NUTRITIONAL VALUES AND ANTIOXIDANT ACTIVITIES OF ORGANICALLY GROWN VEGETABLES

LAW POOI SAN

THESIS SUBMITTED IN PARTIAL FULFILLMENT FOR THE BACHELOR DEGREE OF FOOD SCIENCE WITH HONOURS (FOOD SCIENCE AND NUTRITION)

PERPUSTAKAAN
UNIVERSITI MALAYSIA SABAH

SCHOOL OF FOOD SCIENCE AND NUTRITION
UNIVERSITI MALAYSIA SABAH
2012
**UNIVERSITI MALAYSIA SABAH**

**BORANG PENGESEHAHAN STATUS TESIS**

<table>
<thead>
<tr>
<th><strong>JUDUL:</strong></th>
<th>Nutritional values and antioxidant activities of organically grown vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAZAHA:</strong></td>
<td>Food Science and Nutrition (CH504)</td>
</tr>
</tbody>
</table>

**SESI PENG AJIAN:** 2008/2009

Saya

(LAW POOL SAN)

(HURUF BESAR)

mengaku memberikan tesis (LPS/Sarjana/Doktor Falsafah) ini di simpan di Perpustakaan Universiti Malaysia Sabah dengan syarat-syarat kegunaan seperti berikut:

1. Tesis adalah hakmilik Universiti Malaysia Sabah.
2. Perpustakaan Universiti Malaysia Sabah dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan tesis ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (/)

- [ ] SULIT (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)
- [✓] TERHAD (Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

(TANDATANGAN PENULIS)

Alamat Tetap: No. 1, Lorong CP /K,
Cheras Perdana, 43000
Kajang, Selangor.

Tarikh: 23/8/12

(TANDATANGAN PUSTAKA WAN)

Prof. Madya Dr. Clyde Fook Yee
Nama Penyelia

Tarikh: 23/8/12

**CATATAN:**
* *Potong yang tidak berkenaan.
* *Jika tesis ini SULIT atau TERHAD, sila lampiran surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh tesis ini perlu dikelaskan sebagai SULIT dan TERHAD.
* Tesis dimaksudkan sebagai tesis bagi Ijazah Doktor Falsafah dan Sarjana secara penyelesaikan, atau disertasi bagi pengajian secara kursus dan penyelesaikan, atau Laporan Projek Sarjana Muda (LPSM).
DECLARATION

I hereby declare that the material in this thesis is my own except quotation, excerpts, equation, summaries and references, which have been duly.

02 JULY 2012

LAW POOI SAN
BN08110135
CERTIFICATION

NAME : LAW POOI SAN

MATRIC NO. : BN08110135

TITLE : NUTRITIONAL VALUES AND ANTIOXIDANT ACTIVITIES OF ORGANICALLY GROWN VEGETABLES

DEGREE : BACHELOR OF FOOD SCIENCE WITH HONOURS (FOOD SCIENCE AND NUTRITION)

VIVA DATE : 02 JULY 2012

DECLARED BY

1. SUPERVISOR
   ASSOC. PROF. DR. CHYE FOOK YEE

2. EXAMINER 1
   MR. MANSOOR ABD HAMID

3. EXAMINER 2
   DR. MUHAMMAD IQBAL HASHIMI

4. DEAN
   ASSOC. PROF. DR. SHARIFUDIN MD SHAARANI
ACKNOWLEDGEMENT

First of all, I would like to express my sincere gratitude and thanks to my supervisor, Assoc. Prof. Madya Dr. Chye Fook Yee for his supervision, guidance, support and advice throughout the duration of my final year project as a part of my coursework.

Sincere appreciate to all lecturers of School of Food Science and Nutrition that provided support and encouragement, with their precious knowledge and guidance through my 4 years course in SSMP. Thank to the laboratory assistants, especially Mr.Wilter, Mr. Shahirun, Mr. Duasin and Ms. Dorrien, for their kindness in provide me the chemical and glassware, and willingness to extend the operation of lab over time.

Big thanks to senior Mr. Tin Hoe Seng, Mr. Ng Seah Yang, Mr. Birdy Scott and Ms. Koon Siew Siew for their valuable experience, teaching, advice and supports in through this project. Extended appreciation for my fellow teammate, Candice Woo, Mah Li Yun, Yvonne Chwee, Eunice Lai, Law Pay Wei and Karen Quah, as well as other friends who had help me a lot along the path of thesis. Thank you for their helping, accompanying and supporting.

Lastly, I would like to express my gratitude to my family member for their love, care and financial support.

Thankyou.
ACKNOWLEDGEMENT

First of all, I would like to express my sincere gratitude and thanks to my supervisor, Assoc. Prof. Madya Dr. Chye Fook Yee for his supervision, guidance, support and advice throughout the duration of my final year project as a part of my coursework.

Sincere appreciate to all lecturers of School of Food Science and Nutrition that provided support and encouragement, with their precious knowledge and guidance through my 4 years course in SSMP. Thank to the laboratory assistants, especially Mr.Wilter, Mr. Shahirun, Mr. Duasin and Ms. Dorrien, for their kindness in provide me the chemical and glassware, and willingness to extend the operation of lab over time.

Big thanks to senior Mr. Tin Hoe Seng, Mr. Ng Seah Yang, Mr. Birdy Scott and Ms. Koon Siew Siew for their valuable experience, teaching, advice and supports in thought this project. Extended appreciation for my fellow teammate, Candice Woo, Mah Li Yun, Yvonne Chwee, Eunice Lai, Law Pay Wei and Karen Quah, as well as other friends who had help me a lot along the path of thesis. Thank you for their helping, accompanying and supporting.

Lastly, I would like to express my gratitude to my family member for their love, care and financial support.

Thankyou.
ABSTRACT

The study was conducted to determine the nutrient composition and antioxidant activities of low land vegetables, which are organically grown. Leafy green mustard (Brassica juncea), Chinese kale (Brassica alboglabra), and fruit type vegetable on okra (Abelmoschus esculentus) and long bean (Vigna unguiculata subsp. sesquipedalis) were obtained from selected organic farms registered under Organic Scheme Malaysia. Proximate composition was determined by AOAC method, while total phenolic content were estimated by Folin-Ciocalteu reagent, and the antioxidant activities were measured by 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical method, Ferric reducing antioxidant power (FRAP) assay, β-carotene bleaching (BCB) assay, and Oxygen Radical Absorbance Capacity (ORAC). The phenolic compounds responsible for the antioxidant activity were identified by High Performance Liquid Chromatography (HPLC). Results show there was no significant different (p>0.05) in macronutrients content between conventionally and organically grown vegetables. However, the protein content of the conventionally grown vegetables was higher than their organic counterpart, with the highest found in kale (2.24 g/100g FW). The antioxidant activities as determined by 4 assays were found higher in organically grown vegetables, especially in leafy greens with organic mustard has the highest DPPH scavenging activities (25.03%) and ORAC value (29.94 μmol Trolox/g). Organic vegetables were found to have a significantly (p<0.05) higher phenolic compounds that are responsible for the antioxidant activity in particularly quercetin and catechin. The phenolic content was strongly correlated (R²>0.7) with DPPH and FRAP assay. In conclusion, the basic nutrients of the organically grown vegetables do not seem to be superior to their conventional counterparts. However, the antioxidant activity and the presence of phenolic compounds were found much higher in the organically grown vegetables.
ABSTRAK
KOMPOSISI NUTRIEN DAN AKTIVITI ANTIOKSIDAN SAYUR-SAYURAN ORGANIK.

# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TITLE</td>
<td>i</td>
</tr>
<tr>
<td>DECLARATION</td>
<td>ii</td>
</tr>
<tr>
<td>APPROVAL OF EXAMINERS</td>
<td>iii</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT</td>
<td>iv</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>ABSTRAK</td>
<td>vi</td>
</tr>
<tr>
<td>LIST OF CONTENTS</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>x</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF ABBREVIATIONS AND SYMBOL</td>
<td>xiii</td>
</tr>
<tr>
<td>LIST OF APPENDIX</td>
<td>xv</td>
</tr>
</tbody>
</table>

## CHAPTER 1: INTRODUCTION

1

## CHAPTER 2: LITERATURE REVIEW

2.1 Organic Food

2.1.1 Organic Food Market in Global

2.1.2 Organic Food Market in Malaysia

2.2 Organic Farming

2.2.1 Organic Farming in Global

2.2.2 Organic Farming in Malaysia

2.2.3 Organic Farming in Sabah

2.2.4 Organic Farming Standard and Certification

2.2.5 Certification Scheme in Malaysia

2.3 The Organic Food and Consumer

2.3.1 Consumer Awareness and Knowledge on organic food

2.3.2 Price and Willing to Pay Organic Food

18

20
3.7.1 1,1-diphenyl-2-picrylhydrazyl radical scavenging assay
3.7.2 β-carotene bleaching assay
3.7.3 Ferric reducing antioxidant power assay
3.7.4 Oxygen Radical Absorbance Capacity
3.8 Quantification of phenolic compound
3.9 Quantification of vitamin C, Beta-carotane and tocopherol
  3.9.1 Extraction of vitamin C
  3.9.2 Extraction of Beta-carotane and tocopherol
  3.9.3 Quantification of vitamins with HPLC
3.10 Quantification of mineral content
  3.10.1 Microwave Digestion of sample for mineral test
  3.10.2 Quantification of mineral content with ICP-MS
3.11 Statistical Analysis

CHAPTER 4: RESULTS AND DISCUSSION
4.1 Nutrient composition of organically and conventional grown vegetable
4.2 Total phenolic content
4.3 Antioxidant activities of organic and conventional grown vegetables
  4.3.1 DPPH radical scavenging activity
  4.3.2 Ferric reducing antioxidant power (FRAP) assay
  4.3.3 Beta-Carotene Bleaching Assay
  4.3.4 Oxygen Radical Absorbance Capacity (ORAC)
4.4 Quantification of phenolic compound
4.5 Correlation between total phenolic compounds and antioxidant assay antioxidant

CHAPTER 5: CONCLUSION AND SUGGESTION

REFERENCES
APPENDIX
LIST OF TABLE

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Comparison the main advantages and disadvantages of organic farming</td>
<td>10</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>Comparison of price premiums for organic foods on selected countries.</td>
<td>20</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>Summary of recent studies comparing organic and conventional food with respect to nutrient level.</td>
<td>30</td>
</tr>
<tr>
<td>Table 3.1</td>
<td>Retention time of selected phenolic compounds</td>
<td>52</td>
</tr>
<tr>
<td>Table 3.2</td>
<td>Condition of HPLC for separation and identification of vitamin C, β-carotane and tocopherol</td>
<td>54</td>
</tr>
<tr>
<td>Table 3.3</td>
<td>Condition of ICP-MS for determination of mineral content in sample</td>
<td>58</td>
</tr>
<tr>
<td>Table 4.1</td>
<td>Nutrient compositions of organic and conventional vegetables on fresh weight basis.</td>
<td>53</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Total phenolic content in organic and conventional fruit type and leafy type vegetables.</td>
<td>61</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>DPPH scavenging activity in organic and conventional vegetable</td>
<td>63</td>
</tr>
<tr>
<td>Table 4.4</td>
<td>Quantification of phenolic compounds</td>
<td>75</td>
</tr>
<tr>
<td>Table 4.5</td>
<td>Regression($R^2$) between antioxidant assay</td>
<td>76</td>
</tr>
</tbody>
</table>
LIST OF ABBREVIATIONS AND SYMBOLS

AAC - Antioxidant Activity Coefficient
AAPH - 2,2'-azobis(2-amidino-propane) dihydrochloride
BCB - β-carotene bleaching assay
BHT - Butylated hydroxytoluene
DPPH - 1,1-diphenyl-2-picrylhydrazyl
FRAP - Ferric reducing antioxidant power assay
HPLC - High Performance Liquid Chromatography
IFOAM - International Federation of Organic Agriculture Movements
IOAS - International Organic Accreditation Service
ORAC - Oxygen Radical Absorbance Capacity
SOM - Skim Organic Malaysia
TPC - Total phenolic contents
LOO• - Peroxyl radical
EC50 - Effective concentration to reduce 50% of free radical
g - Gram


mg - Milligram
ml - Milliliter
M - Molarity
N - Normality
mM - Milimolar
μM - Micromole
°C - Degree Celsius
< - Less than
UV - Ultraviolet
% - Percentage
v/v - Volume over volume
w/v - Weight over volume
# LIST OF APPENDIX

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendix A</td>
<td>Organic Farm details</td>
<td>96</td>
</tr>
<tr>
<td>Appendix B</td>
<td>Conventional Farm Details</td>
<td>96</td>
</tr>
<tr>
<td>Appendix C</td>
<td>Proximate content of organic and conventional vegetables on fresh weight basis.</td>
<td>97</td>
</tr>
<tr>
<td>Appendix D</td>
<td>Moisture content of organic and conventional vegetables on fresh weight basis. Duncan test.</td>
<td>98</td>
</tr>
<tr>
<td>Appendix E</td>
<td>Protein content of organic and conventional vegetables on fresh weight basis. Duncan test.</td>
<td>98</td>
</tr>
<tr>
<td>Appendix F</td>
<td>Fat content of organic and conventional vegetables on fresh weight basis. Duncan test.</td>
<td>99</td>
</tr>
<tr>
<td>Appendix G</td>
<td>Ash content of organic and conventional vegetables on fresh weight basis. Duncan test.</td>
<td>99</td>
</tr>
<tr>
<td>Appendix H</td>
<td>Dietary fiber of organic and conventional vegetables on fresh weight basis. Duncan test.</td>
<td>100</td>
</tr>
<tr>
<td>Appendix I</td>
<td>Carbohydrate content of organic and conventional vegetables on fresh weight basis. Duncan test.</td>
<td>100</td>
</tr>
<tr>
<td>Appendix J</td>
<td>TPC standard with gallic acid.</td>
<td>101</td>
</tr>
<tr>
<td>Appendix K</td>
<td>Mean of TPC of organic and conventional vegetables on fresh weight basis.</td>
<td>101</td>
</tr>
<tr>
<td>Appendix L</td>
<td>Duncan test TPC of organic and conventional vegetables on fresh weight basis.</td>
<td>104</td>
</tr>
<tr>
<td>Appendix M</td>
<td>Mean data for Antioxidant activities test for organic and conventional vegetable</td>
<td>105</td>
</tr>
<tr>
<td>Appendix</td>
<td>Description</td>
<td>Page</td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Appendix N</td>
<td>DPPH of organic and conventional vegetables on fresh weight basis.</td>
<td>106</td>
</tr>
<tr>
<td>Appendix O</td>
<td>FRAP standard with BHT</td>
<td>107</td>
</tr>
<tr>
<td>Appendix P</td>
<td>FRAP of organic and conventional vegetables on fresh weight basis.</td>
<td>108</td>
</tr>
<tr>
<td>Appendix Q</td>
<td>Beta-carotane bleaching assay of organic and conventional vegetables on fresh weight basis.</td>
<td>108</td>
</tr>
<tr>
<td>Appendix R</td>
<td>ORAC standard curve with Trolox</td>
<td>109</td>
</tr>
<tr>
<td>Appendix S</td>
<td>ORAC of organic and conventional vegetables on fresh weight basis.</td>
<td>110</td>
</tr>
<tr>
<td>Appendix T</td>
<td>Chromatograph of phenolic compounds in sample</td>
<td>111</td>
</tr>
<tr>
<td>Appendix T</td>
<td>Mrs. Tan Organic farm</td>
<td>112</td>
</tr>
<tr>
<td>Appendix U</td>
<td>Mr. Lim Organic farm</td>
<td>112</td>
</tr>
<tr>
<td>Appendix V</td>
<td>Type of fertilizer used in organic farming</td>
<td>113</td>
</tr>
<tr>
<td>Appendix W</td>
<td>The different between organic and conventional farming plot on receiving sunshine.</td>
<td>113</td>
</tr>
<tr>
<td>Appendix X</td>
<td>Conventional kale and organically grown kale</td>
<td>114</td>
</tr>
</tbody>
</table>
The term "organically grown food" can be describe that the food have been produced with the principles and practise of organic agriculture, which grown without the use of most artificial fertilizer, pesticides and genetic modification and produced in accordance, in a way that emphasises crop rotation, using natural fertilizer, manage practices that restore, maintain and enhance ecological harmony to ensuring that the life of soil is maintained (Asami et al., 2003). According to Food and Agricultural Organization of the United Nations (FAO, 2001), "organic" has been defined as the process where natural inputs in the field are approved and synthetic inputs are prohibited. The CODEX Alimentarius Commission has sets up international organic agriculture standards as it defines as "an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activities. It is based on minimal use of off-farm inputs management practice which restores, maintain and enhance ecological harmony". While the minimum standards for organic systems are similar across the world, but the differences in actual practices between production systems can be vary substantially in different regions.

The compendium of Scheme Organic Malaysian defined organic farming as "one of the many methodologies that are supportive of the environment. It is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity" (SOM, 2007). The Department of Agriculture Malaysia is responsible for regulations governing the production of organic foods and administration of Scheme Organic Malaysian (SOM), applied to farms of unprocessed plant and plant products based on the Malaysian Standard MS 1529:2001. Effective from 1 January 2011, all locally Malaysia grown organic fresh produces are required to register under SOM to clarify organic vegetables and fruits with genuinely natural and chemical free. As report form Department of
Agricultural (2010), there are total 37 farms have been certified and awarded the “Organic Malaysia” logo, while another 155 farms have registered to participate in the scheme.

The organic food industry has been showing the highest levels of growth of all food sectors (Bourn and Prescott, 2002). Current trade volume of global sales is estimated at approximately US$46 billion Dollars, with 15%-20% growth annually (INFOAM, 2006). In Asia, Japan leads with the largest organic market, followed by China, Malaysia, Singapore, and Thailand being the emerging markets (Yussefi and Willer, 2002). Main organic food market is representing by the Japanese market of “agro-ecological” product, which increase 3% in retails volume, with value reaching ¥40 billion in 2010 (Euromonitor International, 2011). Since 2001, organic farming was introduced in Malaysia with 131ha, had increased the acreage to 2691ha in 2009 (Laporan Jabatan Pertanian Malaysia, 2009) and there are now more stores and restaurants selling organic goods nationwide in Malaysia.

The rapid growth organic food market is due to increase consumer awareness in health as well as have lessened confident in conventionally produced food that may of use chemical fertilizer, pesticides and preservative (Winter and Davis, 2006). Overall, most studies report that consumer purchase organic foods because of a perception that such products are more nutritious and healthy than conventional produced alternative, and willing to pay a higher price for organic foods (Dangour et al., 2009). Question and doubt on whether organic food and farming have an added value that justifies the support and the premium price has lead a great interest of both consumer and producer on the information about nutritional quality and health benefits of organic food compare to the conventional one. However, in spite of the great demand for organic products, the available information regarding the nutritional quality of these products is still scare. Therefore, the study of nutritional quality of organic foods is urgently needed as fundamental to clear the doubts of consumer in the choice between organic products and conventional ones.
The principle of "health improvement" in prospect of consumer on organic products is product that free from pesticides and characterized by higher nutritional quality (Luthria et al., 2010) which with good content of substances such as protein, carbohydrate, lipids, minerals, vitamins (vitamin C, E and A) and other antioxidant (Lima and Vianello, 2011). Vegetable is a focal point of this controversy, since contain most of the essential components of human nutrition. Nutrient have been viewed as food components that either cannot be synthesized in human body such as vitamin C or those required a specific factor that may in circumstances be absent or inadequate (essential amino acid, fatty acid, and vitamins), and there have been now recognize that many component such as dietary fiber, phenolic acid and flavonoids are associated with lower disease risk (Hounsome et al., 2008). The phytochemical, such as phenolic compound have been linked to as functional antioxidant in human body, and has been investigated to bring benefits on human health as there it is possible to prevent oxidative damage disease such as aging, cancer, hypertension and cardiovascular disease (Faller and Fiolho, 2010; Sulaiman et al., 2011).

Majority studies were investigating nutritional differences between organically and conventionally grown foods based on food components such as protein, sugar, vitamins and minerals and recently there has been shifted and emphasis research investigating the concentration of non-nutritional on antioxidant. However, the numerous studies on the nutritional quality of organic produce have produced inconsistent results (Zhao et al., 2006). Types of comparative studies include grocery store study, farm study, comparison of fertilizers and other cultural practice conducted on farm or on-station replicated trials and the differences observed in literatures are cleared that variability data presented from different paper is due to inability to control or standardize the basic environmental factors such as soil physical (Lester and Eischen, 1996; Olivere et al., 2003), fertilization (Dumas, 2003), and season, location and climatic (Howard et al., 2002), may affect plant development and yield and influence food quality to differing extent.
Due to the limited literature, whether they are having different outcome of nutritional value between the organic farming and conventional practices is yet to be determined. The possible different groups of vegetables contribute differently on nutritional values remains to be determined. Furthermore, most of the studies are done in four seasons countries. The evidence may not appropriately to be used in Malaysia which is high humid, sunshine and rainfall all the years, and more research is require in the phytochemicals which have health potential on human body. This study resulted in new knowledge contribution on nutritional value and antioxidant between organically and conventional grown vegetable in Malaysia especially Sabah. Since, there is still lack of documented data on this area. Therefore, the study was designed to examine the difference in nutrient content and antioxidant activities between the organic crops and those grown with agricultural chemicals.

The objective of this study is designed:

(i) To determine the nutrient composition of low land vegetables which grown organically and conventionally, in Sabah Kota-Kinabalu

(ii) To determine antioxidant activities of selected vegetables

(iii) To quantified specific type of phenolic compounds in vegetable
CHAPTER 2

LITERATURE REVIEW

2.1 Organic Food

The main reason people opt for organic product is related to health issues, environmental and food safety scandals. Health issues related to conventional processed food such as allergens and contaminations present in additives, artificial coloring and preservative have increased the demand for organic food, especially in the baby food industry (Davies et al., 1995). The concerns of presence of growth hormones, heavy use of antibiotics in animal products and worries about genetic engineering are the reason that consumers choose organic food product and fear of disease such as the incident of mad cow disease and influenza flu had sudden rise the demand for organically grown food as well. According to the Euromonitor, (2006) the demand for organic food in Singapore has increased 15% in June 2005, as it is attributes to the increasing concern of bird flu and had turn their food choice to organic food. Organic goods are an ideal long term option for retails, as it is much better than other add value products such as fortified or functional product with less reliant on fads, publicity and constant development (Euromonitor, 2006).

2.1.1 Organic Food Market in Global

Global organic agricultural market has developed rapidly and currently remain firmly concentrated in the US and Western Europe. According to INFOAM, 2006 from the year of 1995-2004 the organic farming sector experienced an average growth of 15-20% each year. The global market for organic product in 2007 is US$46 billion, as biggest
organic food market is conpher by the United State followed by European market, with German as the leader in Europe as well as UK, France and Italy (Bonn and Frick, 2009).

Figure 2.1: Overview of word market for organic food in 2007 with total global sale of US$ 46 Billion (Bonn and Frick, 2009).

Demand for organic food in EU and North America, the two main organic food markets, has nearly doubled over the last decade (Willer and Kilcher, 2011). In Great Britain, as well as in Denmark, most organic foods are sold through mainstream retail channels. Moreover, organic sales are concentrated around a few large multiples. According to Wier et al., (2008) purchase data, three multiples (Tesco, Sainsbury and Waitrose) are responsible for 70% of total organic sales in Great Britain, while two multiples (Coop Denmark and Dansk Supermarked) are responsible for 64% of total organic sales in Denmark. Supermarkets generally hold a much lower share of organic sales in almost all other European countries. By contrast, direct sales and specialist
shops constitute on average 50% of all organic sales on the European market, and in some countries more than 80% (Synergie, 2002; Hamm et al., 2002).

The report "Global Organic Foods & Beverages Market Analysis by Products, Geography, Regulations, Pricing Trends, & Forecasts (2010 - 2015)" analyzes the organic food, beverages, and supplements market by products and geography and studies the major market drivers, restraints, and opportunities for organic food and beverages in major geographies of North America, Europe and Asia. The demand for organic food in Asia has been growing at 15 to 20 percent every year over the last decade (FiBL and IFOAM, 2009). Main organic food market is representing by the Japanese market of “agro-ecological” product, which increase 3% in retail volume, with value reaching ¥40 billion in 2010 (Euromonitor, 2011). The region of Asia pacific is becoming an increasingly important supplier of organic foods, and increase available locally as the supply grows. According to Euromonitor, (2007) it prospect that organic food market in Asia Pacific will see sating growth in grocery retailing over 2007 to 2012. The increasing importance of the organic food business is probably a result of greater interest in both a healthier and safer diet and a better environment (Knudson, 2007).

Organic retailing has begun to appear and growth in some of the regions of Asia Pacific markets. Several supermarket chains such as Jusco, Cold Storage, Giant and Carrefour in Hong Kong, Singapore and Malaysia have begun carry organic lines products. Even in some developing countries are seeing developments of organic retailing, such as the Foodworld’s Gourmet concept store in India, is begin to featuring organic product and Country Farm in Malaysia has operating four retail stores in Malaysia as well as supplying organic food product to a number of local supermarkets chains. These organic retailing initiatives have demonstrated that there is potential for the market even in countries with average incomes.
Organic food has gone through a tough year in 2009. According to Soil Association on UK Organic Market Report, (2010) supermarket value of organic fresh fruit and vegetable has dropped almost 7%, and dramatically drop 23% for fresh meat as the economic downturn may be consider as the main reason of watershed for organic food. And thru, the worst has seem to be over, as the top ranking retailer Tesco has stated that sales of it organic vegetables have increase again in April 2010. In short, the organic food market is growing up fast, and its consumer has increasing likely to want additional assurances and extra benefits to convincing them to spend on money in organic food with worthwhile (Euromonitor, 2010).

2.1.2 Organic Food Market in Malaysia

In Malaysia, the organic food is considered at introductory stage. Currently, our export volume is small, and is mostly sent to Singapore (Sivapragasam et al., 2006). Since, currently SOM is not recognized by international markets yet. For product to enter the international market such as Europe and Japan, the producers have to comply with standards of the respective importing countries (Sabastian, 2005). In such cases, registered certifiers from the respective countries will inspect the produce for compliance before export. The product will be given the necessary labels of certification.

Currently, Country farm organic is the leading player of Malaysian organic industries, it is a manufacturer, exporter and licensor of organic product, which offer wide range of organic product and services through retails shop, wholesales and restaurants with achieved international standard and certified HALAL, and HACCP toward EU and NOP and USDA standard. Retail shops such as Jusco, Cold Storage, Giant, and Carrefour in Malaysia have started to carry organic food product line, and there are now more stores and restaurants selling organic goods nationwide in Malaysia.
REFERENCES


Bonn, and Frick. 2009. IFOAM and FiBL present new facts and figures about organic agriculture worldwide at the BioFach World Organic Trade Fair 2009 in Nuremberg, Germany.


and Agriculture Organisation (FAO) and World Health Organisation (WHO) Food Standards Program, Rome, Italy.

Crinnion, W. J. 2010. Organic food contain higher levels of certain nutrient, lower of pesticides and may provide health benefit for consumer. Alternative medicine Review. 15(1):4-11.


9th Malaysia Plan (2006-2010), chapter 22.