

CHAPTER I

INTRODUCTION

1.1 Background and Rationale

Date (*Phoenix dactylifera*) is a favourite food of Prophet Muhammad (PBUH). Allah has mentioned in the Quran:

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ (وَهُوَ الَّذِي أَنْشَأَ جَنَّاتٍ مَعْرُوشَاتٍ وَغَيْرَ مَعْرُوشَاتٍ وَالنَّخْلَ وَالزَّرْعَ مُخْتَلِفًا أَكْلُهُ
وَالزَّيْتُونَ وَالرُّمَانَ مُتَشَابِهًا وَغَيْرَ مُتَشَابِهٍ كُلُوا مِنْ ثَمَرِهِ إِذَا أَثْمَرَ وَآتُوا حَقَّهُ يَوْمَ حَصَادِهِ وَلَا تُسْرِفُوا إِنَّهُ لَا يُحِبُّ
المُسْرِفِينَ)

صدق الله العظيم

(Al-Quran, Al-Anaam, Verse 141:142)

"It is who causes gardens to grow, both trellised and non-trellised, and palm trees and crops of different kinds of food and olives and pomegranates similar and dissimilar. Eat of each its fruit when it yields and give its due Zakat on the day of its harvest, and be not excessive. Indeed, does not like those who commit excess".

قال رسول الله صل الله عليه وسلم : " من تصبح بسبع تمرات عجوة لا يصابه في هذا اليوم سُم ولا سحر "

"The Messenger said; who ever has seven Ajwa dates every morning he will not be harmed on that day by poison or magic".

There found the dates is very important on source of food and the studies to investigate the chemical compounds in dates is necessary. Dates are important sources of food and contain 75 % carbohydrate, 0.25 % fat, 1.3 % minerals, 0.10 % fiber and vitamins, notably vitamin A, B1, B2, and C. The most important minerals in dates are sodium, calcium, potassium, phosphorus, magnesium and iron (Entezari et al., 2004).

It is a perfect food for humans because it is less in fat and does not burden the heart.

The iron in dates is a good diet for patients with anemia, and the presence of minerals such as calcium, sodium, potassium leads to the treatment of inflammation of the nerves because that minerals deficiency is the prime cause of the inflammation. Dates are used for the treatment of many diseases such as blood pressure, kidney failure, gallbladder diseases and inflammation (Saleh et al., 2011).

In addition, there are more than 15 minerals in dates. The percentage of each mineral in dehydrated dates varies from 0.1 to 916 mg / 100 g date, subject to the type of mineral. The minerals and salts that are found in various proportions include boron, calcium, cobalt, copper, fluorine, iron magnesium, manganese, potassium, phosphorous, sodium and zinc. Dates contain at least six vitamins including vitamin C, vitamin B1 (thiamine), B2 (riboflavin), nicotinic acid (niacin) and vitamin A (Kchao et al., 2014). Dates contain elemental fluorine that is useful for protecting teeth against decay. Selenium, which professionals believe helps to prevent cancer and enhance the immune system, is also found in dates. The protein in dates contains 23 types of amino acids, some which are not present in the most popular fruits such as oranges, apples and bananas.

Ingestion of high amount of fruits and vegetables will ease the risk of a number of chronic diseases as revealed by Nicoli et al., (1999). This is made possible by the composition of a group of phytochemicals: dietary fibre, phenolic compounds, natural antioxidants, and other bioactive compounds. Compounds that can delay or inhibit the oxidation of lipids or other molecules by inhibiting the initiation or propagation of oxidative chain reactions are regarded as antioxidants (Velioglu et al., 1998). This properties are mainly due to phenolic compounds, such as flavonoids, phenolic acids,

and phenolic diterpenes. The antioxidant activity of phenolic compounds is a result of their redox properties, which can play an important role in absorbing and neutralizing free radicals, quenching singlet and triplet oxygen, or decomposing peroxides (Osawa et al., 2013).

These phytochemicals have a substantial quantity of antioxidant characteristics that are linked with lower occurrences and lower death rates of cancer. Date fruits have phenolic compounds (mainly cinnamic acids) and flavonoids (flavones, flavonols and flavanones) that provide antioxidant activities as stated by Velioglu et al., (1998), Vayalil (2002) and Mansouri et al., (2005).

The compositional and sensory characteristics of three native sun-dried date varieties cultivated in Oman, matching the antioxidant activity, anthocyanins, carotenoids, and phenolics for each diverse variety Al-Farsi et al., in (2005), concluded that with the creation of the field of functional food and nutraceuticals, any evidences on the health-promoting components of dates will improve the knowledge and appreciation for the uses of dates in these health-promoting products.

Iranian dates was analysed to assess the total antioxidant properties of plant extracts, such as 2,2-azinobis (3-ethylbenzothiazine-6-sulfonic) ABTS assay (Miller et al., 1993) and the ferric reducing antioxidant power (Ferric reducing ability of plasma) FRAP assay (Benzie and Strain, 1996). Total antioxidant capacities of dates was analysed on Iranian dates using an improved ABTS method (Cai et al., 2004 and Re et al., 1999), an improved FRAP assay. The total phenolic contents of dates fruit was also assessed using the classical Folin Ciocalteu reagent, and the relationship

between the total antioxidant capacities and phenolic contents in the samples was also tested. Additionally, aluminum chloride colorimetric method was used to recognize flavonoids in the dates zinc Kiran, S (2014). The data obtained is useful in assessing the antioxidant properties and phenolic compounds of different types of dates and also useful in knowing their chemical constituents and functionality. Researches on other fruits indicated the likelihood that storage can have a consequence on the degree of antioxidant compounds. When refrigerated, fruits lose stability during storage, but dates are relatively stable over a long period of time Kevers et al., (2007).

GC-MS is one of the most widespread analytical techniques in many scientific fields owing to its high sensitivity at low detection limit, rapid identification and having the ability of respectively analyzing number of ingredients analytes; therefore, it is the most appropriate to analyze the volatile components (Chavan & Amarowicz. 2013). The commercialization of LC-TOF-MS allows the use of moderate electro spray ionization because it allows accurate mass and retention time data to recognize the compounds (Ferrer & Thurman, 2003).

1.2 Problem Statement

Previous researches in dates used pure solvents such as methanol or chloroform to extract compounds in dates. They detected antioxidants, flavonoids, phenols, etc. The extraction yield is dependent on the polarity of the solvents. Therefore, by mixing different solvents at different ratio, the polarity will be changed. This means that more compounds can be extracted. This work is proposed to study the extraction of biochemical compounds in dates using three types of solvents (methanol, n-hexane

and chloroform) to improve the extraction yield. No studies have been done on the extraction of biochemical compounds in dates using three mixtures of solvents. The polarity of solvents will determine the high number and the type of compounds in plant. The polar compounds will be extracted by polar solvent / mixture, and the non-polar compounds by non-polar solvents / mixture. By mixing the solvents at different ratio the polarity of mixture of solvents will be changed and will affect the extraction yield.

1.3 Objectives

- (i) To optimize three-mixture design to extract the higher number of compounds in dates such as antioxidants, flavonoids, phenolics, carotenoids, etc.
- (ii) To develop method for identification of biochemical compounds in dates using GC-MS and LC-TOF-MS.
- (iii) To apply Principal Components Analysis (PCA) technique on multivariate data of GC-MS to study the relationship between biochemical compounds extracted in dates with polarity of solvents mixture.

1.4 Scope of Research

Scope of research covers three types of solvent (methanol, chloroform and n-hexane) at different ratios and date palm fruit available in Malaysian market. GC-MS was used to analyze the extracts, and LC-MS-TOF was used for certain extract when applicable for comparison. Principal Components Analysis (PCA) was used to study the relationship between biochemical compounds in dates with polarity of mixture.