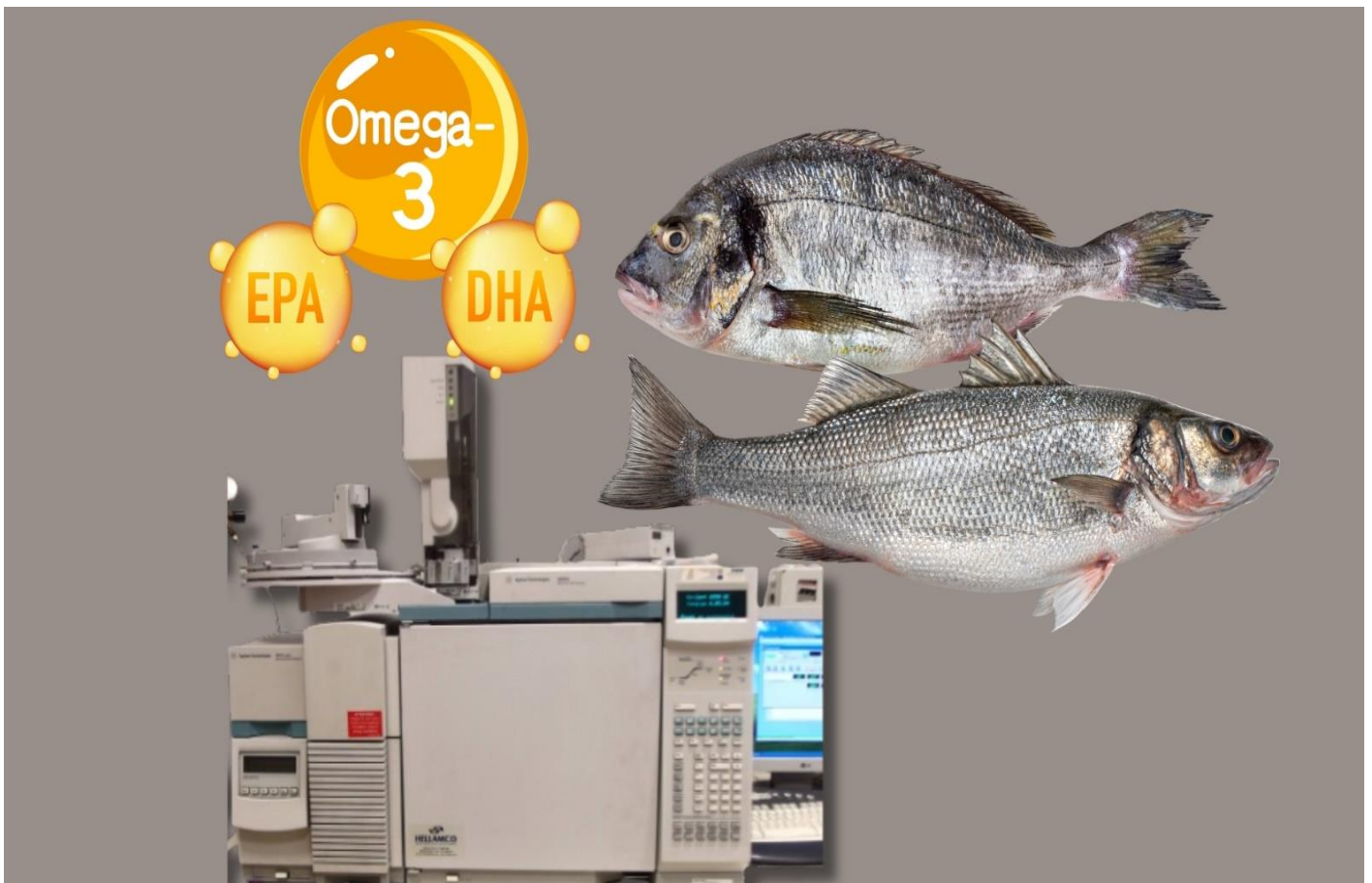


Informative Study Guide

2024

Application of gas chromatography for the determination of fatty acids in fish and fish feed



1. Introduction

The Center of Continuing Education and Lifelong Learning (CCELL) of the Agricultural University of Athens (AUA) welcomes you to the educational program entitled " **Application of gas chromatography for the determination of fatty acids in fish and fish feed** " with a total occupational duration of **32.5 hours**. The program will be conducted in the Laboratory of Applied Hydrobiology of the Department of Animal Science at the Agricultural University of Athens and will be implemented using a **blended** learning approach, **distance learning** (Synchronous Education) through the CCELL /AUA E-class platform and **in-person** (participants' physical presence is required).

Scientific Coordinator of the program is Ms. **Eleni Miliou**, Professor of the Department of Animal Production Science of the Agricultural University of Athens

2. Purpose

The current Training Program is implemented within the framework of the action: "External services implementation" of the EU-CONEXUS-RESEARCH FOR SOCIETY (EU-CONEXUS-RFS) program of the European Commission (HORIZON 2020), with the main objective of combining access in advanced research infrastructures and processes, training in how to use them, learning new skills and sharing best practices (job shadowing)

3. Program Necessity

Fatty acids are an important component of the human diet and affect health. The determination of fatty acids in fish and fish feed helps to ensure the quality of the food we consume. Analysis of lipid composition and changes in fatty acid content during processing can provide valuable information on the nutritional quality of fish and seafood. This knowledge can help promote the consumption of fish species with higher levels of beneficial fatty acids to support overall health and well-being. The composition of fish feed in fatty acids plays an important role in the development, physiology, quality and well-being of farmed fish in Aquaculture. At the same time, the production of Aquaculture products through sustainable practices contributes to the improvement of the production process, as well as the protection of the environment by reducing the environmental footprint of the Aquaculture industry.

4. Learning objectives

Upon completion of this course, participants will have understood the importance of fatty acids both in fish themselves and in the diet of consumers, and will have been taught the commonly used methods for analyzing the fatty acid composition of fish and fish feed.

Knowledge:

1. Understanding the significance of fatty acids in fish
2. Introduction to the commonly used methods for analyzing fish fatty acid composition
3. Recognition of the nutritional value of fatty acids in human diet
4. Searching, analyzing and synthesizing data
5. Knowledge of Aquaculture production systems
6. Ability to troubleshoot problems in the production process

Skills:

1. Promotion of creative and inductive thinking
2. Adaptation to new situations

3. Decision making
4. Promotion of creative and inductive thinking

Abilities

1. Respect for the natural (aquatic) environment
2. Animal (fish) welfare awareness
3. Individual and group work

5. Target group

Graduates of Schools of Natural Sciences such as, for example: graduates holding a degree in Marine Science, Oceanography, Animal Sciences, Biosciences, Biotechnology, Biology, Biochemistry, and other Applied Sciences, Veterinary Sciences, high school teachers in Natural Sciences, as well as other individuals interested in the subject.

6. Certificates

Certificate Type:

- Certificate of Education

7. Educational program structure

Title of teaching unit	Subunit title	Duration in hours	ECVET/ ECTS
« Application of gas chromatography for the determination of fatty acids »	Subunit 1.1: Introduction to gas chromatography and fatty acid analysis	5,0	0,2
	Subunit 1.2: Folch extraction: which combines chloroform and methanol, to isolate lipids from tissues.	7,5	0,3
	Subunit 1.3: Esterification: Fatty acids can be converted into fatty acid methyl esters (FAMES) using reagents like boron trifluoride (BF ₃) in methanol.	4,0	0,2
	Subunit 1.4: Gas chromatography: FAMES analysis with capillary gas chromatography (GC) with the help of internal standards.	5,0	0,2
	Subunit 1.5: Fatty acids peaks identification with Chemstation software	11,0	0,4

8. workshop

Practical training is NOT included

9. Scientific team

Scientific Manager of the program is Ms. [Eleni Miliou](https://zp.aua.gr/faculty/miliou-barsaki_eleni/) Professor, Department of Animal Production Science, Agricultural University of Athens

https://zp.aua.gr/faculty/miliou-barsaki_eleni/

The training program is delivered by members of the AUA academic staff of the and external collaborators:

[Eleni Miliou](https://zp.aua.gr/faculty/miliou-barsaki_eleni/), Professor, Department of Animal Production Science, Agricultural University of Athens

https://zp.aua.gr/faculty/miliou-barsaki_eleni/

[Evanthia Chatzoglou](#), University Research Associate AUA

(CV in pdf attached)

10. Method of implementation

- *Mixed*

11. Training techniques - Tools - Equipment

The training techniques in this training program are designed taking into account the specificities and needs of adults. They have been designed and adapted according to the needs and interests of those employed in the fields of Marine Science, Biosciences, Veterinary Sciences, Food Safety, and Education. Training methods will be employed where participants actively engage in experimental procedures, create working groups for activities that promote critical thinking, and expand knowledge in the subject of study. Participants will be trained with the aim of perceiving the direct correlation between learning and practical application in their workplace. Training will be conducted using the scientific equipment of the Applied Hydrobiology Laboratory of the Agricultural University of Athens, in laboratory rooms of the premises as well as in classrooms of the Department of Animal Science. Additionally, for remote teaching methods, the capabilities of Microsoft Teams software or the CCELL/AUA E-class platform will be utilized.

With the present method, using gas chromatography with a flame ionization detector (GC/FID), the percentage of fatty acids in fish oils of fish feed (marine oils), as well as in the fat isolated from fish flesh, is determined.

Analytically:

- Folch extraction of total fat from fish and fish feed: carried out using a solvent mixture containing chloroform and methanol.
- Preparation of Fatty Acid Methyl Esters: Esterification with BF_3 is an efficient method that allows the conversion of fats into methyl esters of long-chain fatty acids for further analysis by gas chromatography.
- Gas chromatography: sample methyl esters (FAMES) are separated based on their carbon chain length (CL), the number of unsaturation sites and the positions of double bonds (isomers) through a fused silica column. This method determines the content and concentrations of saturated fatty acids (SFA), cis-monounsaturated fatty acids (MUFA) and cis-polyunsaturated fatty acids (PUFA), including arachidonic acid (ArA), eicosapentaenoic acid (EPA) and docosahexaenoate acid (DHA), in marine oils
- Identification and quantification of fatty acid peaks with Reference Mix standard via Chemstation software

Laboratory equipment:

- Analytical balance accurate to 0.1 mg,
- Centrifuge with a head suitable for centrifugation of tubes with a capacity of 15 ml (4,000 g)
- Furnaces temperature 40 – 100°C
- Nitrogen evaporator/Hotblock 30-110°C
- Capillary column gas chromatograph

12. Educational Materials - Additional Resources

The educational material of the seminar consists of notes describing the theoretical background of the analyses, their purpose and significance, and their applications in the fields of Marine Sciences, Biosciences, Veterinary Sciences, and Food Safety. Additionally, analysis protocols with instructions for equipment use are provided. Supplementary sources of information such as literature, websites, and video presentations are also offered, aiming to expand knowledge on the subject, explore the possibilities of applying the provided knowledge and enhance relevant skills.

13. Evaluation Methodology

13.1 Evaluation of trainees

1. Solving exercises during the seminar
2. Final examination with **multiple-choice questions** (minimum passing level: 50% correct answers).

13.2 Evaluation of the training program (trainers, trainees, CCELL)

The evaluation of the training program will be done through a questionnaire completed by trainees. The findings will be used to continue and/or improve the training program.

14. Obligations of trainees/Certificate of Education

To successfully complete the program, participants must:

- have attended all the teaching modules. Absences cannot exceed 10% of the scheduled training hours.
- to have successfully completed the training program examination, the trainees must answer correctly at least 50% of the questions of the final examination, i.e. achieve a grade of at least 50, with an excellent score of 100. In this case, the trainees receive a Certificate of Education, which is published by the Center for Education and Lifelong Learning of the Agricultural University of Athens. The examination will take place through the **electronic CCELL/AUA E-class platform**.
- to have paid all the tuition fees by the start of the Program.
- to have submitted the completed evaluation questionnaire of the Educational Program.

After the successful completion of the program, the participants are awarded a Certificate of Education, which is issued (in English) by the Center of Continuing Education and Lifelong Learning (CCELL) of AUA.

Participants who attended but did not complete the entire program may be provided with a **Certificate of Attendance**.

15. Participation cost/Discount policy

The cost of joining the program is **100 euro** and must be paid before the start of the program in order to secure participation in the program.

Discount Policy:

- to AUA graduates: 15%,

Interested parties **deposit the above amount into the following account**, in which the beneficiary is the **AUA Special Research Funds Account (E.L.K.E.)**, necessarily stating their name and the ELKE code of the project: **(Code: 80211)**.

National Bank in the account with IBAN GR 280110040000004001883448

The proof of deposit is attached to the submitted application electronically on the website of the Center of Continuing Education and Lifelong Learning (CCELL) of the Agricultural University of Athens (AUA).

16. Applications

Those interested submit an application online until **19/03/2024** [on the website of the Center of Continuing Education and Lifelong Learning \(CCELL/K.E.DI.VI.M.\)](#) of the AUA and fill in or attach all the prerequisites.

In the event that the minimum required number of trainees is not gathered, CCELL reserves the right to change the start date of the program or to cancel it.

17. Contact

For more information, interested parties can contact

- with the Secretarial Support of the e-mail program: echatzoglou@aua.gr Telephone number: 210 5294401 (10.00-15.30)
- with the Secretariat of the Center of Continuing Education and Lifelong Learning (CCELL/K.E.DI.VI.M.) of the Agricultural University of Athens: email: kedivim@aua.gr Telephones: 210 5294400 (10.00-15.30)