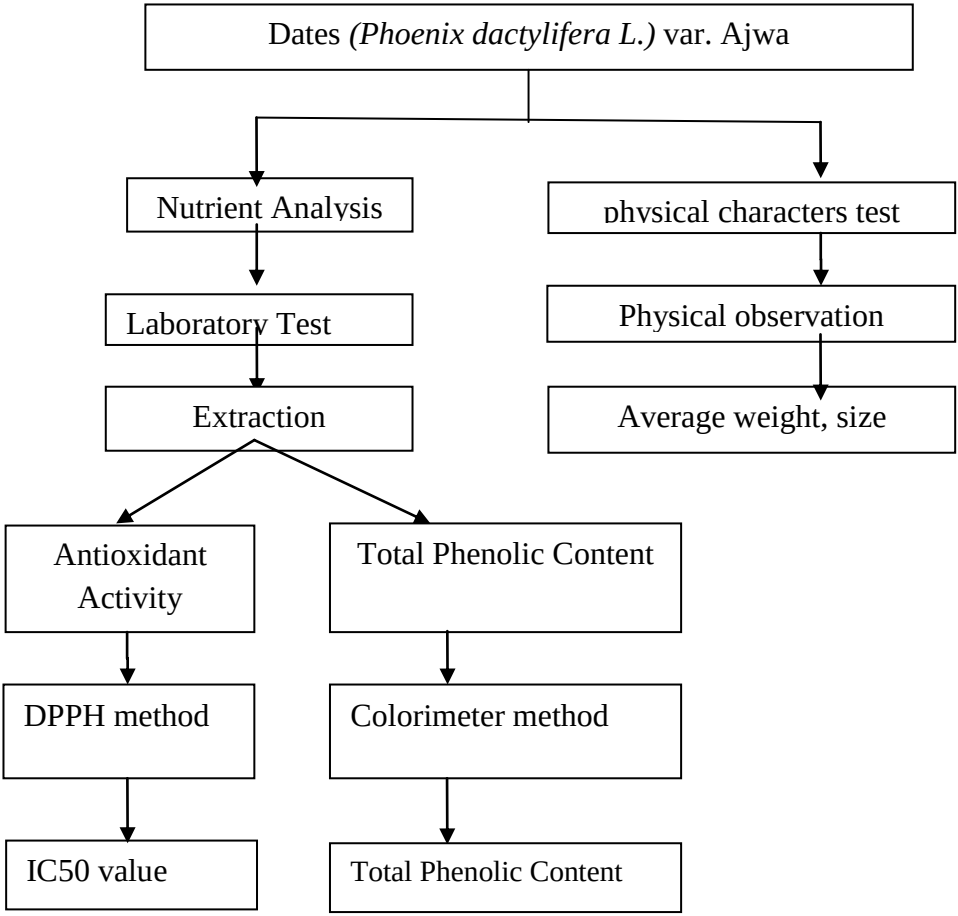

Figure 6 Theoretical Framework.

CHAPTER III
RESEARCH METHODS

A. Types of research

This study uses quantitative research with the type of approach laboratory experiments. There are several stages carried out in the research, namely sample preparation, sample extraction, antioxidant activity test, determination of physical properties, statistical analysis.

B. Research Location and Time

The study was done at the Nutrition and Science Laboratory of UIN Walisongo. It will be held in November–December 2021.

C. Operational definition

Research is shown to find out:

Table 3 Operational Definition

Variable	Operational definition	Measuring scale	Results
Physical character	The physical characteristics of food, in general include shape, size,	Ratio (average weight, average value)	Expressed in grams (weight), cm (size)

	weight.		
Antioxidant Activity Test	Antioxidant activity to capture free radicals in the form of DPPH solution.	Ratio	Expressed in IC_{50} parameters (µg/mL)
Total Phenolic Test	Total phenolic content	Ratio	Expressed in mg GAE/g extract

D. Tools and Materials

1. Tools

The tools used in this research are analytical balance, vernier calipers, blender, test tube, beaker, measuring pipette, maceration toolset, hot plate, vacuum rotary evaporator, centrifuge, UV-Vis spectrophotometer, glass funnel, filter paper, cup, oven, scissors. laboratory, foil aluminum foil, plastic wrap.

2. Ingredient

The material used dates (*Phoenix dactylifera L.*) var. Ajwa, ethanol p.a, DPPH(*1,1-diphenyl-2-picrylhydrazyl*) solution, methanol p.a, BHT (*Butylated hydroxytoluene*), folin-ciocalteu p.a, gallic acid p.a.

E. Method

1. Determination of Physical Properties

The following are the details of testing physical properties:

a. Size

Take 10 dates at random. Each date was measured in length, width, and thickness with the help of vernier calipers (Siddiq, *et al.*, 2018).

b. Average weight

Ten dates were taken at random, weighed one by one with an analytical balance, and separated between the flesh of the dates and the seeds of the dates. Each was weighed with an analytical balance. The average weight of date flesh and date seeds. Besides that, it also observes the size of the fruit(Ahmad, *et al*., 2020) Dates that have been measured are calculated as the average weight of the dates, flesh, and seeds. Separate the flesh of the dates with the seeds. Each was weighed with an analytical balance. Calculating the average weight of date flesh and date seeds (Shiddiq, *et al*. 2018).

2. Extraction Preparation

The extraction process was carried out by weighing a sample of 100 g of dates (*Phoenix dactylifera L.*), separating the seeds and fruit. Cut the fruit by 1-2 cm with washed scissors. Put the date sample into a beaker glass and add 1 L of 100% ethanol, heated with 60-75ºC for 10 minutes, and then cooled at room temperature. Mix and grind the mixture with the help of a blender. It was centrifuged at 5000 rpm for 5 minutes. The

remaining sample was re-extracted by adding 80% ethanol and then heated for 10 minutes, cooled at room temperature, and centrifuged at 10,000 speed for 10 minutes (Siddiqi, *et al*., 2018). The mixture of dates and ethanol was heated at a temperature of 65–70ºC for 10 minutes. The temperature of 65–70ºC is the optimum temperature for taking phenolic content (Lu, Zhou, and Rong. 2012).

3. Total Phenolic Test

a. Operating time

The purpose of operating time measurement is that the complex formation reaction with *folin-ciocalteu* reagent can occur optimally with a marked change in absorbance that begins to stabilize. Measurement of OT within 90 minutes using gallic acid as a standard. Gallic acid is included in phenolic compounds so it is used as a standard and is used to calculate phenolic levels through the gallic acid equivalent method (Marselina, 2018).

b. Preparation of gallic acid main liquor

5 mg of gallic acid was dissolved in methanol to 10 ml, homogenized to obtain a solution with a concentration of 500 g/ml (Marselina, 2018).

c. Preparation of Blank Solution

Taking 0.1 ml of methanol pa then added 7.9 ml of distilled water; 0.5 ml of *folin-ciocalteau*, homogenized for ± 1 minute, and added 1.5 ml of 20% Na2CO3 then incubated for 90 minutes.

d. Determination of Wavelength

Pipette 0.1 ml of the standard gallic acid solution then add 7.9 ml of distilled water; 0.5 *folin-ciocalteau*, homogenized for ± 1 minute and added 1.5 ml of 20% Na2CO3 then incubated for 90 minutes. After that, the maximum wavelength was measured using a UV Vis spectrophotometer in the range of 400-800 nm (Marselina, 2018).

e. Gallic acid calibration curve

Gallic acid standard solution was pipetted with every 0.3125 ml; 0.625 ml; 1.25 ml; 2.5 ml; 5 ml into a 5 ml volumetric flask and add methanol up to the calibration line of the volumetric flask to obtain a solution with a concentration of 31.25 ppm; 62.55 ppm; 125 ppm; 250 ppm; 500 ppm. From each concentration, 0.1 ml was taken, 7.9 ml of distilled water was added, 0.5 ml of *Folin-Ciocalteau* reagent was taken, homogenized for ± 1 minute and then 1.5 ml of 20% Na2CO3 was added and let sit for 90 minutes. The absorbance of each solution concentration against the reagent used (blank) was measured by UV-Vis spectrophotometry with a maximum wavelength and then a calibration curve was made with the linear regression line equation $y = ax + b$ from gallic acid (Marselina, 2018).

f. Preparation of sample solution

The thick extract of dates was weighed 2 g dissolved into methanol up to 10 ml (Marselina, 2018).

g. Determination of Total Phenolic Levels in Ajwa Dates Extract

0.1 ml of the test solution was taken and then 7.9 ml of distilled water was added, 0.5 ml of *Folin-Ciocalteau* reagent, homogenized for 1 minute, and added 1.5 ml of 20% Na2CO3 and let stand 90 minutes. The absorbance of each test solution was measured against gallic acid calibration at the maximum wavelength. The phenol concentration is expressed in units of mgGAE/g sample extract (Marselina, 2018).

4. Antioxidant Activity Test

Testing of antioxidant activity using the DPPH method. DPPH (*1,1-diphenyl-2-picrylhydrazyl)* is a method for scavenging free radicals, especially to calculate the antioxidant potential activity of a compound, extract, or other biological sources. This method is very simple, where the extract is mixed with DPPH solution and the absorbance is recorded after a specified period (Kedare & Sigh. 2011).

The procedure of testing antioxidant activity:

a. Preparation of DPPH Solution

DPPH solution was prepared by dissolving 0.0039 g of DPPH in 100 mL of methanol p.a to obtain a concentration of 0.1 mM DPPH solution (Restiana, 2020).

b. Determination of the Maximum Wavelength of DPPH

The absorbance of 0.1 mM DPPH solution was measured at a wavelength of 500-525 nm using a UV-Vis

spectrophotometer to determine the maximum (Restiana, 2020).

c. Blank Solution Test

4 mL of 0.1 mM DPPH solution was taken and put into a test tube then measured into a test tube and then the absorbance was measured at its maximum wavelength (Restiana, 2020).

d. Sample Antioxidant Activity Test

Ajwa date palm extract was prepared by weighing 10 mg dissolved with methanol p.a to 25 mL so that the concentration became 400 mg/L. Sample solution of 400 mg/L was taken each 6.25 ml was dissolved in methanol pa up to 10 mL and to be a concentration 250 mg/L. Take sample solution of 250 mg/L to make sample solution of 100 mg/L. After that, make series solution from 100 mg/L was taken each 0,05 mL;0,1mL;0,2 mL;0,3 mL;0,4 mL;0,5 mL and dissolve in methanol p.a to 10 mL was formed 0,5 ppm; 1 ppm; 2 ppm; 3 ppm; 4 ppm; 5 ppm. 2 mL of 0.1 mM DPPH solution was taken and put into a test tube and 2 mL of sample was added for each concentration series. It was left for 30 minutes and then the absorbance was measured at the maximum wavelength (Restiana, 2020).

e. Comparative Solution Antioxidant Activity Test (BHT)

BHT mind liquor was prepared by weighing 2.5 mg of BHT powder dissolved in methanol p.a up to 25 mL to a concentration of 100 mg/L. 0.005 mL; 0.01 mL; 0.02 mL; 0.04 mL; 0.08 mL; 0.16 mL of the comparison mother liquor were taken after that dissolved in methanol p.a up to

10 mL and obtained a concentration of 0.05 ppm; 0,1 ppm; 0,2 ppm; 0,4 ppm; 0,8 ppm; 1,6 ppm. 2 mL of 0.1 mM DPPH solution was taken and put into a test tube, and 2 mL of the comparison solution was added for each concentration series. It was left for 30 minutes and then the absorbance was measured at the maximum wavelength (Restiana, 2020).

5. Data analysis

a. Physical Character Test

Average values (n=10) with standard deviations were reported for differences in physical properties such as length, width, thickness for the size and weight of fruit, flesh, and seeds of Ajwa dates. All the results of the analysis are stated by the average value with a standard deviation with SPSS 25 *apps* (Shiddiqi, *et al*. 2020).

b. Total phenolic test

The results of the gallic acid absorbance data made a linear regression equation using MS. Excel 2010 provided that the value of R^2 > 0.95. After that, look for the concentration (x) by using the linear regression equation that has been made (Marselina, 2018). Calculate the total phenolic content with the formula:

$$kadar\ total\ fenolik : \frac{konsentrasi\ (\mu g/ml\ x\ vol.sampel(ml)}{berat\ sampel\ (g)}\ x\ FP$$

c. Antioxidant Activity Testing

The antioxidant activity was tested using the DPPH method using a solution of DPPH (*1,1-diphenyl-2-picrylhydrazyl)* radicals. The percentage inhibition of antioxidant activity can be calculated by the formula:

Antioxidant activity % :

$$\frac{A0 - A1}{A_0}$$

Description :

A0: control absorbance

A1: sample absorbance

The sample was repeated 3 times

(Sugiyanti, D., *et al*. 2018).

CHAPTER IV
RESULTS AND DISCUSSION

A. Data Description

1. Sample

The sample used in this study was dates (*Phoenix dactylifera L.*) var. Ajwa as much as 100 grams. The samples used were Dates (*Phoenix dactylifera L.*) Ajwa variant sold in Ajwa Al Madina branded packaging and sealed. These dates are planted in the plantations of the UAE, Dubai. This date fruit has a textured character with smooth and soft fibers, with a golden brown color, large fruit size, picked in a state of rutab ripeness.

2. Physical Characters Test

Testing the physical characteristics of dates (*Phoenix dactylifera L.)* var. Ajwa there are two variables, namely size and weight:

a. Size

The results obtained for the length, the average value is 3.412 cm, the maximum value for the maximum value is 3.7 cm and the minimum value is 3.1 cm. For the width, the average value is 2,162 cm, the maximum value is 2.5 cm and the minimum value is 2 cm; for thickness the average value is 0.554 cm, the maximum value is 0.7 cm and the minimum value is 0.460 cm.

Table 4 The Result of Data Size

	Lenght	Width	Thickness
Average±SD	3.412±0.153	2.162±0.1716	0.554±0.0875

b. Weight

For the whole fruit weight of dates (*Phoenix dactylifera L.*) var. Ajwa has an average score of 11.570 grams, a maximum score of 13.058 grams and a minimum score of 9.331 grams. For fruit weight without seeds the average value is 10.240 grams, the minimum value is 7.920 grams and the maximum value is 11.447 grams. The average value of date seeds is 1.269 grams, the maximum value is 1.545 grams and the minimum value is 1.042 grams.

Table 5 Dates Weight Calculation Results (*Phoenix dactylifera L.Varian Ajwa*

	Fruit	Flesh	Seed
Average±SD	11.570±0.153	2.162±0.172	0.554±0.0875

3. Extraction

Extraction is done by reflux method which has modified the temperature to 65-70^{0}C with 99.9% ethanol solvent. The result of ethanol extraction of date palm (*Phoenix dactylifera L.*)

Ajwa variant was a thick extract with a weight of 58.73 gr. The yield of the extract was 58.73%.

4. Total Phenolic Test

a. Wavelength optimization

Based on the measurement results, the maximum absorbance value was 0.829 in a standard solution of gallic acid with a wavelength of 745 nm.

b. Gallic Acid Standard Standard Solution Test

Based on the results of measurements of absorbance values carried out at each different concentration with a maximum wavelength of 745 nm which was repeated 3 times, the absorbance value data were obtained as follows:

Table 6 Result of Absorbance of Standard Standard Solution of Gallic Acid

Concentration	Average absorbance ±SD
0	0
31.25	0.103±0.000
62.5	0.161±0.000
125	0.684±0.017
250	1.366±0.004
500	2.103±0.001

c. Sample absorbance measurement

Based on the absorbance measurement of the sample solution which was treated the same as the standard standard gallic acid solution, the following data were obtained:

Table 7 The Results of Sample Absorbance

Sample absorbance	1x	2x	3x	Average±SD
1	0.968	0.968	0.967	0.968±0.0057
2	0.861	0.861	0.861	0.861±0.0000
3	0.973	0.973	0.973	0.973±0.0000

5. Antioxidant Activity Testing

a. Determination of the maximum wavelength of DPPH

The maximum wavelength of the DPPH solution was determined by measuring the absorbance value using UV-Vis spectrophotometry at a wavelength of 500-550 nm. Based on the measurement results, the maximum wavelength was found at 511, 512, 513, and 514 nm with an absorbance value of 0.808.

b. Antioxidant activity test of Date Extract (Phoenix dactylifera L.) Variant Ajwa

Dates extract solution (*Phoenix dactylifera L.*) with different concentrations absorbance value was measured

with a maximum wavelength of 514 to obtain the percentage inhibition value (%I) of date extract (*Phoenix dactylifera L.*) against DPPH free radicals as shown in the table below:

Table 8 Results of the Average Percentage of Inhibition Value of Date Extract (*Phoenix dactylifera L.)* Variant Ajwa

[EC] (mg/L)	%I AVERAGE ± SD
0.5	29.608±0.253
1	35.052±0.046
2	46.722±0.619
3	58.887±0.197
4	66.309±0.315
5	81.897±0.498

Description :
[EK] = concentration of date extract (*Phoenix dactylifera L.*) var. Ajwa
%I = Percentage of inhibition
SD = standard deviation

c. Comparison Compound Antioxidant Activity Test

Based on the results of measurements of absorbance values carried out at different concentration with a maximum

wavelength of 514 nm and the absorbance results were obtained as follows.

Table 9 The Results of Percentage Inhibition of

[BHT] mg/L	%I AVERAGE ± SD
0.1	48.979±0.178
0.2	50.279±0.107
0.4	53.991±0.194
0.8	75.186±0.566
1.6	90.593±0.538

Comparative Soluble (BHT)

Description :
[BHT] = BHT concentration (mg/L)
%I = Percentage of inhibitors
SD = Standard Deviation

B. DISCUSSION

1. Sample

The sample used in this research is dates (*Phoenix dactylifera L.*)var.Ajwa. These dates are commercial products that have the Ajwa Al Madinah brand. These dates are produced by UAE farms, especially the eastern part of Dubai. Dates purchased sealed, weighing 100 gr. These dates have the characteristics of a smooth and soft fiber, with a moderate level of sweetness.

2. Physical Test

Testing the physical characteristics of dates (*Phoenix dactylifera L*.) there are two elements, namely shape and weight. Physical properties of food ingredients are characteristics of biological (organic) materials that can be measured. Physical characters/visible on food ingredients include shape, size (Rohadi, 2009). The purpose of physical testing is to determine the quality of a food ingredient which is one of the elements to support consumer satisfaction (Pudjirahaju, 2018). Sampling on dates was done by taking from the ends, bottom, middle, front side, back side, right side and left side of the package. Physical characters testing includes:

a. Size

Size is one of the important physical components of foodstuffs for evaluating the quality of foodstuffs, separating foreign objects, grading fruits and vegetables. Length, thickness, and width are general terms used to suit the large, medium, and small diameters. A caliper is a tool to measure each of these components. Observation of physical parameters is used in determining the appropriate technology application in the processing process. Fruit size was measured based on 3 points, namely the base, middle, and tip (Aman, *et al*. 2019). The purpose of measuring the size of dates is to determine the quality of the good shape of the thickness of the flesh, the length of the dates, and the width of the dates used in the study.

In measuring the size of dates (*Phoenix dactylifera L.*) the Ajwa variant used a caliper as a measuring tool. Sampling in this test is random sampling where the bottom, middle, top, right, left, front and back of the packaging are taken. The size characteristic data collection has three sides, namely length, width and thickness with the number of samples n = 10. First measure the length of the date palm, then the fruit is opened wide and measure the width of the fruit. After that measure the thickness of the date flesh. The results of the measurement data were analyzed using SPSS 25 *apps* to find the average, maximum, minimum and standard deviation values. The measurement results obtained the average value; minimum; and the maximum length is 3.412±0.153 cm; 3.1 cm and 3.7 cm, for a width of 2.162±0.172 cm; 2 cm; and 2.5 cm, for thickness 0.554±0.087 cm; 0.46 cm; and 0.7 cm. The results of previous research by Hamid, *et al.*, (2018) for the size of the date palm (*Phoenix dactylifera L.*) var. Ajwa The average fruit length is 26.4±1.7 mm, width is 14.6±2.6 mm.

b. Weight

Measurement of weight in various types of food is an important physical component to assist in the assessment and planning of food consumption. In addition, weight greatly affects the level of consumer attractiveness to these foodstuffs (Handayati, *et al.*, 2008). Measurement of weight on dates (*Phoenix dactylifera L.*) varian Ajwa with three weight components of whole fruit, flesh and seeds. The purpose of measuring the weight of dates, date flesh and date

seeds is for initial checking before further research is carried out to determine the nutritional content of dates. The weight of dates were measured using a analitycal scale. The first weighing stage is by weighing whole dates, date flesh, date seeds. the data obtained from the measurement results were analyzed with SPSS 25 *apps* by determining the average, maximum, minimum and standard deviation values. The results obtained mean ± SD; maximum; and the minimum weight for whole fruit is 11.571±1.082 gr; 13.058 gr; 9.331 gr, for flesh weight 10.242±1.102 gr; 11.447 gr; 7, 920 gr, and for seeds 1.269±0.175 gr; 1.545 gr; 1.042 gr.

Judging from the results of the measurement data of size (thickness, length, and width) and weight of each date palm has a different size and weight this is because the process of growth and development of dates on each date is different. This is in accordance with the word of God in QS. Al-Ra'd verse 4:

وَفِيْالاَرْضِ قِطَعٌ مُتَجٰوِرٰتٌ وَجَنّٰتٌ مِّنْ اَعْنَا بٍ وَّزَرْعٌ وَّنَخِيْلٌ صِنْوَانٌ وَّغَيْرُ صِنْوَانٍ يُّسْقٰى بِمَاءٍ وَّاحِدٍوّانُفَضِّلُ بَعْضَهَا عَلَى بَعْضٍ فِى الاُكُلِ ؕ اِنَّ فِي ذٰلِكَ الَاٰيٰتٍ لِّقَوْمٍ يَعْقِلُوْنَ

The means :

“In the earth there are adjoining parts, vineyards, plants, and palm trees that branch and do not branch. (All) are watered with the same water, but We favor one plant over the other in taste. Verily in that (there are) signs (of Allah's greatness) for a people who understand."

In the interpretation of Shihab (2002) explaining what is described in this verse related to the greatness and power of Allah, this verse continues that the earth as a place to set foot, pieces of land that unite some are barren and fertile and some are overgrown by various different plants. -different. Some are used as vineyards, rice fields and also palm tree plantations. All gardens and plants are watered with the same water and then grow and bear fruit at a certain time, this is what causes the quality of each date to have a different quality.

3. Extraction

Initial extraction for testing total phenolic and antioxidant activity. This extraction was carried out by a modified reflux method, namely heating the mashed sample with 99,9% ethanol solvent at a temperature of 60-75ºC which became the optimum temperature for taking phenolic levels within 10 minutes and then cooled (Soehendro, *et al*., 2015). Centrifugation is the process of separating solid particles from liquids using the principle of gravity. The separation mechanism is as follows: the rotating speed exerts a centrifugation force on the solid particles. Along with the centrifugation force, there is also a gravitational force acting on the particles. With the help of these two styles, solid particles will move in the direction of the resultant force. The direction of the resultant force is to the bottom-outer corner. In a certain time the solid will be completely separated from the

liquid or completely separated until all the solids move in the direction of the resultant force (Istianah, *et al.*, 2018).

The results of the extraction are carried out by an evaporation process with a rotary evaporator to form a thick liquid extraction result. The principle of the rotary evaporator is to evaporate the extraction solvent and only leave the extracted compound (Reos, *et al*., 2017). The extraction yield was 58.73 grams with a percentage of yield is 58.73%. The yield of the extract is the ratio of the dry weight of the product produced to the weight of the raw material (Yuniarifin, et al. 2006). Extract yield was calculated based on the ratio of the final weight (weight of the resulting extract) with the initial weight (weight of cell biomass used) multiplied by 100% (Sani et al. 2014). This yield value is related to the amount of bioactive content contained in a food ingredient. Bioactive compounds are compounds contained in the bodies of animals and plants. This compound has various benefits for human life, including as a source of antioxidants, anti-inflammatory, anticancer, and antibacterial (Dewatisari, et al. 2017). Based on the description above, there are several extraction methods that have been carried out in previous studies using the maceration method with methanol solvent (Nazilah, 2019), the reflux method with 50% ethanol solvent modifying the temperature to 80ºC (al-Harthi, et al. 2015), the maceration method with water and methanol as a solvent (Saleh, et al. 2011). For the result of yield in previous study not listed.

4. Total Phenolic Test

In this total phenolic test using the colorimetri method. This method is one of the simplest and most common methods to be used in quantitative testing of total phenolic from an extract or material used as a sample (Firdaus, 2011). The principle of this method is the reduction of *Folin ciceltaeu* reagent (*phosphomolybdic acid-phosphotungsic acid*) by the phenol group on tyrosine and tryptophan which is analyzed to produce *molybdenum blue* which is blue so that its intensity can be measured colorimetrically (Rohman and Sumantri, 2018). Colorimetric reactions are very often used in UV/Vis spectrophotometric methods because they are easy, fast and low cost. This method measures the total concentration of phenolic hydroxyl groups in the sample extract. The polyphenols in the sample extract were reacted with *folin-ciocaltaeu* reagent to form a blue complex that could be measured by a UV-Vis spectrophotometer with a certain wavelength (Blainski, A., *et al*., 2013).

The steps carried out in the total phenolic test are:

a. Operating Time

The aims of use operating time is obtain absorbance measurement time that provides a stable absorbance value. If the absorbance value is stable, the error in measurement can be minimized. In this study, the operating time used was 90 minutes after the addition of the reagent which would result in a stable absorbance value (Marselian, 2018).

b. Optimizing the Wavelength of Gallic Acid Standard Solution

The optimization of the wavelength of the standard gallic acid solution was carried out with the aim of knowing what the maximum wavelength was measured through the highest absorbance value based on the results of measurements with UV-Vis spectrophotometry with a wavelength of 400-800 nm and it can minimized error in research (Marselina, 2018). So that the resulting wavelength is 745 nm with the highest absorbance value with an absorbance value of 0.829. In research of Armin, *et al*., (2011) show that the wavelength of gallic acid is 745 nm with absorbance 0,701.

c. Preparation of Gallic Acid Standard Solution Calibration Equation

The addition of *folin-Ciocelteau* reagent to gallic acid will change the color to yellow and after adding 20% Na_2CO_3 the color will turn blue. Each concentration has a different color intensity, the higher the concentration of *gallic acid* is the darker the blue color. After that, let stand for 90 minutes and measure the absorbance at each concentration with a wavelength of 745 nm. The color change when the *folin-Ciocalteu* reagent is reacted with phenolic compounds changes from yellow to blue when react in alkaline atmosphere. The intensity of the blue color depend on the amount of phenolic compounds contained. The higher the concentration of phenolic compounds is the darker the blue color produced. The blue color that looks

proportional to the phenolic compounds formed the higher the concentration of phenolic compounds, the more phenolic ions are formed so that the blue color produced is more concentrated (Ismail, Runtuwene and Fatimah, 2012).

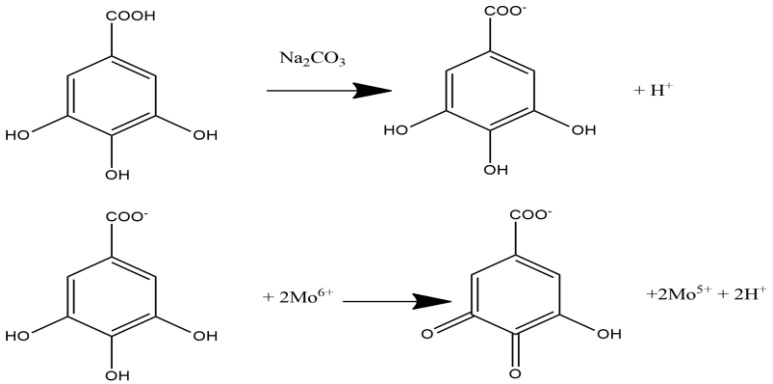

Figure 7 Reaction of Gallic Acid with f*olin-Ciocalteau*.

Folin–Ciocalteu reagent oxidizes *phenolic-hydroxy* and reducing heteropoly acids (*phosphomolybdate-phosphotungsate*) contained in *folin Ciocalteu* reagent to form *molybdenum-tungsen* complex a blue color which is detected by the spectrophotometer. The greater the consistency of phenolic compounds, the more phenolic ions that reduce heteropoly (*phosphomolybdate-phosphotungsate*) to a *molybdenum-tungsate* complex so that the resulting blue color is more concentrated. Phenolic

compounds react with *folin-Ciocalteu* reagent only in alkaline conditions with the dissociation of protons in phenolic compounds into phenolat ions. With the addition of a Na2CO3 solution, the atmosphere becomes alkaline (Hapsari, *et al*. 2018).

Gallic acid (*3,4,5-trihydroxybenzoic acid*) is a phenolic compound that is often used in determining the total phenolic content. *Gallic acid* is the standard solution in quantitative total phenolic testing, because gallic acid is formed from *3-dehydroshikimic acid* in the shikimate pathway which goes through a series of chemical reaction steps to obtain aromatic amino acids, namely L-phenylalanine, L-tyrosine which is a form of the basic structure found on coumarins, lignans, cinamic acid, and flavonoids (Dewick, 2001).

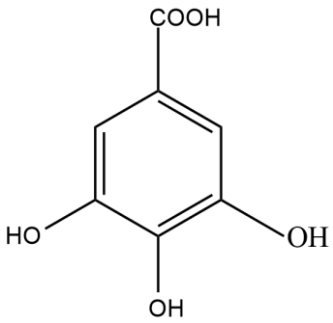

Figure 8 Gallic Acid Structure

The results of the absorbance of each concentration are made a calibration curve and produce a linear regression equation.

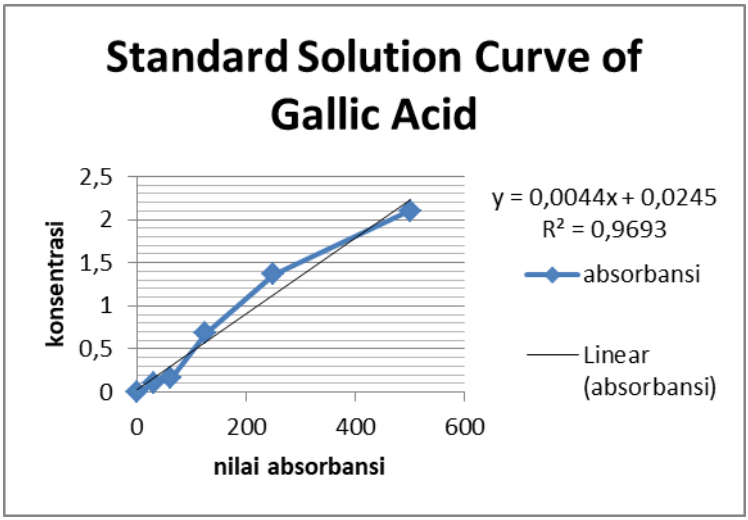

Figure 9 Curve of Gallic Acid Standard Solution

Based on the absorbance results of the gallic acid solution from each concentration, a linear regression equation curve was obtained as shown in the figure with a value of y= 0.0044x + 0.0245 and R^2 = 0.9693.

d. Sample Absorbance Measurement

The sample solution was prepared by dissolving 2 g of thick date extract in 10 mL of methanol and measuring the absorbance of the sample was carried out with the same

treatment as the standard solution of gallic acid. The phenol concentration is expressed in units of mgGAE/g sample extract (Marselina, 2018). After obtaining the sample absorbance value data then calculate the concentration (x) with the linear regression equation. From this concentration value, the total phenolic content can be calculated and the resulting phenolic content in dates (*Phoenix dactylifera L*.) varian Ajwa is 10.1778±0.9776 mg GAE g extract. In a previous study of Mansouri, et al.(2005) testing of total phenolics using the *folin-ciocalteau* method resulted in 10 kind of dates from Saudi, one of which was dates (*Phoenix dactylifera L.),* the highest total phenolic content in dates (*Phoenix dactylifera L*.) was 8,36 mg GAE g extract sample that found in dates (*Phoenix dactylifera L*.) varian Ajwa and in Hamid (2018) show that total phenolic content for Ajwa is 3,35 mg GAE/100 g.

5. Antioxidant Activity Testing

In testing this antioxidant activity using a simple, easy method and using a small number of samples with a short time, namely the DPPH free radical absorption method. The DPPH solution mixed into the sample solution is purple. If there is antioxidant activity in the sample, it causes a color change from purple to yellow (Marjoni, *et al*. 2015). In this antioxidant activity test, a comparison solution of BHT (*butylated hydroxytolune*) is used which is generally used as a synthetic antioxidant in foods that have proven antioxidant activity or in scavenging free radicals. This can be seen from

the structure of BHT which has a phenolic hydroxy group and two butyl tertiary groups.Many research that prove available of hydroxyl phenolic which can scavenging free radicals in the concentration range 10-70 µM, the higher the concentration of BHT the greater the activity of scavenging free radicals (Noviana, *et al.,* 2007).

a. DPPH Wavelength Optimization

DPPH wavelength optimization is used to determine the maximum DPPH wavelength from the highest absorbance value based on the measurement results using UV-Vis spectrophotometry at a wavelength of 500-525 nm. This measurement aims to minimize errors and maximize sensitivity (Fibonacci, 2020). In optimizing the maximum wavelength, the wavelength is 511-514 with an absorbance value of 0.808. DPPH wavelength according to theoretical ranges from 515–520 nm (Sagar, *et al*, 2011). In another study it was stated that the maximum wavelength for DPPH detected was around 514 nm (Buijnster, *et al*, 2001). In testing the antioxidant activity in this study using a maximum wavelength of 514 nm.

b. Operating Time

In testing the antioxidant activity using the operating time for the incubation period of the solution after the sample solution was added DPPH. The incubation time is 30 minutes (Molyneux, 2004)

.

c. Antioxidant Activity Test

Antioxidant activity test of date (*Phoenix dactylifera L.*) varian Ajwa ethanol extract in this study used the DPPH method which is the easiest and most frequently performed (Santoso, 2021). The principle of the DPPH method is to use the principle of spectrophotometry, the DPPH solution has a dark purple color, if an antioxidant compound is added, the color changes to bright yellow. When the absorbance value is measured by spectrophotometry, the higher the antioxidant level, the absorbance value will decrease, the purple color of the DPPH reacted with antioxidant compounds will fade, this indicates that there is scavenging activity (antioxidant activity) (Nurjanah, *et al*., 2021).

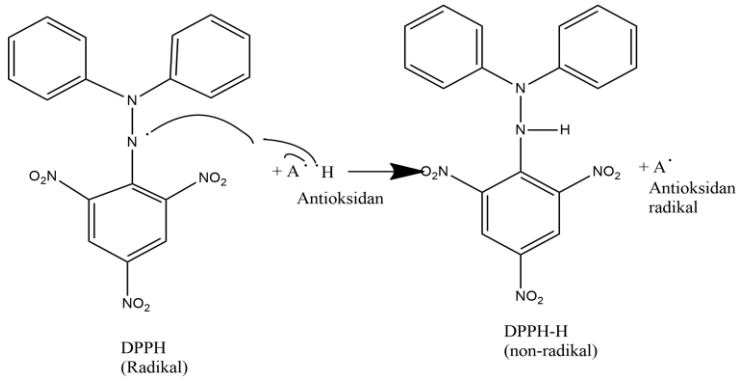

Figure 10 DPPH Reaction

The result of testing antioxidant activity, it is interpreted by the IC_{50} value (half maximal inhibitory concentration) is a measure of the effectiveness of the inhibitor of a compound in biological or biochemical functions, meaning how many compounds are used to inhibit certain biological processes up to half (50%) the inhibitory concentration of the compound. The smaller the IC_{50} value, the higher the antioxidant activity. There are several categories of antioxidant activity with IC_{50} values, namely very strong antioxidant activity if it is less than 50 mg/L, categorized as strong between 50-100 mg/L, between 100-200 mg/L categorized as moderate antioxidant activity, and more than 200 mg/L. L is categorized as weak activity (Tukiran, *et al,* 2019)

Based on the percentage of DPPH free radical inhibitor to date extract (*Phoenix dactylifera L*.) varian Ajwa at each test concentration, a linear regression equation curve was obtained in Figure 12 with a value of $y = 11.307x + 23.87$ with a value of $R^2 = 0.9942$. The IC_{50} value is determined based on the linear equation so that the IC_{50} value is 2.3095 mg/L.

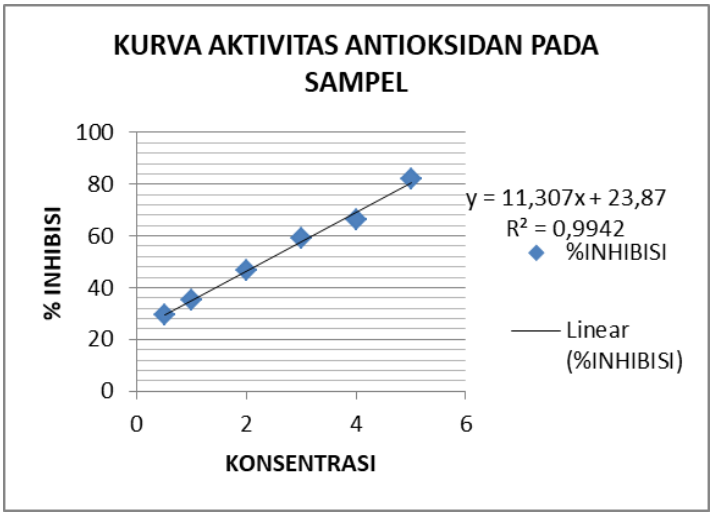

Figure 11 Antioxidant Activity Curve in Sample

The results of previous studies total antioxidant activity in dates (*Phoenix dactylofera L.*) varian Ajwa of 119.14±5.35 g/ml (Zihad, *et al*., 2021). When compared with the comparison compound BHT, the absorbance value was measured with the results forming a curve Y= 29.469x + 45.534, R2 = 0.9599 had an IC_{50} value of 0.151 mg/L.

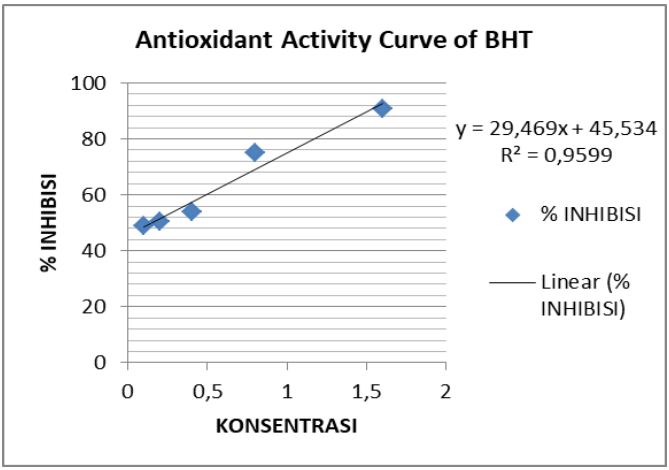

Figure 12 BHT Anti Antioxidant Activity Curve

The IC_{50} value can be categorized as a very strong antioxidant activity. The antioxidant activity of the BHT comparison solution was stronger than that of dates (*Phoenix dactylifera L.*) Ajwa variant. Because the antioxidant activity of dates (*Phoenix dactylifera L.*) varian Ajwa is classified as very strong, so it can be used as an alternative food for natural antioxidants and has potential to be functional food that high antioxidant.

The results in this study were higher in total phenolic content (10,17 mgGAE/ g ekstract) and

antioxidant activity (2,130 mg/L) than the results of previous studies, this was due to differences in the extraction method used, the extraction method used was more effective. Based on the description above, there are several extraction methods that have been carried out in previous studies using the maceration method with methanol solvent (Nazilah, 2019) with the results of antioxidant activity of 4.650 ppm, the maceration method with water and methanol as a solvent resulted in antioxidant activity with 2.90 mg/ml water and 3.80 mg/ml methanol (Saleh, et al. 2011). To obtain bioactive compounds, an extraction process is carried out. The extraction method greatly affects the concentration or the loss of the therapeutic effect of the sample, which is relatively stable and can also decompose depending on the extraction method used (Djamal, 2010). The higher the extract yield value, the higher the content of substances that are attracted to a raw material (Budiyanto, 2015). The other result show that total phenolic content in dates (*Phoenix dactylifera L*.) varian Ajwa 3.35 mg GAE/ 100 g with extraction method using ethanol p.a through ultrasound assited extraction method using a Nexul Ultrasonic Cleaner (NXP1002) for 1 hours without heating (Hamid, *et al*. 2018).

CHAPTER V
CONCLUSION AND SUGGESTION

A. Conclusion

In this chapter, the researcher concluded based on the research problem. From problem the physical characteristics of date (*Phoenix dactylifera L.*) var.Ajwa of size leght, width, and thickness. For length 3.4120±0.1533 cm; width 2.1620±0.1717 cm; thickness 0.5540±0.0875 cm. For weight (whole fruit 11.5712±1.0817 gr, for flesh 10,2421±1.1023680 gr and seeds 1.2688±0.1753 gr), the total phenolic test of 10.1778±0.9776 mg GAE g extract, for testing the antioxidant activity of date extract (*Phoenix dactylifera L.*) varian Ajwa IC_{50} value is 2.311 mg/L belong to very strong antioxidant activity. From the result, date (*Phoenix dactylifera L.*) can be natural antioxidant and has potential to be a functional food that high antioxidant and for this research ekxtraction method more effective that previous research.

B. Suggestion

It can continue to next research with the others variable such as fiber, glycemic index, glucose or making functional food from Ajwa dates.

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APPENDICES

Calculation Appendix

RESEARCH RESULT

- PHYSICAL CHARACTER TESTING
  SIZE DATA

No.	Sample	Lenght	Width	Thickness
1.	Sample 1	3.49	2.06	0.59
2.	Sample 2	3.46	2.5	0.69
3.	Sample 3	3.37	2.3	0.5
4.	Sample 4	3.38	2.22	0.5
5.	Sample 5	3.44	2.1	0.61
6.	Sample 6	3.70	2.1	0.5
7.	Sample 7	3.1	2.34	0.5
8.	Sample 8	3.3	2	0.46
9.	Sample 9	3.34	2	0.49
10.	Sample 10	3.49	2	0.7

Descriptive Statistics

	N	Minimum	Maximum	mean	Std. Deviation
Lenght	10	3.10	3.70	3,4120	,15325
Width	10	2.00	2.50	2.1620	,17165
Thickness	10	,46	,70	,5540	,08746
Valid N (listwise)	10				

WEIGHT DATA

No.	Sample	Weight		
		Fruit	Flash	Seed
1.	Sample 1	11.944	10.783	1.159
2.	Sample 2	13.058	11.947	1.052
3.	Sample 3	11.545	10.500	1.042
4.	Sample 4	10.795	9.4853	1.306
5.	Sample 5	12.408	11.270	1.127
6.	Sample 6	11.003	9.524	1.479
7.	Sample 7	9.331	7.920	1.409
8.	Sample 8	11.988	10.424	1.550
9.	Sample 9	11.034	9.702	1.329
10.	Sample 10	12.607	11.367	1.240

Descriptive Statistics

	N	Minimum	Maximum	mean	Std. Deviation
Need	10	9.3306	13.0576	11.571190	1.0816730
B_meat	10	7,9200	11.4469	10.242130	1.1023680
B_seed	10	1.0417	1.5448	1.268790	,1752968
Valid N (listwise)	10				

- **EXTRACTION**

  The result of thick syrup maserat

  Extract weight + beaker glass = 238.14 gr

  Weight of empty beaker = 179.41 gr

  Extract weight = 238.41 – 179.41 = 58.73 gr

  Extraction yield:

$$\%Rendemen = \frac{massa\ ekstrak}{massa\ simplisia}\ x\ 100\%$$

$$= \frac{58{,}73\ gr}{100\ gr}\ x\ 100\%$$

$$= 58{,}73\ \%$$

- **TOTAL PHENOLIC TESTING**

Concentration Calculation

Gallic acid mindr liquor concentration

5 mg gallic acid was dissolved in methanol to a volume of 10 ml to a concentration of 500 ppm.

500 ppm = 500 mg / 1000 L
= 5 mg / 10 ml

Gallic acid series

V1 x C1 = V2 X C2
0.3125 x 500 = 5 x C2
C2 = 0.3125 x 500 / 5
C2 = 31.25
V1 x C1 = V2 X C2
0.625 x 500 = 5 x C2
C2 = 0.625 x 500 / 5
C2 = 62.5

V1 x C1 = V2 X C2
1.25 x 500 = 5 x C2
C2 = 1.25 x 500 / 5
C2 = 125

V1 x C1 = V2 X C2
2.5 x 500 = 5 x C2
C2 = 2.5 x 500 / 5
C2 = 250

V1 x C1 = V2 X C2
5 x 500 = 5 x C2
C2 =5 x 500 / 5
C2 = 500

Preparation of 20% Na2CO3 solution
% = gr/ml x 100%
20% = gr/25 x 100%
20 x 25 = 100 gr
500 =100 g
gr=5 gr

	CONCENTRATION				
BLANK	31.25	62.5	125	250	500
0	0.103	0.161	0.683	1.364	2,103
0	0.104	0.161	0.686	1.371	2,101
0	0.103	0.161	0.683	1.364	2.104
0	0.103333333	0.161	0.684	1.366333	2.102667

Average Result of Gallac Acid Absorbance

Concentration	Average absorbance ±SD
0	0
31.25	0.103333±0.00057
62.5	0.161±0.000
125	0.684±0.0173
250	1.366333±0.00404
500	2.102667±0.00152

Sample Absorbance With Concentration

sample absorbance	1x	2x	3x	AVERAGE
1	0.968	0.968	0.967	0.9677667
2	0.861	0.861	0.861	0.861
3	0.973	0.973	0.973	0.973

Table of Gallic Acid Absorbance Value

Sample weight (g)	Volume (L)	FP	Absorbance	Average absorbance	Concentration (µg/mL)	Total Flavonoid Content mg GAE/g extract
2	0.01	1	0.968	0.96776	2141.53	10.707665
			0.968			
			0.967			
2	0.01	1	0.861	0.861	1901.36	9.05056
			0.861			
			0.861			
2	0.01	1	0.973	0.973	2155.68	10,778
			0.973			
			0.973			

Notes : FP = Dilution Factor

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Phenolic	3	9.05056	10.77800	10,1787417	,97766669
Valid N (listwise)	3				

From the above calculation, the average total phenolic result is 10.77800±0.977669

CALCULATION OF FORMULA

$$kadar\ total\ fenolik : \frac{konsentrasi\ (\mu g/ml\ x\ vol.sampel(ml)}{berat\ sampel\ (g)}\ x\ FP$$

PHENOLIC TOTAL CALCULATION EXAMPLE

Average absorbance: 0.973

sample : 2 gr

Volume : 10 ml : 0.01 L

Dilution factor : 1

Regression equation:

Y = 0.00044x + 0.0245

0.973 = 0.00044x + 0.0245

0.973 – 0.0245 = 0.00044x

0, = 0.00044x

X = 0.9485 / 0.00044

X= 2,155.68

$$x = \frac{2.155,68\ x\ 0,01}{2}\ \text{x } 1$$

X = 10,778 mg GAE/gr extract

CALCULATION OF ANTIOXIDANT ACTIVITY TESTING

Preparation of 0.1 mM . DPPH Solution

Weight = 0.0039 gr

Mr DPPH = 394.32

$$10^{-4}M = \frac{berat\ DPPH}{394{,}32} \times \frac{1000}{100}$$

$$berat\ DPPH = \frac{0{,}0001\ x\ 394{,}32}{10}$$

$$berat\ DPPH = 0{,}003932\ gr$$

Preparation of 250 ppm . Sample Solution

400 ppm = 400 mg /1000

= 10 mg / 25 mL

Solution Preparation 250 pmm

400.V = 250. 10

V = 2500/400

V = 6.25 ml

Preparation of 100 ppm Solution

250.V = 100. 10

V = 1000/250

V = 4 mL

Preparation of Solution Series

V1 x C1 = V2 X C2
V1 x 100 = 10 x 0.5
V1 = 5/ 100
V1 = 0.05 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 1
V1 = 10/ 100
V1 = 0.1 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x2
V1 = 20/ 100
V1 = 0.2 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 3
V1 = 30/ 100
V1 = 0.3 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x4
V1 = 40/ 100
V1 = 0.4 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 5
V1 = 50/ 100
V1 = 0.5 mL

BHT Solution Preparation

100 ppm = 100/1000

= 2.5 mg /25 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 0.05
V1 = 0.5/ 100
V1 = 0.005 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 0.1
V1 = 1/ 100
V1 = 0.01 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 0.2

V1 = 2/ 100
V1 = 0.02 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 0.4
V1 = 4/ 100
V1 = 0.03 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x0.8
V1 = 8/ 100

V1 = 0.08 mL

V1 x C1 = V2 X C2
V1 x 100 = 10 x 1.6
V1 = 16/ 100

V1 = 0.16 mL

ANTIOXIDANT ACTIVITY TEST RESULTS IN EXTRACT AJWA DATES

N0.	Sample	A DPPH	A Sample	% I	%I Average ± SD
1	0.5	0.808	0.567	29.82673	29.60822 ± 0.25258
		0.809	0.569	29,66625	
		0.808	0.571	29.33168	
2	1	0.808	0.525	35,02475	35.05152±0.04637
		0.809	0.525	35.10507	
		0.808	0.525	35,02475	
3	2	0.808	0.431	46,65842	46.72165±0.6193
		0.809	0.431	46,72435	
		0.808	0.43	46,78218	
4	3	0.808	0.334	58,66337	58.88657±0.19671
		0.809	0.332	58,96168	

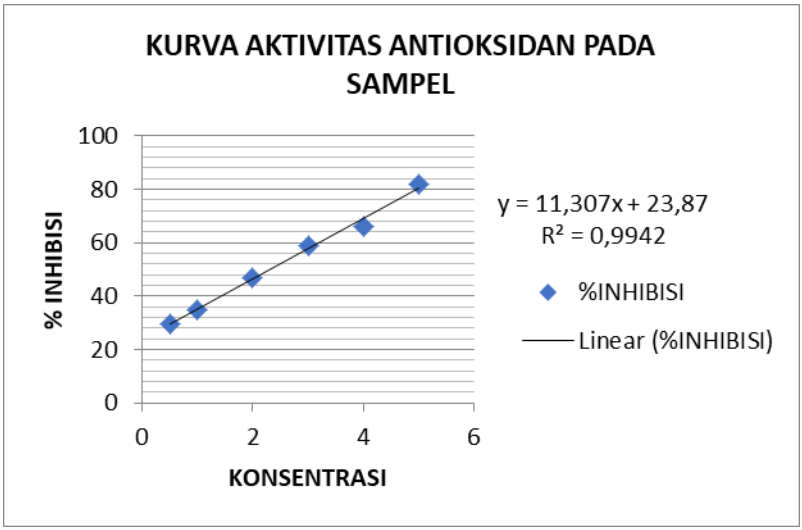
		0.808	0.331	59.03465	
5	4	0.808	0.275	65,96535	66,30925±0.31512
		0.809	0.272	66,37824	
		0.808	0.27	66.58416	
6	5	0.808	0.15	81.43564	81.89694±0.49849
		0.809	0.147	81.82942	
		0.808	0.142	82.42574	

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
A	3	29.33	29.83	29.6082	,25258
B	3	35.02	35.11	35.0515	0.04637
C	3	46.66	46.78	46.7216	,06193
D	3	58,66	59.03	58,8866	,19671
E	3	65.97	66.58	66.3092	,31512
F	3	81.44	82.43	81.8969	,49849
Valid N (listwise)	3				

% INHIBITION OF EXTRACT AJWA DATES

CONCENTRATION	%INHIBITION ± SD
0.5	29.60822±0.25258
1	35.05152±0.04637
2	46.72165±0.6193
3	58.88657±0.19671
4	66,30925±0.31512
5	81.89694±0.49849



CALCULATION IC50

Y = 11.307x + 23.87

50 = 11.307x + 23.87

50-23.87 = 11.307x

X = 2.31095 mg/L

COMPARATIVE SOLUTION BHT

NO	SAMPLE	ADPPH	A SAMPLE	% INHIBISI	% INHIBISI ±SD
1	0.1	0.808	0.414	48,76238	
		0.809	0.413	48,94932	
		0.808	0.412	49,0099	
		0.807	0.41	49,19455	48.9790±0.17816
2	0.2	0.808	0.403	50.12376	
		0.809	0.402	50.30902	
		0.808	0.401	50,37129	
		0.807	0.401	50,3097	50.2785±0.10718

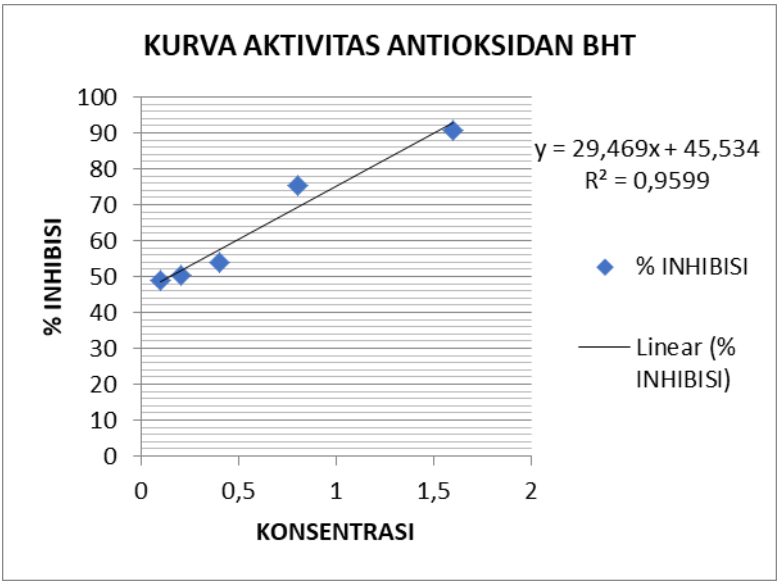
				9	
3	0.4	0.808	0.374	53.7128 7	
		0.809	0.372	54.0173 1	
		0.808	0.371	54.0841 6	
		0.807	0.37	54.1511 8	53.9914±0.19355
4	0.8	0.808	0.201	75.1237 6	
		0.809	0.201	75,1545 1	
		0.808	0.2	75.2475 2	
		0.807	0.2	75,2168 5	75.1857±0.05657
5	1.6	0.808	0.081	89.9752 5	
		0.809	0.078	90.3584 7	
		0.808	0.074	90.8415 8	
		0.807	0.071	91,2019 8	90.5943±0.53829

Descriptive Statistics

	N	Minimum	Maximum	mean	Std. Deviation
A	4	48.76	49,19	48,9790	,17816
B	4	50,12	50.37	50.2785	,10718
C	4	53.71	54.15	53.9914	,19355
D	4	75.12	75.25	75.1857	0.05657
E	4	89.98	91.20	90.5943	,53829
Valid N (listwise)	4				

The Result % Inhibition of BHT

CONCENTRATION	% INHIBISI± SD
0.1	48.97904±0.17816
0.2	50.27847±0.10718
0.4	53.99138±0.19355
0.8	75.18566±0.5657
1.6	90.5932±0.53829



CALCULATION IC50

Y = 29.469X + 45.534

50 – 45,534 = 29,469X

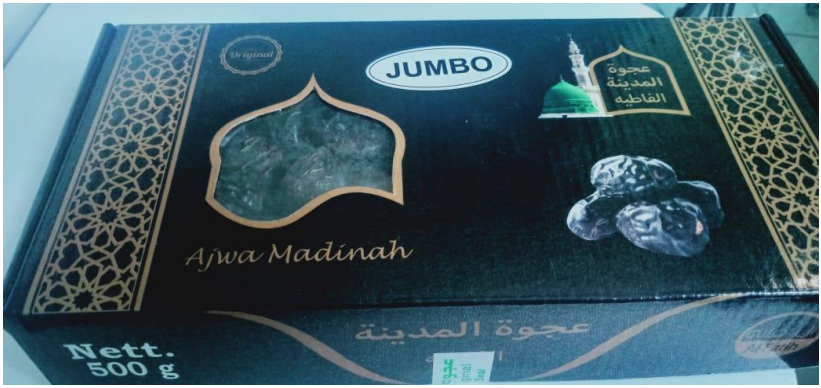
4,466 = 29,469X

X = 4.466/ 29.469

X = 0.151 mg/L

Figure Appendex

Sample



Physic Characters Test

Tools and Materials

Sample of Dates

Open the sample

Measure the size of sample

Extraction

Boiling

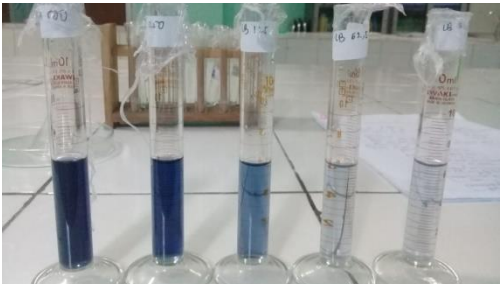
The extract after boiling

The extract before centrifuge

After centrifuge

Evaporate process

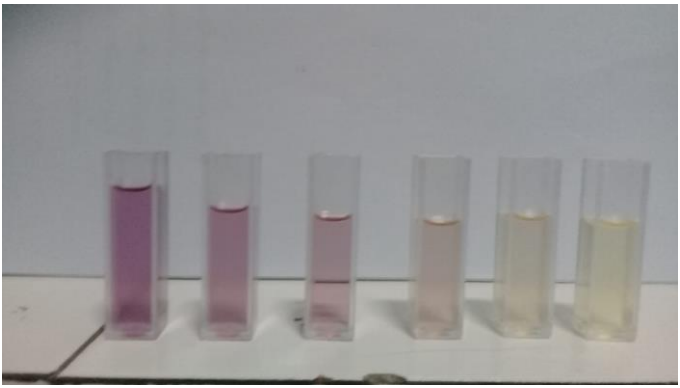
Total Phenolic Content Test



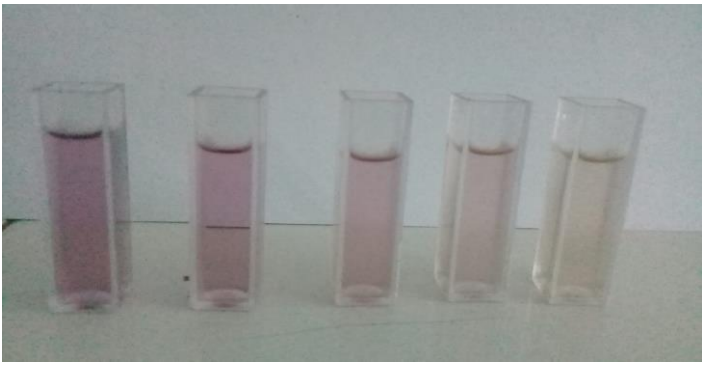
The Colour Change of Gallac Acid Series

The Last Colour of Sample

Antioxidant Activity Test

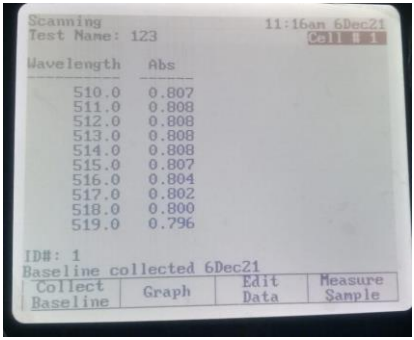


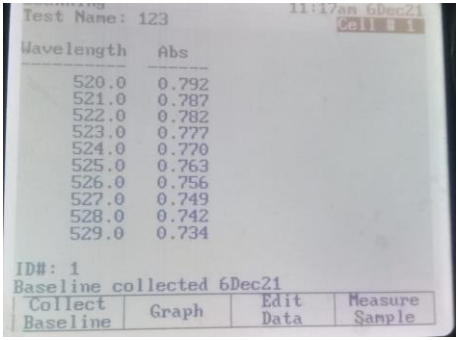
The Discoloration of Sample Extract Dates (*Phoenix dactylifera L.*) varian Ajwa



The Discoloration of BHT

The Wavelenght of DPPH





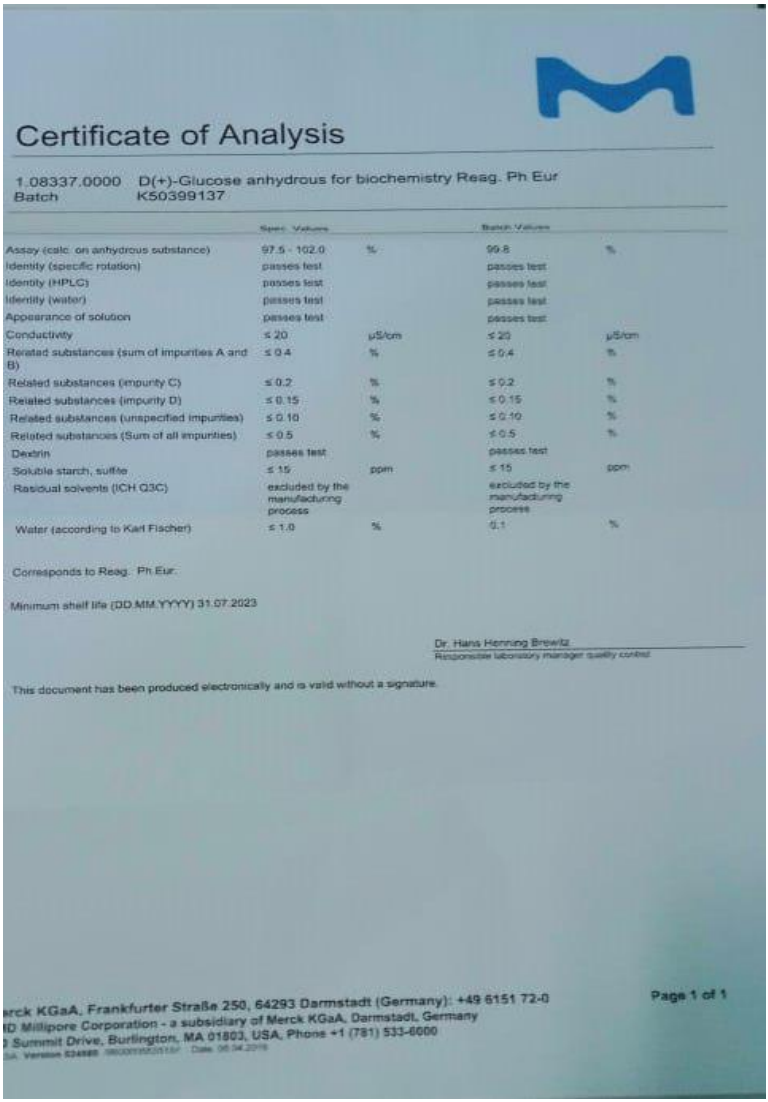
The Graphic of DPPH wavelength

Material Name Appendex

Catalogue Number	109001
Synonyms	Reagent for phenol and bovine serum albumine acc. to Folin and Ciocalteu
Product Information	
HS Code	3824 99 96
Physicochemical Information	
Density	1.24 g/cm3 (20 °C)
pH value	<0.5 (H_2O, 20 °C)
Safety Information according to GHS	
Hazard Pictogram(s)	
Hazard Statement(s)	H290: Dapat korosif terhadap logam. H314: Menyebabkan kulit terbakar yang parah dan kerusakan mata.
Precautionary Statement(s)	P234: Simpan hanya dalam wadah aslinya. P280: Kenakan sarung tangan pelindung/ pakaian pelindung/ pelindung mata/ pelindung wajah/ perlindungan pendengaran. P301 + P330 + P331: JIKA TERTELAN : Basuh mulut. JANGAN merangsang muntah. P303 + P361 + P353: JIKA TERKENA KULIT (atau rambut): Tanggalkan segera semua pakaian yang terkontaminasi. Bilas kulit dengan air. P304 + P340 + P310: JIKA TERHIRUP: Pindahkan korban ke udara segar dan posisikan yang nyaman untuk bernapas. Segera hubungi SENTRA INFORMASI KERACUNAN atau dokter/tenaga medis.

Safety Information according to GHS	
	P305 + P351 + P338: JIKA TERKENA MATA : Bilas dengan seksama dengan air untuk beberapa menit. Lepaskan lensa kontak jika memakainya dan mudah melakukannya.Lanjutkan membilas.
Signal Word	Bahaya
Storage class	8B Bahan berbahaya korosif, tidak dapat terbakar
WGK	WGK 1 agak berbahaya untuk air
Disposal	3 Reagen organik yang relatif tidak aktif harus dikumpulkan dalam kategori A. Jika terhalogenasi, harus ditempatkan dalam Kategori B. Untuk residu padat gunakan Kategori C.
Storage and Shipping Information	
Storage	Simpan pada +15°C hingga +25°C.
Transport Information	
Declaration (railroad and road) ADR, RID	UN 3264 , 8, III
Declaration (transport by air) IATA-DGR	UN 3264 , 8, III
Declaration (transport by sea) IMDG-Code	UN 3264 , 8, III, Segregation Group: 1 (Acids)
Specifications	
Equivalent acid	c(H+) = 2 mol/l (2N)

Specifications	
Sensitivity (to phenol)	conforms
Sensitivity (to bovine serum albumin)	conforms



Certificate of Analysis

1.08337.0000 D(+)-Glucose anhydrous for biochemistry Reag. Ph Eur
Batch K50399137

	Spec. Values		Batch Values	
Assay (calc. on anhydrous substance)	97.5 - 102.0	%	99.8	%
Identity (specific rotation)	passes test		passes test	
Identity (HPLC)	passes test		passes test	
Identity (water)	passes test		passes test	
Appearance of solution	passes test		passes test	
Conductivity	≤ 20	µS/cm	≤ 20	µS/cm
Related substances (sum of impurities A and B)	≤ 0.4	%	≤ 0.4	%
Related substances (impurity C)	≤ 0.2	%	≤ 0.2	%
Related substances (impurity D)	≤ 0.15	%	≤ 0.15	%
Related substances (unspecified impurities)	≤ 0.10	%	≤ 0.10	%
Related substances (Sum of all impurities)	≤ 0.5	%	≤ 0.5	%
Dextrin	passes test		passes test	
Soluble starch, sulfite	≤ 15	ppm	≤ 15	ppm
Residual solvents (ICH Q3C)	excluded by the manufacturing process		excluded by the manufacturing process	
Water (according to Karl Fischer)	≤ 1.0	%	0.1	%

Corresponds to Reag. Ph.Eur.

Minimum shelf life (DD.MM.YYYY) 31.07.2023

Dr. Hans Henning Brewitz
Responsible laboratory manager quality control

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HIMEDIA

23, Vadhani Industrial Estate, L.B.S. Marg, Mumbai - 400086
Website : www.himedialabs.com, Email : info@himedialabs.com

Certificate of Analysis

Material Name: 2,2-Diphenyl-1-picrylhydrazyl
CAS Number : 1898-66-4
Material Code : MB263
Lot Number : 0000473772
Molecular Formula : $C_{18}H_{12}N_5O_6$
Report No : 10000464112

TEST	SPECIFICATIONS	RESULTS
Appearance	Green to dark violet to black-gold to black crystals or powder or solid	Dark violet crystals
Solubility	33.3 mg soluble in 1 mL of dimethylformamide	Complies
FTIR	Matches with the standard pattern	Complies
DNases	None detected	Complies
RNases	None detected	Complies
Assay (HPLC)	>= 85.00%	99.99%

STATUS : APPROVED

QC Release Date : 2021-03-15
Expiry Date : 2025-03-08

Quality Control Chemist
Chemical Division

Manager, Quality Control
Chemical Division

Manager, Quality Assurance
Chemical Divison

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PAGE : 1 of 1

Specification

8.42649.0250 Gallic acid (anhydrous) for synthesis

	Specification	
Assay (acidimetric)	≥ 98.0	%
Identity (IR)	passes test	

Dr. Oliver Schramel
Responsible laboratory manager quality co...

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CURRICULUM VITAE

A. Personal Identity

1. Name : Dwi Handayani
2. Place and date of birth : Grobogan, 4 Maret 1998
3. Address : Tegalrejo, Rt. 06/Rw. 01, Kec. Wirosari, Kab. Grobogan
   HP : 082225443064
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B. Education History

1. Formal Education:
   a. TK Pertiwi I Tegalrejo
   b. SD N 1 Tegalrejo
   c. SMP N 1 Wirosari
   d. SMA N 1 Wirosari
2. Non-Formal Education:
   a. Pondok Pesantren Fadhlul Fadhlan, Semarang
   b. Kursus Basic Microsof

C. Academic Achievement

Speaker for International Webinar: Children: Nutrition, Mental, and Spiritual Developmental, 2021

The Colaboration Reseach with lecturer (Screening Awal Potensi Kurma (Phoenix dactylifera L.) Varian Ajwa Sebagai Pangan Fungsional.

D. **Scientific Work**

International article: The Benefits of Antioxidant in Dates (*Phoenix dactylifera L.*) Varian Ajwa

Semarang, 29 December 2021

Dwi Handayani