

EVALUATION OF TOTAL ANTIOXIDANT AND PHYTOCHEMICAL FROM
DIFFERENT MATURITY OF JACKFRUIT LEAVES USING ULTRASONIC-
ASSISTED EXTRACTION

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ABSTRACT

Jackfruit or *Artocarpus heterophyllus* is a tropical fruit that having high medicinal value to human health. Through the previous results of pharmacological studies, it proves that jackfruit leaves provide benefits in medicine such as have some properties of antioxidants, antidiabetics, anticancer, antimicrobial, anti-inflammatory and possess wound healing properties. Many studies reported that jacalin from *Artocarpus heterophyllus* seed is the major source of antioxidants from jackfruit. However, the study on evaluation the total of antioxidant content in *Artocarpus heterophyllus* leaves extract are rarely reported. This study was focused on *Artocarpus heterophyllus* young and matured leaves extract capability in antioxidant activity using environmental friendly extraction via Ultrasonic-Assisted Extraction (UAE) method. It was found that antioxidant activities existed in both young and matured leaves extract. The comparative of different maturity of leaves (young and matured leaves), whereas the ultrasonic extraction parameter involved as variables parameter of ultrasonic amplitude (20%, 60% and 100%) and time sonication (5min, 15min and 25min). At 60% amplitude and 15 minutes sonication, the total of antioxidants of leaves extract in which determined through DPPH analysis showed the percentage of DPPH scavenging activity was low compared to matured leaves with 59.7 % and 78.6 % respectively. These results showed that the occurrence of high antioxidant activity in young leaves compared to mature leaves with the value exhibited in the percentage of DPPH analysis showed the opposite value with antioxidant activity. The phenolic content was determined using Folin-Ciocalteu assay method while the flavonoid content was examined using colorimetric assay. As a result, the extract of young leaves has contributed the higher phytochemical content of phenolic (43.03 g GAE/100 DM) and flavonoids (25.56 g CE/100 DM) compared to matured leaves. The phytochemical content was given significant results which is in line with higher antioxidant in young leaves compared to matured leaves. Therefore, extraction parameters were observed influenced the level of bioactivities in jackfruit leaves extract.

ABSTRAK

Nangka atau *Artocarpus heterophyllus* merupakan buah tropika yang mempunyai nilai perubatan yang tinggi untuk kesihatan manusia. Melalui hasil kajian farmakologi sebelum ini, ia membuktikan bahawa daun nangka memberi manfaat dalam perubatan seperti mempunyai beberapa sifat antioksidan, antidiabetik, antikanser, antimikrob, anti-radang dan memiliki sifat penyembuhan luka. Banyak kajian sebelum ini melaporkan bahawa jaelin daripada biji *Artocarpus heterophyllus* mengandungi sumber antioksidan yang paling banyak. Walau bagaimanapun, kajian mengenai penilaian jumlah kandungan antioksidan dalam ekstrak daun *Artocarpus heterophyllus* adalah sangat jarang dilaporkan. Oleh hal yang demikian, dengan menggunakan pengekstrakan mesra alam melalui kaedah Ultrasonic-Assisted Extraction (UAE), didapati aktiviti antioksidan wujud dalam kedua-dua ekstrak daun muda dan matang. Perbandingan berbeza kematangan daun (daun muda dan matang), manakala parameter pengekstrakan ultrasonik terlibat sebagai parameter pembolehubah amplitud ultrasonik (20%, 60% dan 100%) dan sonikasi masa (5min, 15min dan 25min). Pada amplitud 60% dan sonikasi 15 minit, jumlah antioksidan ekstrak daun yang ditentukan melalui analisis DPPH menunjukkan peratusan aktiviti scavenging DPPH adalah rendah berbanding dengan daun matang dengan masing-masing 59.7% dan 78.6%. Keputusan ini menunjukkan bahawa kejadian aktiviti antioksidan yang tinggi pada daun muda berbanding daun matang dengan nilai yang ditunjukkan dalam peratusan analisis DPPH adalah nilai yang bertentangan dengan aktiviti antioksidan. Kandungan fenolik ditentukan menggunakan kaedah ujian Folin-Ciocalteu manakala kandungan flavonoid diperiksa menggunakan ujian kolorimetrik. Hasilnya, ekstrak daun muda telah menyumbangkan kandungan fitokimia fenolik (43.03 g GAE/100 DM) dan flavonoid (25.56 g CE/100 DM) yang lebih tinggi berbanding daun matang. Kandungan fitokimia telah memberikan hasil yang selari dengan jumlah antioksidan yang lebih tinggi dalam daun muda berbanding daun matang. Oleh itu, parameter pengekstrakan diperhatikan mempengaruhi tahap bioaktiviti dalam ekstrak daun nangka.

TABLE OF CONTENTS

	TITLE	PAGE
	DECLARATION	iii
	ACKNOWLEDGEMENT	iv
	ABSTRACT	v
	ABSTRAK	vi
	TABLE OF CONTENTS	vii
	LIST OF TABLES	x
	LIST OF FIGURES	xi
	LIST OF ABBREVIATIONS	xii
	LIST OF SYMBOLS	xiii
CHAPTER 1	INTRODUCTION	1
	1.1 Research Background	1
	1.2 Problem Statement	2
	1.3 Research Objectives	3
	1.4 Research Scopes	4
	1.5 Research Hypothesis	4
	1.6 Significant of Study	4
CHAPTER 2	LITERATURE REVIEW	7
	2.1 Taxonomy and Morphology of Jackfruit Leaves	7
	2.1.1 Leaf Morphology	8
	2.1.2 Leaf Measurements	10
	2.2 Bioactive Activity in Jackfruit Leaf	11
	2.2.1 Antioxidant Activities	11
	2.2.2 Anti-inflammatory Properties	12
	2.2.3 Wound Healing Properties	12
	2.2.4 Anti-aging Properties	13

2.2.5	Phenolic and Flavonoid Compound in Jackfruit Leaves	14
2.3	Free radical	15
2.4	Extraction using Ultrasonic Assisted Extraction (UAE)	16
2.5	Parameters Affecting Ultrasonic Assisted Extraction (UAE)	17
2.5.1	Duration of Sonication	17
2.5.2	Amplitude of Sonication	18
2.5.3	Temperature of Extraction	18
2.6	Advantages and Disadvantages of Conventional and Advance Technique of Extraction	19
CHAPTER 3	METHODOLOGY	21
3.1	Introduction	21
3.2	Material	22
3.2.1	Material Collection	22
3.2.2	Sample Pre-treatment	23
3.3	Preliminary Stage	24
3.4	Design of Experiment (DoE)	24
3.4.1	Method of Extraction	24
3.4.2	Parameter of Extraction	25
3.5	Qualitative of Analysis	26
3.5.1	DPPH Radical Scavenging Activity Assay	26
3.5.2	Total Phenolic Content Analysis (TPC)	27
3.5.3	Total Flavonoids Content Analysis (TFC)	28
3.6	Statistical analysis	28
CHAPTER 4	RESULTS AND DISCUSSION	29
4.1	Introduction	29
4.2	Effect of Different Parameter on Yield	29
4.2.1	The Changes of Yield Percentage Towards Percentage of Amplitude	30
4.2.2	The Changes of Yield Percentage Towards Sonication Time	31

4.3	Effect of different extraction parameter on antioxidant activity	31
4.3.1	The Changes of Antioxidant Activity Towards Percentage of Amplitude	32
4.3.2	The Changes of Antioxidant Towards Sonication Time	33
4.4	Effect of different extraction parameter on total phenolic and total flavonoid content and bioactive content	34
4.4.1	The Changes of Total Phenolic Content (TPC), Total Flavonoid Content (TFC) and Bioactive Content Towards Percentage of Amplitude	34
4.4.2	The Changes of Total Phenolic Content (TPC), Total Flavonoid Content (TFC) and Bioactive Content Towards Sonication Time	35
4.5	Preliminary Parameter's Finding	36
4.6	Effect of different maturity of jackfruit leaves on Total Phenolic Content (TPC), Total Flavonoid Content (TFC) and Bioactive Content.	37
CHAPTER 5	CONCLUSION AND RECOMMENDATION	41
REFERENCES		43

LIST OF TABLES

TABLE NO.	TITLE	PAGE
Table 2.1	Advantages and disadvantages of conventional and advance technique of extraction (Azmin et al., 2016 ; Ahmed et.al, 2019 ; Azwanida 2015)	19
Table 3.1	The experimental design for young and matured leaves jackfruit using Ultrasonic Assisted Extraction (UAE)	26
Table 4.1	The total phenolic and flavonoid content at different parameter for young and matured leaves jackfruit.	34

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
Figure 2.1	Jackfruit tree	7
Figure 2.2	(a) Leaf growing alternately in the twigs, (b) Young leaf and (c) Matured leaf	9
Figure 2.3	Jackfruit leaf measurement (Source from Karunaratne & et.al,2018)	10
Figure 2.4	(a) Exogenous sources of free radical (Arben et al., 2016), (b) Endogenous sources of free radicals. (Arben et al., 2016)	16
Figure 3.1	The overall flowchart of study	22
Figure 3.2	The method of extraction jackfruit leaves using Ultrasonic- Assisted Extraction (UAE)	25
Figure 4.1	Percentage of yield extraction (%) of jackfruit leaves at different leaves maturity with different amplitude (%) and sonication time (min)	30
Figure 4.2	The percentage of DPPH scavenging activity of different leaves maturity at different amplitude (%) and sonication time (min)	32
Figure 4.3	(a) Percentage of scavenging activity at different leaf maturity with the function of amplitude (%) and (b) Percentage of scavenging activity at different leaf maturity with the function of sonication time (min)	38

LIST OF ABBREVIATIONS

ROS	-	Reactive Oxygen Species
DPPH	-	Diphenylpicrylhydrazyl
GAE	-	Gallic acid equivalent
HPLC	-	High Performance Liquid Chromatography
SOD	-	Superoxide Dismutase
UAE	-	Ultrasonic-Assisted Extraction
TPC	-	Total Phenolic Content
TFC	-	Total Flavonoid Content
UV-VIS	-	UV -VIS Spectrophotometer
UV-VIS	-	UV -VIS Spectrophotometer

LIST OF SYMBOLS

g	-	gram
%	-	percentage
L	-	litre
°C	-	degree celcius
m	-	meter
mg	-	miligram
hr	-	hour
mL	-	mililiter
nm	-	nanometer
ppm	-	part per million
μl	-	Microliter
μg	-	Microgram
ml/min	-	mililiter per minute
w/v	-	weight per volume
v/v	-	volume per volume
rpm	-	revelutions per minit (speed)
k	-	Kilo
Hz	-	Hertz

CHAPTER 1

INTRODUCTION

1.1 Research Background

The study of herbal plants as a natural source of antioxidants has been carried out for many years by researchers. Knowledge of antioxidants as therapeutic agents capable in preventing cell damage which caused by free radicals in the human body led the researchers to search through various species of herbal plants and also not left behind the fruit plants such as jackfruit being as a source of research (Shinde et al., 2015). The natural antioxidants are believed to be present relatively minor side effects compared to synthetics antioxidants, which tend to be unstable and may carcinogenic (Chandra et al., 2014).

One of the fruit plants that can be used as medicine is jackfruit. Jackfruit (*Artocarpus heterophyllus L.*) is a plant of the family Moraceae, which is widely grown in tropical countries such as Indonesia, Brazil, Thailand, the Philippines, and Malaysia (Burci et al., 2015). Jackfruit leaves and bark are traditionally used to treat hypertension, diabetes, cancer, asthma, dermatosis, cough, wounds, acne, and diarrhea (Moke et al., 2017, Ilmi et al., 2020). Jackfruit leaves contain metabolites, such as alkaloid, saponins, phenols, and flavonoids (Ilmi et al., 2020).

In India jackfruit is known as the “poor food”. But despite the bad name, it turns out that jackfruit contains very rich nutrients of vitamins and minerals (Srivastava et al., 2020). For instance, the vitamins that was found are retinol (A), thiamine (B1), riboflavin (B2) and ascorbic acid (C) and meanwhile the example of minerals are potassium, phosphorus, calcium, and iron that help strengthens the immune system against disease, in addition to maintaining healthy eyes and skin (Shrikant et al., 2012). The constituent of Jackfruit has important value in medicine

as well as in medical food industry because due to the medicinal, physiological, and functional properties of jackfruit which have been proven through several studies (Nuraizat et al., 2018). From researchers' findings, it was found that jackfruit is a beneficial fruit because it contains many bioactive compounds. Seeds and aril are usually waste products from jackfruit are also found to be nutritious if eaten (Sreeletha et al., 2018).

Jackfruit also contains phenolic acids such as tannic acid, ferulic acid, and gallic acid. During ripening process, the concentration of gallic acid was increased and resulted in decreasing of ferulic acid. Thus, the unique profile from phytochemical analysis of jackfruit is highly recommend because it has ability in promoting good health (Luis et al., 2018).

The major protein of jacalin found from the jackfruit seeds is a tetrameric two chain fixture that combines with heavy chain of 133 amino acid residues (Ranasinghe et al., 2019). The jacalin is representing over 50% in seed and capable of binding to human IgA and T-Antigen (Homen et al., 2018). However, the content of jacalin is depends on the growth stage, the more mature the jackfruit seed, the more protein content (Dhierllate et al., 2020).

Therefore, this research aims to determine the total antioxidant in extracts of different maturity of jackfruit leaves using Ultrasonic-Assisted Extraction (UAE). Through the findings also it will observe the correlation of phenolic content and flavonoid content with the strength of antioxidant activity.

1.2 Problem Statement

Specifically, antioxidants with plant origins are of considerable interest. Certain phytochemicals, especially plant phenolics and flavonoids, may be potential antioxidants with chemo preventive effects. Jackfruits leaves have potential to be one of source of natural antioxidant due to its phytochemical that contribute to this bioactivity. Different maturity of plant leaves will contribute different amount of

phytochemical content. However, no study was carried out on the evaluation of antioxidant value of jackfruit leaves with different maturity or age of leaves level.

Extraction produced through conventional techniques involving organic volatile solvents such as acetone, chloroform, ethyl ether, ethanol, dichloromethane, ethyl acetate, hexane, benzene, and toluene have been reported to be used to produce medicinal plant extracts will often leave a residue on the product produced (Kwabena et al., 2021). The residue may pose a serious public health risk to humans and do not provide any therapeutic benefit. Most of these volatile organic solvents are highly toxic, human carcinogens, environmental hazards, nongenotoxic animal carcinogens, possible causative agents of other irreversible toxicity such as neurotoxicity or teratogenicity (Umamaheswari et al., 2021) . Hence, the proposed of using Ultrasonic-assisted extraction (UAE) technique in this study to extract functional components from different matrixes; it impacts safety and more rapid than conventional extraction techniques.

1.3 Research Objectives

There are two objectives in this study:

- 1) To evaluate the different parameter of jackfruit leaves extract on the percentage of antioxidant activity.
- 2) To compare different maturity of jackfruit leaves on the percentage of antioxidant.

1.4 Research Scopes

The scopes are:

- 1) Extraction of jackfruit leaves with different extraction parameters ultrasonic amplitude (20%, 60% and 100%) and sonication time (5 min, 15 min and 25 min).
- 2) Analysed the total of antioxidant activity of the leaves extract using DPPH Radical Scavenging Activity assay
- 3) Determination of total phenolic content and total flavonoid content through bio-chemical assay.
- 4) Comparison the antioxidant activity between different maturity leaves at different range of extraction parameters.

1.5 Research Hypothesis

- 1) The young leaves extract will contribute high antioxidant activity due to high phytochemical content compared to matured leaves extract.
- 2) Different range of extraction parameters will affect the antioxidant activity.

1.6 Significant of Study

Jackfruit is a potential local fruit to be developed as a plantation crop in Malaysia and have many varieties. Jackfruit with variety registration of J37 from Nangka MASTURA CJ-USM 2000 was choose as plant material in this study. Nangka MASTURA was discovered on 2000 by Profesor Dr. Zainal Abidin, who is a researcher and also lecture from Universiti Sains Malaysia (USM). According to Zainal Abidin (1999), MASTURA jackfruit has many advantages. One of its advantages is that it produces results quickly which is 18 months after planting compared to other types of jackfruits that are common takes 30 to 36 months to start

fruiting. Its economic lifespan is estimated to be around 25-30 years, if the management is done well (Norman, 2004). In this study, the jackfruit leaves were picked from Nangka MASTURA with the age range of 15 years. Therefore, the leaves picked at this age are very significant to be used in the study considering that many fruits have been produced before and the taking of leaves does not affect the productivity of new fruit production. Antioxidants and phytochemicals contained in jackfruit leaf extract are able to offer benefits in the food, nutraceutical or cosmeceutical industries. Sources of vitamins and minerals in jackfruit leaf extract provide a healthy diet in the food industry. Jackfruit leaf extract containing flavonoids is a good source of bioactive agents for nutraceutical industry. The rich antioxidants in jackfruit leaf extract promise a natural whitening agent is suitable for use in the cosmetic industry.

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