



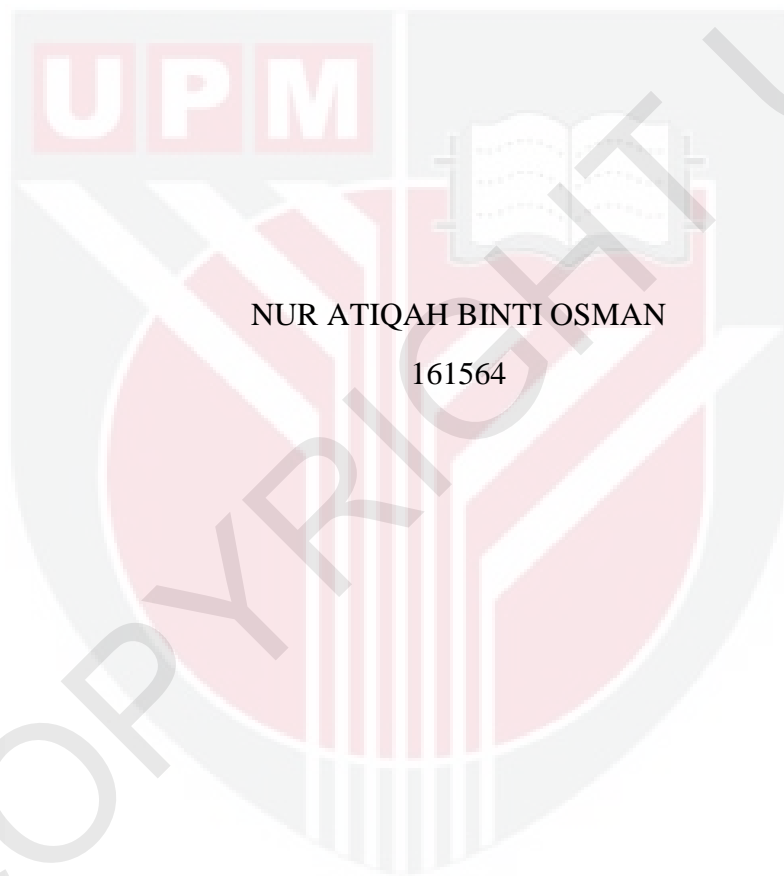
**UNIVERSITI PUTRA MALAYSIA**

***COMPARISON OF YEAST (*Saccharomyces cerevisiae*)  
FERMENTATION BETWEEN HONEY AND COMMERCIAL SUGARS***

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**FBSB 2015 66**

COMPARISON OF YEAST (*Saccharomyces cerevisiae*) FERMENTATION  
BETWEEN HONEY AND COMMERCIAL SUGARS



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## PENGESAHAN

Dengan ini adalah disahkan bahawa laporan bertajuk “Comparison of Yeast (*Saccharomyces cerevisiae*) Fermentation Between Honey and Commercial Sugars” telah disiapkan serta dikemukakan kepada Jabatan Biokimia oleh Nur Atiqah Binti Osman sebagai syarat untuk kursus BCH 4999, projek dari Fakulti Bioteknologi dan Sains Biomolekul, Universiti Putra Malaysia.

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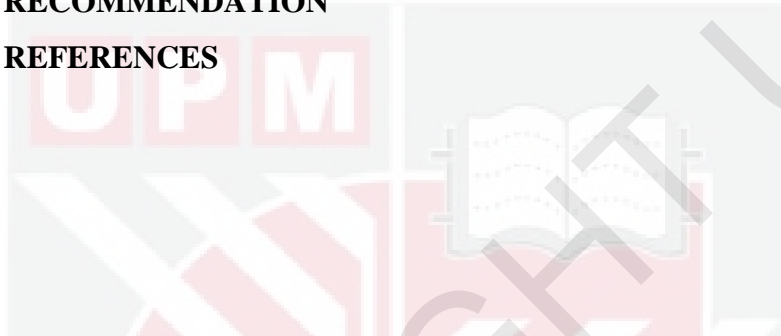
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## LIST OF ABBREVIATIONS

ATP	Adenosine Triphosphate
cm <sup>3</sup>	Cubic Centimetre
°C	Degree Celsius
g	Gram
kHz	Kilohertz
L	Litre
ml	Milliliter
min	Minutes
nm	Nanometer
%	Percent
VAC	Volts AC Power



## ABSTRACT

**Background.** Honey varies in color and flavour. Its composition also varies widely and depending largely on its floral sources. Because of honey's complex and unusual composition, honey has its own properties that make it differ from all other sweetening agents. The purpose of this study was to compare sugar metabolism between selected honey samples from Malaysia and a few countries and commercial sugar by using *Saccharomyces cerevisiae* as a model organism. The significant differences in the sugar metabolism is important to predict honey as quality sugar sources compared to typical commercial sugar.

**Methodology.** Forty-five samples of honey which have equivalent amount of sugar composition as three commercial sugars namely glucose, fructose, and sucrose that used as control were screen by using rapid fermentation techniques. The experiment is repeated with the aid of cultured yeast in order to validate the screened data using packed baker yeast ( *S. cerevisiae* ).

**Results.** The comparison of glucose metabolized by yeast *S. cerevisiae* using rapid fermentation techniques were successfully proved that the fermentation in honey sugar and commercial sugar the yeast cells fermented honey sugar the most. Among the forty five samples of honey, honey tramp species ( sample 32 ) released the highest amount of carbon dioxide.

**Conclusion.** The results found that the honey samples exhibited a significant differences in sugar metabolism between honey and commercialised sugar . It is also suggested that honey has the ability to reduce the blood glucose and might be suitable to be consumed by healthy and diabetic person.

## ABSTRAK

**Latar Belakang.** Madu berbeza dari segi warna dan rasa. Komposisinya juga berbeza-beza secara meluas dan sebahagian besarnya bergantung kepada sumber bunga. Oleh kerana komposisinya kompleks dan luar biasa madu mempunyai ciri-ciri tersendiri yang menjadikannya berbeza daripada semua ejen pemanis lain. Tujuan kajian ini adalah untuk membandingkan metabolisme gula antara sampel yang dipilih madu dari Malaysia dan beberapa negara dan gula komersial dengan menggunakan *Saccharomyces cerevisiae* sebagai model organisma. Perbezaan yang signifikan dalam metabolisme gula adalah penting untuk meramalkan madu sebagai sumber gula yang berkualiti berbanding dengan gula komersil biasa.

**Metodologi.** Empat puluh lima sampel madu yang mempunyai jumlah bersamaan komposisi tiga gula komersial iaitu glukosa, fruktosa dan sukrosa yang digunakan sebagai kawalan adalah skrin dengan menggunakan teknik penapaian pesat. Eksperimen diulang dengan bantuan yis dikultur untuk mengesahkan data menggunakan ibu roti ( *S. cerevisiae* ).

**Keputusan.** Perbandingan glukosa yang dimetabolismakan oleh yis *S. cerevisiae* menggunakan teknik penapaian pesat telah berjaya membuktikan bahawa penapaian antara gula dari madu dan gula komersil, gula madu yang paling banyak ditapai oleh sel yis. Di antara empat puluh lima sampel madu jenis tualang ( sampel 32 ) paling tinggi mengeluarkan jumlah karbon dioksida.

**Kesimpulan.** Keputusan mendapati bahawa sampel madu mempamerkan perbezaan yang signifikan dalam metabolisme gula antara madu dan gula komersial. Ia juga mencadangkan bahawa madu mempunyai keupayaan untuk mengurangkan glukosa dalam darah dan sesuai untuk dimakan oleh orang yang sihat dan kencing manis.

## CHAPTER 1

### INTRODUCTION

Malaysia has a large biodiversity therefore many honey with different sugar and chemical composition could be found here. Honey contains various types of sugars such as glucose, sucrose, fructose, lactose, maltose, galactose, xylose and minerals such as nitrogen, flavonoids and some other proteins. Honey composition was very dependent on the geographic location even for the same plant species. It is suggested that even the same floral origin honey composition may be quite different and it became interested to find out which sugars are present and in what percentage and which sugar is metabolized the most by cell.

Like for many other microorganisms, *Saccharomyces cerevisiae* preferred glucose as their main carbon source and thus classified as glucose-sensitive yeasts. For most eukaryotic cells, glucose has many significant effects on cell function. Yeast not only able to detect mere presence or absence of glucose, they display totally different metabolic modes depending on the carbon source, minerals, and other nutrient available. Therefore, maintaining glucose homeostasis is a great importance to many organisms for their proper growth and signaling optimal condition to the cellular machinery.

The range of carbon sources that support the growth of the yeast is differs greatly based on their sugar composition and nutrient. Surprisingly during fermentative growth all pyruvate the end product of glycolysis investigated seem to be converted into many organic metabolites including molecular

hydrogen, carbon dioxide and water. In this study how cells perceive and respond to sugar as carbon source is an important and unanswered question.

Rapid fermentation techniques will be used in this experiment because of its simplicity, economical, nonhazardous, and repeatable. The techniques involved sugar solution as carbon sources with the aid of *S. cerevisiae* into the test tube and sealed with balloons. The produced gas will be quantified by using water displacement method. Fermentation of sugars was carried out under continuous mild ultrasonication conditions.

It is hypothesized that honey could induced a unique sugar uptake mechanism compared to condition where only typical commercial sugars are available. In this regard, I am interested to study *S. cerevisiae* respond to honey that has about 80% carbohydrate composition.

Hence, the aim of this study involves the following objectives:

- 1) To screen and compare sugar metabolism of honey in yeast, *S. cerevisiae* using rapid fermentation technique
- 2) To validate the rapid screening data using a grown yeast fermentation
- 3) To predict which honey is a good candidate for diabetic patient consumption.

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