UNIVERSITI SAINS MALAYSIA
GERAN PENYELIDIKAN UNIVERSITI PENYELIDIKAN
LAPORAN AKHIR

# THE OMEGA -3 AND OMEGA-3 INDEX BLOOD LEVELS AND THEIR ASSOCIATION WITH DEMOGRAPHIC, CLINICAL CHARACTERISTICS, FASTING BLOOD SUGAR AND LIPID PROFILES AMONG HEALTH STAFFS POPULATION


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PENYELIDIK BERSAMA

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CIK NOR FADZLINA HAMID



2015

BAHAGIAN PENYELIDIKAN
Pusat Pengajian Sains Perubatan

# SENARAI SEMAKAN UNTUK BUKU LAPORAN AKHIR GERAN USM JANGKA PENDEK
(untuk di isi oleh penyelidik)

| | | |
|---|---|---|
| NAMA PENYELIDIK UTAMA | : | Prof Madya Dr Kamarul Imran Musa |
| NAMA CO-RESEARCHER | : | 1. Dr Rohana Abdul Jalil<br>2. Professor Dr Shaiful Bahari Ismail<br>3. Professor Dr Wan Mohamad Wan Bebakar<br>4. Associate Professor Gan Siew Hua<br>5. Associate Professor Wan Rosli Wan Ishak<br>6. Dr Mohd Ismail Ibrahim<br>7. Dr Mohd Nazri Shafei<br>8. En Rosliza Haron<br>9. Cik Nor Fadzlina Hamid |
| TAJUK GERAN | : | The Omega-3 And Omega-3 Index Blood Levels And Their association With Demographic, Clinical Characteristics, fasting Blood Sugar And Lipid Profiles Among Health Staffs Population |

SENARAI SEMAKAN SEMASA PENYERAHAN BUKU LAPORAN AKHIR
(Sila Tandakan (√) Pada Kotak Yang Berkenaan)

| NO. | PERKARA | ADA | TIADA |
|---|---|---|---|
| 1. | Borang Laporan Akhir Projek Penyelidikan USM Jangka Pendek | X | |

| | | | |
|---|---|---|---|
| 2. | Borang Laporan Hasil Penyelidikan, PPSP | X | |
| 3. | i) Salinan Menuskrip dan Salinan surat/email bukti penghantaran dan penerimaan manuskrip oleh mana-mana journal atau | X | |
| | ii)Kertas penerbitan disertakan | X | |
| 4. | Penyata Perbelanjaan (Financial Statement)<br>(Sila dapatkan daripada Jabatan Bendahari) | X | |
| 5. | Laporan Komprehensif (termasuk kertas persidangan atau seminar dan penerbitan saintifik hasil daripada projek ini) | X | |
| 6. | Surat pemakluman penghantaran Laporan Akhir ke Bhg. Penyelidikan | X | |

Nota:

1) Sila buat 2 salinan buku laporan Akhir
2) No. 1- 5 - Perlu dimasukkan dalam Buku Laporan Akhir
3) No. 6 - Hantar terus Kepada En.Ahmad Imran Khamis(RCMO) hanya salinan sahaja kepada Bhg. R&D, PPSP

# BORANG LAPORAN HASIL PENYELIDIKAN
## PPSP

Tajuk geran:
**The Omega-3 And Omega-3 Index Blood Levels And Theirassociation With Demographic, Clinical Characteristics,fasting Blood Sugar And Lipid Profiles Among Health Staffs Population**

Penyelidik:

1. **Associate Professor Dr Kamarul Imran Musa (Principal Investigator)**

2. **Dr Rohana Abdul Jalil**

3. **Professor Dr Shaiful Bahari Ismail**

4. **Professor Dr Wan Mohamad Wan Bebakar**

5. **Associate Professor Gan Siew Hua**

6. **Associate Professor Wan Rosli Wan Ishak**

7. **Dr Mohd Ismail Ibrahim**

8. **Dr Mohd Nazri Shafei**

9. **En Rosliza Haron**

10. **Cik Nor Fadzlina Hamid**

Jenis geran:
**RU**

Tempoh geran:
**1/1/2009-30/6/2011**

Jenis laporan: Laporan Kemajuan [ ] Alatan di beli [X] Ya:nyatakan.....

Laporan Akhir*: [X] [ ] Tidak

| OBJEKTIF SPESIFIK KAJIAN (sama spt dalam proposal asal) | SECARA RINGKAS TERANGKAN PENCAPAIAN/HASIL | OBJEKTIF TERCAPAI ATAU TIDAK |
|---|---|---|
| 1. To determine the blood levels of omega 3 (EPA and DHA) in µg/ml among the medical and health staff | The blood levels of EPA dan DHA were successfully measured. This was the first study in local setting to show the levels in human | Tercapai |

| | | |
|---|---|---|
| population in Kelantan. | blood sample. | |
| 2. To compare the levels of omega 3 in different socio-demographic and health profiles among the medical and health staff population in Kelantan. | We have been able to compare the EPA dan DHA levels between different socio-demographic groups and between different health profiles. Our results show there were a few differences in the levels of both fatty acids. | Tercapai |
| 3. To compare the mean between omega 3 fatty acid levels in µg/ml with the knowledge of fish consumption benefits and knowledge of omega 3 compounds among the medical and health staff population in Kelantan. | We have compared and correlated the levels of EPA and DHA with the scores of the validated questionnaire on the benefits and knowledge of Omega 3 fatty acids (EPA and DHA). Respondents with higher knowledge score tended to have higher EPA and DHA levels | Tercapai |
| 4. To study the associations between omega 3 fatty acid with the clinical characteristics and biochemical profiles among the medical and health staff population in Kelantan. | We have been able to correlate the EPA dan DHA levels between different clinical and biochemical profiles. Our results show that generally respondents with better clinical and biochemical profiles have higher Omega 3 fatty acids. | Tercapai |

- *Laporan Akhir perlu disertakan salinan manuskrip dan surat yang dihantar kepada mana-mana jurnal untuk penerbitan.*

UNIVERSITI SAINS MALAYSIA

# UNIVERSITY RESEARCH GRANT
# FINAL REPORT
## *Geran Penyelidikan Universiti*
## *Laporan Akhir*

| | |
|---|---|
| A. | PARTICULARS OF RESEARCH / *MAKLUMAT PENYELIDIKAN:* |
| (i) | **Title of Research:**<br>*Tajuk Penyelidikan:*<br><br>THE OMEGA -3 AND OMEGA-3 INDEX BLOOD LEVELS AND THEIR ASSOCIATION WITH DEMOGRAPHIC, CLINICAL CHARACTERISTICS, FASTING BLOOD SUGAR AND LIPID PROFILES AMONG HEALTH STAFFS POPULATION |
| (ii) | |
| B. | PERSONAL PARTICULARS OF RESEARCHER / *MAKLUMAT PENYELIDIK:* |
| (i) | **Name of Research Leader:**<br>*Nama Ketua Penyelidik:*<br><br>PROF MADYA DR KAMARUL IMRAN BIN MUSA |
| | **Name of Co-Researcher**<br>*Nama Penyelidik Bersama:*<br><br>1. PROF MADYA GAN SIEW HUA<br>2. DR MOHD ISMAIL BIN IBRAHIM<br>3. DR MOHD NAZRI BIN SHAFEI<br>4. CIK NOOR FADZLINA BINTI HAMID<br>5. DR ROHANA BINTI ABD. JALIL<br>6. ENCIK ROSLIZA BIN HARON<br>7. PROFESOR SHAIFUL BAHARI ISMAIL<br>8. PROFESOR WAN MOHAMAD BIN WAN BEBAKAR<br>9. PROF MADYA WAN ROSLI BIN WAN ISHAK |
| (ii) | **School/Institute/Centre/Unit :**<br>*Pusat Pengajian /Institut/Pusat/Unit :*<br><br>SCHOOL OF MEDICAL SCIENCES, HEALTH CAMPUS<br>SCHOOL OF ALLIED HEALTH, HEALTH CAMPUS |

UNIVERSITI SAINS MALAYSIA

# UNIVERSITY RESEARCH GRANT
# FINAL REPORT
## *Geran Penyelidikan Universiti*
## *Laporan Akhir*

| | |
|---|---|
| A. | **PARTICULARS OF RESEARCH** / *MAKLUMAT PENYELIDIKAN:* |
| (i) | **Title of Research:**<br>*Tajuk Penyelidikan:*<br><br>THE OMEGA -3 AND OMEGA-3 INDEX BLOOD LEVELS AND THEIR ASSOCIATION WITH DEMOGRAPHIC, CLINICAL CHARACTERISTICS, FASTING BLOOD SUGAR AND LIPID PROFILES AMONG HEALTH STAFFS POPULATION |
| (ii) | |
| B. | **PERSONAL PARTICULARS OF RESEARCHER** / *MAKLUMAT PENYELIDIK:* |
| (i) | **Name of Research Leader:**<br>*Nama Ketua Penyelidik:*<br><br>DR KAMARUL IMRAN BIN MUSA |
| | **Name of Co-Researcher**<br>*Nama Penyelidik Bersama:*<br><br>PROF MADYA GAN SIEW HUA<br>DR MOHD ISMAIL BIN IBRAHIM<br>DR MOHD NAZRI BIN SHAFEI<br>CIK NOOR FADZLINA BINTI HAMID<br>DR ROHANA BINTI ABD. JALIL<br>ENCIK ROSLIZA BIN HARON<br>PROFESOR SHAIFUL BAHARI ISMAIL<br>PROFESOR WAN MOHAMAD BIN WAN BEBAKAR<br>PROF MADYA WAN ROSLI BIN WAN ISHAK |
| (ii) | **School/Institute/Centre/Unit :**<br>*Pusat Pengajian /Institut/Pusat/Unit :*<br><br>SCHOOL OF MEDICAL SCIENCES, HEALTH CAMPUS<br>SCHOOL OF ALLIED HEALTH, HEALTH CAMPUS |
| D. | **Duration of this research :**<br>*Tempoh masa penyelidikan ini :*<br><br>***Duration :** 2 YEARS AND 6 MONTHS<br>*Tempoh :*<br><br>**From** : 1 JAN 2009 **To** : 30 JUNE 2011<br>*Dari:* *Ke :* |

**E.** **ABSTRACT OF RESEARCH**

(An abstract of between 100 and 200 words must be prepared in **Bahasa Malaysia and in English**. This abstract will be included in the Annual Report of the Research and Innovation Section at a later date as a means of presenting the project findings of the researcher/s to the University and the community at large)

***Abstrak Penyelidikan***

(Perlu disediakan di antara 100 - 200 perkataan di dalam **Bahasa Malaysia dan juga Bahasa Inggeris**.
Abstrak ini akan dimuatkan dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu cara untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & masyarakat luar).

SEE ATTACHMENT 1

**F.** **SUMMARY OF RESEARCH FINDINGS**

*Ringkasan dapatan Projek Penyelidikan*

SEE ATTACHMENT 2

**G.** **COMPREHENSIVE TECHNICAL REPORT**

*Laporan Teknikal Lengkap*

Applicants are required to prepare a comprehensive technical report explaining the project.
(This report must be attached separately)
Sila sediakan laporan teknikal lengkap yang menerangkan keseluruhan projek ini.
[Laporan ini mesti dikepilkan]

SEE ATTACHMENT 3

**List the key words that reflectour research:**

*Senaraikan kata kunci yang mencerminkan penyelidikan anda:*

| English | Bahasa Malaysia |
|---|---|
| OMEGA 3 | OMEGA 3 |
| EPA (eicosapentaenoic acid) | EPA (Asid Eikosapentaenoik) |
| DHA (docosahexaenoic acid) | DHA (Asid Dokosaheksanoik) |

H. a) **Results/Benefits of this research**
*Hasil Penyelidikan*

| No. *Bil:* | Category/Number: *Kategori/ Bilangan:* | Promised | Achieved |
|---|---|---|---|
| 1. | **Research Publications (Specify target journals)** *Penerbitan Penyelidikan (Nyatakan sasaran jurnal)* | 3 | 5 (2 papers with Impact Factors, 1 draft manuscript, 2 theses) |
| 2. | **Human Capital Development** | | |
| | **a. Ph. D Students** | | |
| | **b. Masters Students** | **1** | **2**<br>**Dr Helmy Hazmi – Masters in Community Medicine**<br><br>**Dr Maini Sabait – Masters in Public Health** |
| | **c. Undergraduates (Final Year Project)** | | |
| | **d. Research Officers** | | |
| | **e. Research Assisstants** | **1** | **1**<br>**Miss Kartini Daud (Jab Perubatan Masyarakat)** |
| | **f. Other: Please specify** | | |
| 3. | **Patents** *Paten* | 0 | 0 |
| 4. | **Specific / Potential Applications** *Spesifik/Potensi aplikasin* | 0 | 0 |
| 5. | **Networking & Linkages** *Jaringan & Jalinan* | Network with a) School of Allied Health | Yes |
| 6. | **Possible External Research Grants to be Acquired** *Jangkaan Geran Penyelidikan Luar Diperoleh* | - | - |

- Kindly provide copies/evidence for Category 1 to 6.

**b) Equipment used for this research.**
*Peralatan yang telah digunakan dalam penyelidikan ini.*

SEE ATTACHMENT 4



| Items | | | |
|---|---|---|---|

| Items<br>*Perkara* | Approved Equipment | Approved Requested Equipment | Location |
|---|---|---|---|
| **Specialized Equipment**<br>Peralatan khusus | Null Perisian : Stata/SE 11 with PDF & Printed Documentation (RM4,310)<br><br>Toshiba Portege M800 (RM3,999) | <br><br><br><br>Protech Protech Chest Freezer (RM3,900)<br><br>IKA T25 Digital Ultra-Turrax Cat No : 3565000 (RM8,288) | Dept of Community Medicine, School of Medical Sciences, Health Campus<br><br>Dept of Community Medicine, School of Medical Sciences, Health Campus<br><br>Room2, Food Lab, School of Health, Health Campus<br><br>Room 2, Food Lab, School of Health, Health Campus |
| **Facility**<br>Kemudahan | | | |
| **Infrastructure**<br>Infrastruktur | | | |

| H. | COMMENTS OF PTJ'S RESEARCH COMMITTEE<br>*KOMEN JAWATANKUASA PENYELIDIKAN PERINGKAT PTJ* |
|---|---|

**General Comments:**
*Ulasan Umum:*

Secara keseluruhan; penghasilan output geran adalah amat baik; Penyelia telah berjaya menghasilkan 2 penerbitan iaitu jurnal yg berindeks, 2 pelajar sarjana dan pembentangan abstrak.

Kesimpulan, dipersetujui utk tutup geran.

# ATTACHMENT 1

# Part I

# ABSTRACT

INTRODUCTION Two important types of Omega 3 fatty acids are the Eicosapentaenoic Acid (EPA) and Docosahexaenoic Acid (DHA). The main sources of EPA and DHA come from the marine life species. Both EPA and DHA are linked with the protection from cardiovascular risk factors, inflammatory related diseases and neuro-psychology diseases in human. This study aimed to assess the levels of EPA and DHA in selected marine and fresh-water species of fishes and shellfish found in the east coast of Peninsular Malaysia. Next, the study aimed to measure the blood levels of EPA and DHA in health workers in the state of Kelantan, Malaysia and their important related factors.

METHODOLOGY A cross sectional study was done. It was divided into two parts; 1) to assess the level of EPA and DHA in selected marine and fresh water species of fishes and shellfish found along the east coast of Peninsular Malaysia and 2) to measure the blood levels of EPA and DHA in the randomly selected health workers in the state of Kelantan. The relationship between the levels of EPA and DHA with the socio-demography profiles, health status, knowledge level, physical activity, anthropometry measurement and blood biochemical profiles were also assessed. The levels of EPA and DHA were measured from a total of 14 species of marine fish, 3 species of freshwater fish, 4 species of shellfish and 2 commercially canned fish. In addition, a total of 380 randomly selected health workers from 4 selected health premises in the state of Kelantan from the period of June 2010 until September 2010, answered a set of questionnaire, their anthropometry were measured and blood samples were taken. The blood samples were analyzed to determine the level of EPA and DHA and other cardiovascular biomarkers.

RESULTS The fat contents of the marine fish species, the freshwater fish species and shellfish ranged from 1.01% to 15.83%. Most fishes in the study have shown that their fat contents were beyond 10% of their body weight while their DHA levels were higher than the EPA levels. The study on the health workers showed that the mean level of DHA was 25.9 µg/ml (SD 27.07) while the mean level of EPA was 2.3 µg/ml (SD 1.58). Our analysis showed that the

EPA level (mean 3.5 µg/ml, SD 1.93) and the DHA level (mean 40.1 µg/ml. SD 25.46) were higher among the medical doctors compared to the other categories of health workers. The levels of EPA (mean 2.8 µg/ml, SD 1.91) and DHA (mean 40.1 µg/ml, SD 25.46) were higher among the health workers with higher level of education. The physical activities, anthropometry measurements and levels of biochemical profiles were not related with the levels of EPA and DHA. The level of EPA was significantly higher in the health workers with higher score of knowledge in Omega 3 compounds and their benefits (adjusted mean 2.8 µg/ml) after we have adjusted the effect of the confounding variables. The level of DHA was also higher in this group of health workers (adjusted mean 37.5 µg/ml).

CONCLUSIONS All species of fishes and shellfishes found in the east coast region of Peninsular Malaysia selected in our study are the important sources for EPA and DHA. The health workers with higher knowledge of Omega 3 have higher blood level of Omega 3. Health promotion activities to promote the knowledge about the sources of EPA and DHA are important in the future. Healthy lifestyle practice which includes taking sources with high EPA and DHA contents will be beneficial for good health.

KEY WORDS Omega 3, Eicosapentaenoic Acid, EPA, Docosahexaenoic Acid, DHA

# Part II

# ABSTRAK

PENGENALAN Dua jenis asid lemak Omega 3 yang utama adalah Asid Eikosapentaenoik (EPA) dan Asid Dokosaheksanoik (DHA). Sumber utama EPA dan DHA datang dari spesis hidupan marin. Kedua-dua EPA dan DHA dikaitkan dengan perlindungan terhadap faktor risiko penyakit-penyakit kardiovaskular, penyakit berkaitan keradangan dan penyakit neuro-psikologi pada manusia. Kajian ini bertujuan menilai paras EPA dan DHA dalam spesis ikan dan kerang-kerangan terpilih marin dan air tawar di pantai timur, Semanjung Malaysia. Seterusnya kajian ini mengukur paras EPA dan DHA darah pekerja-pekerja kesihatan negeri Kelantan, Malaysia dan mencari faktor-faktor penting yang berkaitan dengan tahap EPA dan DHA darah mereka.

KAEDAH Satu kajian keratan rentas telah dijalankan. Ia dibahagi pada dua bahagian; 1) untuk menilai paras EPA dan DHA dalam spesis ikan marin, ikan air tawar dan kerang-kerangan terpilih di sepanjang pantai timur, Semenanjung Malaysia dan 2) untuk mengukur paras EPA dan DHA darah pekerja kesihatan yang telah dipilh secara rawak di negeri Kelantan. Perkaitan paras EPA dan DHA dengan profil sosiodemografi, taraf kesihatan, tahap pengetahuan, aktiviti fizikal, ukuran antropometri dan profil biokimia darah dikaji. Sebanyak 14 spesis ikan marin, 3 spesis ikan air tawar, 4 spesis kerang-kerangan serta 2 ikan yang ditinkan secara komersil diukur paras EPA dan DHA. Manakala, seramai 308 pekerja-pekerja kesihatan yang dipilih secara rawak dari 4 premis kesihatan di negeri Kelantan sepanjang tempoh dari Jun 2010 sehingga September 2010, telah menjawab set soalan berkaitan diet dan diambil ukuran antropometri dan diambil sampel darahnya. Sample darah mereka dianalisa untuk paras EPA dan DHA serta beberapa biomarkers penyakit-penyakit kardiovaskular lain.

KEPUTUSAN Spesis ikan marin, ikan air tawar dan kerang-kerangan mempunyai paras lemak berada dari 1.01% hingga 15.83%. Kebanyakan ikan dalam kajian ini mempunyai paras lemak melebihi 10% dari berat badan mereka dan mempunyai kepekatan DHA lebih tinggi dari kepekatan EPA. Kajian ke atas pekerja kesihatan pula menunjukkan paras min DHA responden adalah 25.9 µg/ml (SD 27.07) manakala paras min EPA pula ialah 2.3 µg/ml (SD 1.58).

Analisis kami menunjukkan paras EPA (min 3.5 µg/ml, SD 1.93) dan DHA (min 40.1µg/ml, SD 25.46) adalah lebih tinggi dikalangan doktor perubatan berbanding pekerja-pekerja kesihatan kategori lain. Paras kandungan EPA (min 2.8 µg/ml, SD 1.91) dan DHA (min 40.1 µg/ml, SD 25.46) juga lebih tinggi dikalangan pekerja-pekerja kesihatan yang mempunyai tahap pendidikan yang lebih tinggi. Aktiviti-aktiviti fizikal, ukuran antropometri dan paras profil biokimia darah didapati tidak berkait dengan paras EPA dan DHA. Paras EPA pula adalah lebih tinggi secara signifikan di kalangan mereka yang mempunyai skor pengetahuan yang lebih tinggi tentang sebatian Omega 3 dan kebaikannya (min disesuaikan 2.8 µg/ml) selepas faktor-faktor potensi pembaur diselaraskan. Begitu juga dengan paras DHA yang didapati lebih tinggi dikalangan golongan ini (min disesuaikan 37.5 µg/ml).

KESIMPULAN Kesemua spesis ikan dan kerang-kerangan di pantai timur, Semanjung Malaysia yang terpilih dalam kajian ini adalah sumber penting untuk EPA dan DHA. Kalangan pekerja-pekerja kesihatan pula yang berpengetahuan lebih tinggi mengenai Omega 3 mempunyai dengan paras kandungan Omega 3 dalam darah yang lebih tinggi. Aktiviti promosi kesihatan bagi meningkatkan pengetahuan lebih baik mengenai sumber EPA dan DHA adalah penting. Pengamalan gaya hidup sihat termasuk pengambilan sumber yang tinggi kandungan EPA dan DHA adalah bermenafaat untuk kesejahteraan kesihatan.

KATA KUNCI

Omega 3, Asid Eikosapentaenoik,EPA, Asid Dokosaheksanoik, DHA

# ATTACHMENT 2

Attachment 2

Summary of findings

From this Research University project, we summarize the aims of the project and the related important findings:

1) To determine the serum blood levels of omega 3 (EPA and DHA) in µg/ml among the medical and health staff population in Kelantan. In this study, we have found that the mean DHA level of the medical staffs in this population was 25.9 µg/ml (SD 27.07) while the mean EPA level was 2.3 µg/ml (SD 1.58). Evidently, the levels of EPA and DHA in our respondents were distinctively lower than the Japanese subjects known for their fish eating communities. On the contrary, when the levels of Omega 3 in our respondents were compared to the non fish eating community, we fared much better.

2) To examine the mean omega 3 fatty acid levels (EPA and DHA) in µg/ml, the knowledge of fish consumption benefits and knowledge of omega 3 compounds among the medical and health staff population in Kelantan. Our results show that the mean score for knowledge of the fish consumption benefits in our study population was 6.9 (SD 4.25) out of the highest possible score of 16. Categorically, 60% of the respondents have scores above the mean. In this study, our respondents were aware on the benefits of omega 3 containing fishes in preventing the detrimental cardiovascular end points like getting a heart attack, developing high blood pressure and reducing the risk of getting stroke. A total of 86.5%, 88.3% and 77.5% of respondents agreed that the fish intake could reduce the risk of developing these three major cardiovascular end points. The respondents who have scored above the mean score were considered as those with better levels of knowledge of omega 3 compound benefits. In addition to that, we have found that the score for the

knowledge of the fish consumption benefit also correlated significantly with the omega 3 compound benefit knowledge (Pearson's correlation coefficient = 0.694, P <0.001).

3) To study the associations between omega 3 fatty acid (EPA and DHA) and the levels of physical activity of based on the International Physical Activity Questionnaire (IPAQ) among the medical and health staff population in Kelantan measure as Metabolic Equivalent Values (MET) scores. When examining this, we have found that, the Metabolic Equivalent Values (MET) scores were negatively correlated with both DHA (Pearson's correlation -0.110, P=0.219) and EPA (Pearson's correlation -0.173, P=0.035) levels. However, analysis of numerical values of EPA and DHA according to the different categories of physical activities did not give any significant associations.

4) To study the associations between omega 3 fatty acid (EPA and DHA) with the clinical characteristics and biochemical profiles among the medical and health staff population in Kelantan. We have observed the negative correlations between the EPA and DHA with blood pressure (systolic and diastolic blood pressures). However, the correlations were not significant. In addition, the correlation between Omega 3 fatty acid (EPA and DHA) with the lipid profiles (total cholesterol, triglycerides, HDL and LDL) and fasting blood glucose levels were also not significant. The DHA and EPA levels were not significantly associated with any active medical conditions such as hypercholesterolaemia, hypertension, diabetes mellitus, stroke, heart attack, arrhythmias and rheumatoid arthritis. It was only significantly different in between those with and without indigestion problems (p = 0.013). Those with no indigestion had higher DHA and EPA levels. Higher Omega 3 levels were observed in those who did not have hypertension, those who did not have indigestion and those without rheumatoid arthritis. Our respondents who have reported the presence of hypertension had lower levels of DHA than those who did not have hypertension.

# ATTACHMENT 3

# COMPREHENSIVE TECHNICAL REPORT: THE OMEGA -3 BLOOD LEVELS AND THEIR ASSOCIATION WITH DEMOGRAPHIC, CLINICAL CHARACTERISTICS, FASTING BLOOD SUGAR AND LIPID PROFILES AMONG HEALTH STAFFS POPULATION

Associate Professor Dr Kamarul Imran Musa
on behalf on the OMEGA-3 TEAM (1001/PPSP/811082)

August 20, 2013

# Omega-3 Team

1. Associate Professor Dr Kamarul Imran Musa (Principal Investigator)
2. Dr Rohana Abdul Jalil
3. Professor Dr Shaiful Bahari Ismail
4. Professor Dr Wan Mohamad Wan Bebakar
5. Associate Professor Gan Siew Hua
6. Associate Professor Wan Rosli Wan Ishak
7. Dr Mohd Ismail Ibrahim
8. Dr Mohd Nazri Shafei
9. En Rosliza Haron
10. Cik Nor Fadzlina Hamid

# Chapter 1

# INTRODUCTION

Over the years, Omega 3 fatty acids have been constantly shown to be beneficial in the prevention of diseases and the promotion of health in human. Omega 3 compounds has been shown to be beneficial in promotion of health and prevention of diseases through the modulation of various processes at cellular level such as the brain and visual function, thrombosis, inflammatory reaction and carcinogenesis (Desmond Surette, 2008). Aggressive advertisement and promotion of health products related to omega 3 fish oil have gained significant share in the consumer market. This shows that the health industry players are taking advantage of the growing evidences of the benefit of omega 3 at the same time meeting consumer's demand although some views on certain benefits are heterogeneous. This will indirectly promote the intake of Omega 3 in whatever forms they may be by consumers (Patch et al., 2005).

Omega 3's most traditional and abundant source are marine fish and seafood. Over the years, fortified food with omega has begun to take place on the shelf of supermarkets and make appearance in village groceries in rural Malaysia. This in addition to the fish based product that Malaysian are already consuming. In this part of the world, with a coastline of 4810 kilometres, sea products are expected to be found easily in households of local population regardless of their economic status. This is because although Malaysia is the net importer of fish,

PENGENALAN Dua jenis asid lemak Omega 3 yang utama adalah Asid Eikosapentaenoik (EPA) dan Asid Dokosahcksanoik (DHA). Sumber utama EPA dan DHA datang dari spesis hidupan marin. Kedua-dua EPA dan DHA dikaitkan dengan perlindungan terhadap faktor risiko penyakit-penyakit kardiovaskular, penyakit berkaitan keradangan dan penyakit neuro-psikologi pada manusia. Kajian ini bertujuan menilai paras EPA dan DHA dalam spesis ikan dan kerang-kerangan terpilih marin dan air tawar di pantai timur, Semanjung Malaysia. Seterusnya kajian ini mengukur paras EPA dan DHA darah pekerja-pekerja kesihatan negeri Kelantan, Malaysia dan mencari faktor-faktor penting yang berkaitan dengan tahap EPA dan DHA darah mereka.

KAEDAH Satu kajian keratan rentas telah dijalankan. Ia dibahagi pada dua bahagian; 1) untuk menilai paras EPA dan DHA dalam spesis ikan marin, ikan air tawar dan kerang-kerangan terpilih di sepanjang pantai timur, Semenanjung Malaysia dan 2) untuk mengukur paras EPA dan DHA darah pekerja kesihatan yang telah dipilh secara rawak di negeri Kelantan. Perkaitan paras EPA dan DHA dengan profil sosiodemografi, taraf kesihatan, tahap pengetahuan, aktiviti fizikal, ukuran antropometri dan profil biokimia darah dikaji. Sebanyak 14 spesis ikan marin, 3 spesis ikan air tawar, 4 spesis kerang-kerangan serta 2 ikan yang ditinkan secara komersil diukur paras EPA dan DHA. Manakala, seramai 308 pekerja-pekerja kesihatan yang dipilih secara rawak dari 4 premis kesihatan di negeri Kelantan sepanjang tempoh dari Jun 2010 schingga September 2010, telah menjawab set soalan berkaitan diet dan diambil ukuran antropometri dan diambil sampel darahnya. Sample darah mereka dianalisa untuk paras EPA dan DHA serta beberapa biomarkers penyakit-penyakit kardiovaskular lain.

KEPUTUSAN Spesis ikan marin, ikan air tawar dan kerang-kerangan mempunyai paras lemak berada dari 1.01% hingga 15.83%. Kebanyakan ikan dalam kajian ini mempunyai paras lemak melebihi 10% dari berat badan mereka dan mempunyai kepekatan DHA lebih tinggi dari kepekatan EPA. Kajian ke atas pekerja kesihatan pula menunjukkan paras min DHA responden adalah 25.9 µg/ml (SD 27.07) manakala paras min EPA pula ialah 2.3 µg/ml (SD 1.58).

EPA level (mean 3.5 µg/ml, SD 1.93) and the DHA level (mean 40.1 µg/ml, SD 25.46) were higher among the medical doctors compared to the other categories of health workers. The levels of EPA (mean 2.8 µg/ml, SD 1.91) and DHA (mean 40.1 µg/ml, SD 25.46) were higher among the health workers with higher level of education. The physical activities, anthropometry measurements and levels of biochemical profiles were not related with the levels of EPA and DHA. The level of EPA was significantly higher in the health workers with higher score of knowledge in Omega 3 compounds and their benefits (adjusted mean 2.8 µg/ml) after we have adjusted the effect of the confounding variables. The level of DHA was also higher in this group of health workers (adjusted mean 37.5 µg/ml).

CONCLUSIONS All species of fishes and shellfishes found in the east coast region of Peninsular Malaysia selected in our study are the important sources for EPA and DHA. The health workers with higher knowledge of Omega 3 have higher blood level of Omega 3. Health promotion activities to promote the knowledge about the sources of EPA and DHA are important in the future. Healthy lifestyle practice which includes taking sources with high EPA and DHA contents will be beneficial for good health.

KEY WORDS Omega 3, Eicosapentaenoic Acid, EPA, Docosahexaenoic Acid, DHA

# Part I

# ABSTRACT

the self sufficiency is adequate at 90% level. In such sense, the frequency of fish eating habit per week is expected to be higher. There is a dose response relationship between the intake of fish meals per week and the risk of developing cardiovascular disease risk factors (Kris-Etherton et al., 2002). The Nurses Health Study that recruits nurse participants too are in favour of this finding (Bronner et al., 2002). Health staffs as a working class group with their constant monthly wages possess a higher purchasing power within the general society. It is postulated that greater purchasing power implies more frequent consumption of fish meals (Naji, 2002). Thus, this study will help to ascertain if the level of omega 3 from the consumption of fish of the coastal population especially among the middle income to the higher income earners in the population is associated with any variables investigated.

The benefit of omega 3 should reach the mass and not only to a certain group of people. One of the cheapest natural sources for omega 3 for consumers is fish. Fish can be bought in abundant to feed the entire family compared to omega 3 supplements in the form of tablets. It is essential that the benefits of omega 3 should not only reach a segment of the population, but it should be indiscriminately population wide. In Malaysia, as in most Asian countries, marine source takes up one fifth of the total protein source in the population (Skonhoft, 2006). A study in the east coast of peninsular Malaysia will shed some light on the fish consumption and omega 3 level among dwellers that are in proximity with the sea.

The non communicable disease (NCD) risk factors in Malaysia showed an alarming rate in the recent third National Health and Morbidity Survey (NHMS 3) from the previous decade. The general prevalence of raised blood pressure, hypercholesterolemia, central obesity, physical inactivity and unhealthy diets among adults were 25.7%, 53.3%, 48.6%, 60.1%, 72.8% respectively (WHO, 2007). It is the hope and target of the nutritional research priority area to promote good dietary practices across the lifespan among Malaysian to combat these NCD risk factors (WHO, 2007). The value of fish diet in reduction of

# Chapter 2

# OBJECTIVES

## 2.1 General objectives

The general objectives of the study is to determine the baseline levels of the Omega N-3 Fatty Acid in and their association to the various characteristics in the health staff population in the state of Kelantan, Malaysia.

## 2.2 Specific Objectives

1. To determine the blood levels of omega 3 (EPA and DHA) in µg/ml among the medical and health staff population in Kelantan.
2. To compare the levels of omega 3 in different socio-demographic and health profiles among the medical and health staff population in Kelantan.
3. To compare the mean between omega 3 fatty acid levels in µg/ml with the knowledge of fish consumption benefits and knowledge of omega 3 compounds among the medical and health staff population in Kelantan.
4. To study the associations between omega 3 fatty acid and the levels of physical activity of based on the International Physical Activity Questionnaire (IPAQ) among the medical and health staff population in Kelantan.

# Chapter 3

# METHODS

## 3.1 Research design

A cross sectional study was conducted from June 2010 till October 2010 among staffs working in selected medical and health facility that represents the Kelantan medical and health staff population.

## 3.2 Study setting and duration

The study was conducted in four health facilities from the northern part of the state of Kelantan, namely Hospital University Sains Malaysia, Hospital Raja Perempuan Zainab 2, Hospital Tengku Anis in Pasir Putih and Hospital Tumpat. The duration undertaken to complete data collection was 5 months, from July 2010 till October 2010. All blood samples EPA and DHA levels analysis were completed in March 2011. All data were analyzed in April 2011.

## 3.3 Population and sample

Reference population of the study was medical and health staffs working in the Malaysian Ministry of Health. Medical and health staffs working in the four

population in Kelantan, sampsi rho command in the stata module were used to determine the sample size for a Pearson correlation. Based on the Pearson correlation between EPA in both the plasma phospholipid and cholesterol ester with the correlation of 0.36 (Shahar et al., 1994). The null Pearson is 0.00. The calculated sample size is 81. From the calculation shown, the minimum sample size needed appropriate would be 300. In expectation of a 10% non response from that total, the final number of respondents to be sampled is decided at 330 medical and health staffs.

## 3.5 Selection criteria

Participants who are eligible to participate must be Malaysian and served at least one year in the current medical and health facility. Excluded are those who personally declared or has record evidence of major cognitive disorders or major psychiatric disorders, those with a history of major cardiac even or major surgery within the past six months, vegetarian and pregnant ladies. Each centre provided a list of names of health staffs. A number is labeled against each name. 330 numbers were randomly selected using the SPSS version 12 software and those numbers corresponds with the numbers labelled against the list of names. The number of staffs selected are in proportion to the manpower size from each unit respectively. 330 randomly selected staffs were approached and explained regarding the study and the need to collect their blood samples if they agree to participate. All of them were given a slip to remind them on the day and place of the meeting with researchers and the things to do such as to fast the night before the blood samples were collected. Those who disagree on the first encounter were replaced randomly with another staff member.

cordance to the recommendations from the WHO (Elmadfa and Kornsteiner, 2008) and the American Heart Association (Kris-Etherton et al., 2003). After rounds of meetings and discussions with team members, which include the nutritionist, we came up with 3 constructs in the knowledge domain, namely "fish consumption and its health benefit", "basic knowledge on Omega 3 compound" and "sources of Omega 3". There are eight questions pertaining to the benefits of fish consumption. Respondents will have to rate their agreeability from the range of "strongly disagree" to "strongly agree". In each of the questions, more than 50% of the responses were generally agreeable to the questions. The breakdown of the range of responses in each question is shown in Appendix 2. In order to determine the levels of knowledge of respondents regarding the benefits of eating fish, the sum of scores for each of the questions are added to give a final score. We have determined that the correct responses to all the questions are correct i.e "agree" to "strongly agree". Therefore, each of the responses of " strongly disagree", "disagree", "not sure", "agree" and "strongly agree" carries a mark of -2, -1, 0, +1 and +2 respectively. The accrual score of all the questions will rate the knowledge of the respondent in this section. The bigger the magnitude, the better the level of knowledge of the respondents.

There were 15 questions all together to assess the respondent's knowledge on omega 3. For each question, there are 5 responses ranging from "strongly disagree" to strongly agree", similar to the previous section. We applied the same arithmetic principles used in the previous section to derive at scores to determine the respondent's levels of knowledge on omega 3. The breakdown of the responses of respondents towards the 15 questions can be seen in Appendix 2. For the pilot study of this questionnaire, we have decided to administer this questionnaire to the medical staffs in a private hospital in Kota Bharu. Permission was acquired from the matron and was granted. 31 staffs enrolled in the pilot study via convenient sampling. The objective of the pilot study was to analyze the validity and reliability of the questionnaires to be used on the actual study later. We also aimed to ensure that all staffs regardless of their

### 3.6.4 Physical Activity Assessment

Regarding the physical activity levels of the respondents, we have used the Malay version of short International Physical Activity Questionnaire (IPAQ) that can be downloaded online at http://www.ipaq.ki.se/ (Hagströmer M, 2005). It is an instrument for population surveillance of physical activity among adults. The IPAQ assesses physical activity in 4 domains, namely, leisure time physical activity, domestic gardening activities, work related physical activity and transport related physical activity. The short IPAQ assessed 3 specific types of physical activities undertaken from the previous domains. There are walking, moderate intensity activity and vigorous intensity activity. Respondents will have to recall and fill in the duration of each type of physical activity that they have performed in the past 7 days. These inputs are then computed using a given formula as per instruction using the statistical software to derive continuous score values which are expressed as MET-minute/week. MET stands for Metabolic Equivalent of Task. These MET-minute/week continuous score values can be categorised further into low, moderate or high physical activities based on the following criteria. 1. Low - No activity reported OR - Some activity is reported but not enough to meet categories 2 or 3. 2. Moderate Either of the following 3 criteria - 3 or more days of vigorous activity of at least 20 minutes per day OR - 5 or more days of moderate intensity activity and/or walking of at least 30 minutes per day OR - 5 or more days of any combination of walking. Moderate intensity or vigorous intensity activities achieving a minimum of at least 600 MET minutes/week. 3. High Any one of the following 2 criteria - Vigorous intensity activity on at least 3 days and accumulating at least 1500 MET minutes/week OR - 7 or more days of any combination of walking, moderate or vigorous intensity activities accumulating at least 3000 MET minutes/week.

The IPAQ was validated in 14 centres in 12 countries produced a repeatable data with Spearman's p clustering around 0.8. Data were comparable in both the short and long forms. Even though the criterion validity had a median p of 0.30, it was comparable with most self reported validation studies (Craig et al.,

girdles (for ladies) removed prior to measurement. All female respondents were measured by female research assistants in a private room for modesty intent. Again, three measurements were performed and the mean value recorded. Blood pressure measurement Blood pressure (BP) was measured in the sitting position on the right arm, using the Omron brand digital sphygmomanometers (Model 5 series, Japan). Readings were taken only after respondents had rested and in a relaxed condition. The average of three readings were recorded in the anthropometric form.

### 3.6.6 Biochemical measurement

All respondents were required to fast overnight. 10 mls of venous blood were drawn from their antecubital fossae on the appointed day. The blood were collected in plain bottles for lipid profiles (total cholesterol level, triglycerides levels, high density lipoprotein (HDL) and low density lipoprotein (LDL)) and sodium fluoride bottles for the blood sugar levels. They were sent to a private lab for assessment. For the EPA and DHA measurement, blood samples were collected in a EDTA tube and ice-transported as soon as possible to the Forensic laboratory in the School of Health Sciences, USM. Once in the laboratory, the blood will be immediately centrifuged at the rate of 3500RPM for 10 minutes. The separated plasma will then be transferred into a new bullet tube. Both the plasma and RBC will then be kept frozen at minus 20 degree Celsius until further analysis using the Gas Chromatography Mass Spectrometry (GCMS) method.

The RBC were prepared using the one step transesterification (Lepage and Roy, 1986), prior to the fast Gas Chromatography (GC) analysis, which has been optimized and validated. The VariansTM GC CP3800 system, equipped with CP8400 Automated Sample Injection System and Mass Spectrometer detector (MSD) were used to carry out the fast GC analysis. The EPA and DHA were extracted by using the simplified one step trans-esterification process (Masood et al., 2005). The formed combined hexane solution from the transmethylation