

**Study on the effect of maturity,
geographical location, seasonal variation
and processing method on fatty acid
profile of Tilapia**



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**Thesis submitted to the University of Sri Jayawardenepura
for the award of the Degree of Doctor of Philosophy in Food
Science and Technology in 2013.**

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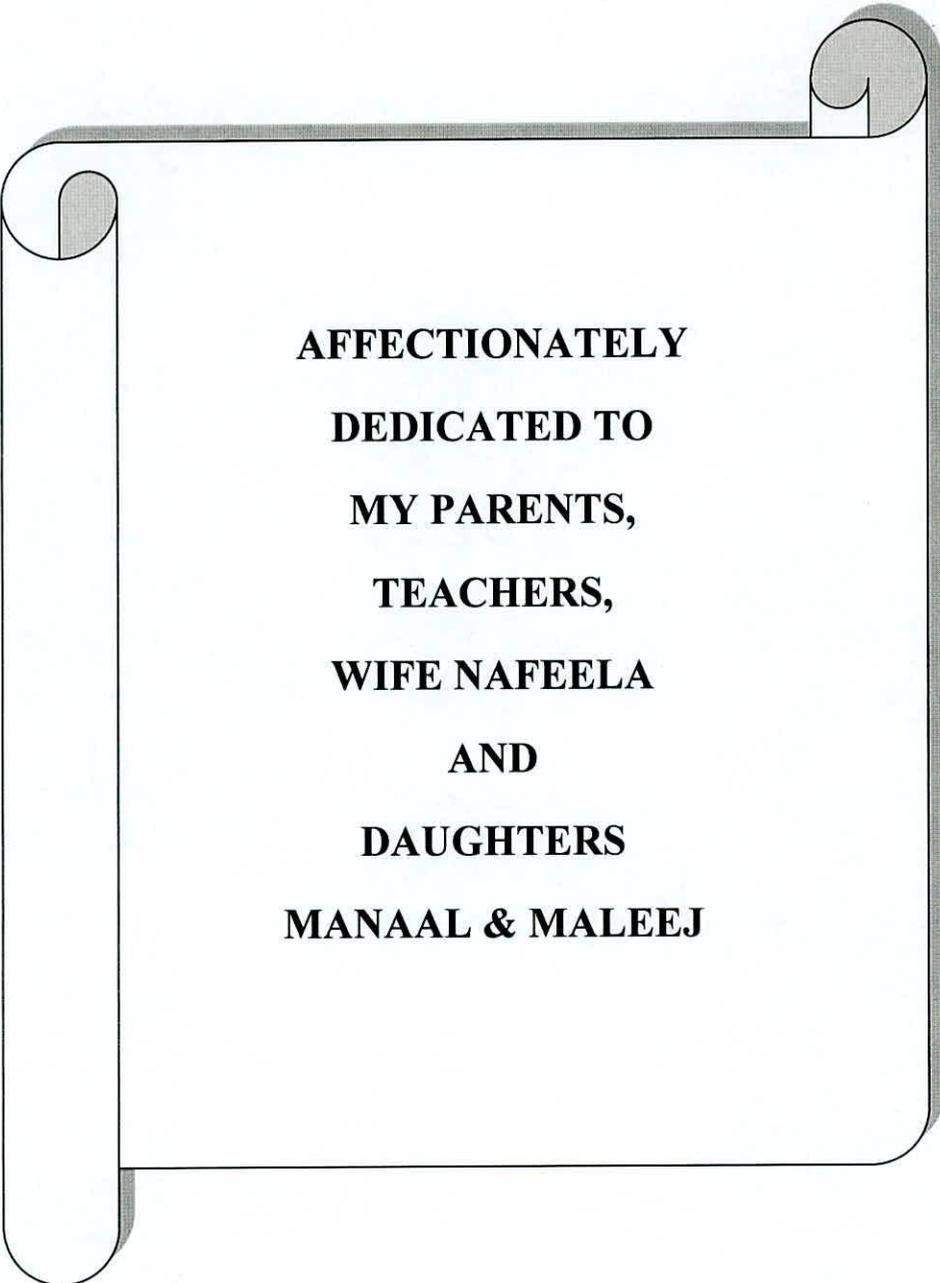
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**AFFECTIONATELY
DEDICATED TO
MY PARENTS,
TEACHERS,
WIFE NAFEELA
AND
DAUGHTERS
MANAAL & MALEEL**

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LIST OF ABBREVIATIONS

- AA - Arachidonic Acid
- AHA - American Heart Association
- AI - Adequate Intake
- ALA -Alpha Linolenic Acid
- BP - Blood Pressure
- CAD - Coronary Artery Disease
- CHD - Coronary Heart Disease
- COX - Cyclooxygenase
- DAG - Diacylglyceride
- DHA - Docosahexaenoic Acid
- DHGLA-Dihomo Gamma Linolenic Acid
- DPA - Docosapentaenoic Acid
- DRI - Daily Recommended Intake
- DTA - Docosatetraenoic Acid
- EDB - Export Development Board
- EFA - Essential Fatty Acid
- EPA - Eicosapentaenoic Acid
- FADS - Fatty Acid Desaturase
- FA -Fatty Acid
- FAME - Fatty Acid Methyl Ester
- FAO - Food and Agriculture Organization
- FDA - Food and Drug Administration
- GC-MS- Gas Chromatography- Mass Spectrometry
- GDP - Gross Domestic Product

GLA - Gamma Linolenic Acid
HDL-C- High Density Lipoprotein-Cholesterol
HEPE -Hydroxyeicosapentaenoic Acid
HETE -Hydroxyeicosatetraenoic Acid
HPEPE-Hydroperoxyeicosapentaenoic Acid
HPETE- Hydroperoxyeicosatetraenoic Acid
HUFA -Highly Unsaturated Fatty Acid
IBD - Inflammatory Bowel Disease
IL - Interleukin
IOM - Institute of Medicine
IQ - Intelligence Quotient
LA - Linoleic Acid
LC -Long Chain
LC-PUFA-Long Chain Polyunsaturated Fatty Acids
LDL- C-Low Density Lipoprotein-Cholesterol
LOX -Lipoxygenase
LT -Leukotriene
MAG - Monoacylglyceride
MFARD- Ministry of Fisheries and Aquatic Resources Development
MI - Myocardial Infarction
NAQDA- National Aquaculture Development Authority
PG - Prostaglandin
PL - Phospholipid
PUFA - Polyunsaturated Fatty Acids
RDA - Recommended Dietary Allowance
SCD - Sudden Cardiac Death

SCFA - Short Chain Fatty Acid

SDA - Stearidonic Acid

SFA - Saturated Fatty Acid

TAG - Triacylglyceride

TX -Thromboxane

UK - United Kingdom

US - United States

VLDL-C-Very Low Density Lipoprotein-Cholesterol

WHO - World Health Organization

Study on the effect of maturity, geographical location, seasonal variation and processing method on fatty acid profile of Tilapia

Udumalebbe Abdul Majeed

ABSTRACT

Tilapia (*Oreochromis niloticus*) is a freshwater fish species that is widely cultured and frequently consumed in Sri Lanka. It is a good source of proteins and health improving fatty acids.

A study was carried out to investigate the impact of maturity stages (six maturity stages, weight ranging from 97.50 ± 2.12 g to 543.00 ± 12.72 g), geographical distribution, seasonal effects and processing methods on proximate composition and fatty acid profiles of Nile tilapia (*O. niloticus*) fillets. For maturity variation, six different sized groups of samples were selected. For assessing the effect of geographical distribution, samples were collected from two different locations, namely, Bandarawela (Wet zone) and Mannar (Dry zone). For studying the seasonal variation, the samples were collected at one month interval over a period of six consecutive months. Smoking, boiling, and frying (in virgin coconut oil) were adopted as processing methods and compared with raw samples.

The proximate composition was assessed as described in the AOAC (1984) and the oil from Tilapia fillets was extracted according to (Bligh and Dyer, 1959). The preparation of fatty acid methyl esters (FAME) and the analysis of GC-MS were done according to (AOCS, 1992).

Proximate values of nutrients namely moisture, ash and fat contents showed a significant variation with maturity stage, geographical location, season and processing

method. Significant variation ($p < 0.05$) was observed only in n-6 FAs and n-3/n-6 ratio with respect to maturity stage. Significant variations ($p < 0.05$) were observed in PUFAs, n-3 FAs and EPA+DHA content with respect to time (January, February and March, 2013), whereas no significant variation ($p > 0.1$) was observed with respect to geographical locations. Significant variation ($p < 0.1$) was observed in SFAs with respect to geographical locations, while not ($p > 0.1$) with respect to time (January, February and March, 2013). No significant variations ($p > 0.1$) were observed in MUFAs, n-6 FAs and n-3/n-6 ratio with respect to both geographical location and time as well. Significant variation ($p < 0.05$) was observed in SFAs, MUFAs, PUFAs, n-3 FAs, EPA+DHA and n-3/n-6 ratio with respect to season, whereas, no significant variation was observed in n-6 FAs. Significant variations ($p < 0.05$) were observed in PUFAs, n-3 FAs, EPA+DHA and n-3/n-6 ratio, SFAs ($p < 0.1$) and MUFAs ($p < 0.1$) with respect to processing methods, whereas no significant variation ($p > 0.1$) was observed in n-6 FAs. Marginal variations in FAs were observed in smoking and boiling process, whereas, significant variations in FAs were observed in frying process. Frying in coconut oil significantly reduced the health beneficial n-3 FAs such as EPA and DHA.

Since the study showed significant variations with respect to maturity, geographical location and seasonal variation, it is suggested that Tilapia is reared in ponds under controlled conditions so that the highest benefits with respect to protein content and health beneficial fatty acids are obtained.