COURSE CODE:	FIS502
COURSE TITLE:	Fishery Technology, Processing and Storage
NUMBER OF UNITS:	2 Units
COURSE DURATION:	Two hours per week

COURSE DETAILS:

Course Coordinator:	Dr. (Mrs.) F.O.A. George
Email:	adebukolageorge@yahoo.com
Office Location:	Room D211, COLERM
Other Lecturers:	Dr. O.J. Olaoye and Dr. (Mrs.) N.B. Ikenweiwe

COURSE CONTENT:

Post harvest spoilage, principles and methods of preservation, packaging, storage, product evaluation and quality control; Estimation of nutrient in fish flesh. Traditional versus modern fish preservation techniques.

COURSE REQUIREMENTS:

This is a compulsory course for all students in Department of Aquaculture & Fisheries Management. In view of this, students are expected to participate in all the course activities and have minimum of 75% attendance to be eligible to write the final examination.

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READING LIST:

• Horwtz, W. (*2000). Association of Official Analytical Chemists (now AOAC International) 17th*
ed Gaithersburg, Md. : AOAC International.
• Osborne, D. R. and Voogt, P, (1978). The analysis of nutrients in foods. *London; New York : Academic Press, 251 p.*
• Pearson, D. (1976). The chemical analysis of foods. Seventh edition, Churchill Livingstone, Edinburgh London and New York. 575p.

LECTURE NOTES

NUTRIENT IN FISH FLESH

• The component of food which are capable of been utilized by animal are described as Nutrients.

• A nutrient is food/ chemical/ substances that an organism needs to live and grow or used in metabolism must be taken in from its environment.

• A nutrient may be defined as any chemical element or compound in the diet or given parentarily special cases that support normal reproduction, growth, location and maintenance of life processes.

• There are **six classes** of nutrients namely: water, protein & amino acids, lipids, minerals & vitamin, carbohydrates, inorganic elements.

• Nutrient- essential/ indispensable & non-essential

Deficiency of good nutrients lead to:

• reduced growth rate (stunted)

• depressed appetite

• disease or even death

Types of nutrients and examples of each.

• Micronutrient e.g Zinc, Lead, Molybdenum, Fluorine, Silicon, Chloride, Copper, Iodine, Manganese,, Cobalt, selenium, molybdenum, etc.

• Macronutrient e.g Sodium, Calcium, Nitrogen, Sulphur, Potassium, Phosphorus, Magnesium,
Oxygen, Carbon, Hydrogen, etc.

• Nutrient could either be classified as:

• Macro nutrient and Micro nutrients.

• Essential and non-essential.

• Nutrients needed in relatively large quantities are called **macro-nutrient** while those needed in relatively small quantities are called **micronutrients**.

• Macronutrients are proteins, carbohydrates, fat and oil.
Micronutrients on the other hand are vitamins (both fat and water soluble) and minerals.

• A nutrient is **essential** to an organism if it cannot be synthesized by the organism in sufficient quantities and must be obtained from an external source.

• A nutrient that is not made by the body is therefore essential. These include essential fatty acids, essential amino acids, vitamins, and certain dietary minerals.

• Whereas, **non-essential nutrient** can be synthesized in the body and thus not important nutritionally. E.g. dietary fibre

COMPOSITION OF NUTRIENT

• Proteins: Amino acids; Nitrogen and Hydrogen Element.

• Carbohydrates: Sugars; Carbon, Hydrogen and Oxygen Element.

• Fats and oil: Carbon, Hydrogen and Oxygen.

• Minerals and Vitamins: Inorganic elements.

NUTRIENT AND BALANCED DIET

• **N**utrients are substances that provide nourishment.
Whereas, balance diet is food containing all nutrients (macro and micro) in right proportion at the right time.

DETERMINATION OF PROXIMATE COMPOSITION OF A GIVEN FISH SAMPLE

• Proximate analysis is a laboratory techniques that informs about a relative proportion in which the different classes of food occur in a particular feedstuff or ingredients.

• In analyzing fish ingredient, we have the:

• Qualitative analysis and Quantitative analysis.
• Qualitative analysis will determine whether the ingredient is there while Quantitative will determine the amount of ingredients there.

MOISTURE CONTENT

• Fish sample intend for moisture analysis must be prepared to prevent loss of water. It involves the measurement of the weight lost due to the evaporation of water. The **methods** used are:
• Air oven method/ drying method/indirect distillation methods.
• Vacuum oven method/ direct distillation method.
• Electrical moisture meters.
• Chemicals methods.
• Karl Fischer method
• Dean and Stark distillation
• **The apparatus and materials for oven drying methods are;**
• Moisture extraction oven
• Desiccations with silica gel.
• Analytical balances
• Porcelain dishes
• Spatula
• Labeling papers and magic markers
• It can be determined using the calculated percentage of moisture in the fish sample:
• % moisture = weight of moisture/weight of sample*100
• OR
• Wet weight minus dry weight/wet weight*100

FAT CONTENT

• The fat content of a fish sample can be determined using the following **methods**;
• Soxhlet method.
• Weibul method/ total fat method.
• Volumetric method.
• The percentage fat content is determined as;
• % fat = weight of fat/ weight of sample*100
• V2= Volume of HCL for the test (ml)
• V1= Volume of HCL for the blank test (ml)
• W= Weight of the sample (g)
• N= Normality of HCL
• Conversion factor (C.F)= 6

ASH CONTENT/MINERAL CONTENT.

• Ash is the inorganic residue remaining after the organic matter has been burnt away.
• The ash obtained is not necessarily of exactly the same composition as the mineral matter present in the original fish sample as there may be losses due to volatilization or some interaction between constituents.
• Ashing is done by the ignition of the food sample at specific temperature. The **methods** used are:
• Total dry ash method.
• Water soluble ash method.
• Metal/ atomic absorption method.
• Acid insoluble ash method.
• Sulphated ash method.
• Mathematically, it is calculated thus;
• % ASH =ash weight (g)/ sample weight (g)*100

CARBOHYDRATE CONTENT

• This is the energy source of the fish sample other than protein.
• The carbohydrate content can be determined by subtracting the percentage of water, ash protein and fat from100.
• Calorific value can then be estimated multiplying the percentage of carbon

CRUDE FIBRE CONTENT

• Crude fibre is the organic residue which remains after the material has been treated under standardized condition with light petroleum, boiling, and dilute H_2SO_4 acid, boiling dilute NaOH solution, dilute HCl, alcohol and ether.
• The crude fibre consists largely of cellulose together with a little lignin. The **methods** used are;
• Volumetric method.
• Dissolution and oxidation method.
• Titration method.
• Mathematically;
% crude oil fibre
• = weight of fibre ash - weight of ash/ weight of the original sample*Dm
• DM= dry matter
• DM= 100-Moisture content

CRUDE PROTEIN CONTENT

• This is the conversion of the nitrogen of the nitrogenous substance into ammonia by boiling with concentrated H_2SO_4 which is fixed by the excess of acid as ammonium sulphate.
• The methods used are;
• Digestion.
• Distillation.
• Titration.

Crude protein Determination

• **Principle and scope:** Estimated by a process developed by a Danish chemist/ brewer, John Kjeldahl. He discovered that 'all protein' contains about the same amount of Nitrogen (16%). He analyzed for nitrogen, which is relatively easy, and calculated crude protein on the basis: 100/16 = 6.25, therefore: NITROGEN x 6.25 = CRUDE PROTEIN. In the presence of sulphuric
acid, sodium sulphate and a catalyst, the amino nitrogen of many organic materials is converted to ammonium sulphate. The ammonia is distilled from an alkaline medium and absorbed in standardized mineral acid. The ammonia is determined by back titration with a standardized mineral base.
• Sample Preparation:
• For fish and fish products that contain no free liquid: comminute the sample until homogenous
• For fish meal grind the sample in a mill or other suitable apparatus until it will pass through a no. 20 sieve.
• Collect the homogenized sample into a thoroughly cleaned, sealable plastic cup or glass bottle.
• Store the sample in a refrigerator or freezer until required.
• **N.B**: Ensure that the prepared sample is still homogenous prior to weighing. If liquid separates from the sample, thoroughly re-blend before use.

Reagents:

• Sulphuric acid (H_2SO_4), nitrogen-free.
• Cupric Sulphate ($CuSO_4$), nitrogen-free, anhydrous.
• Sodium sulphate (N_2SO_4), nitrogen-free, anhydrous.
• Sodium Hydroxide (NaOH).
• NaOH solution (50%w/v)
• NaOH standardized solution (0.1 or 0.2N)
• Boiling granules, selenized. Hengar granules are suitable.

• Hydrochloric acid (HCL).
• Conway indicator.
• Stock solution. Mix 200ml of 0.1% Methyl red solution (in 50% ethanol) with 50ml of 0.1% methylene blue solution (in 50% ethanol).
• Working solution. Dilute 1 volume of stock with 1 volume of absolute ethanol and 2 volumes of distilled water. (pH: change 5.4: Acid-Purple, Alkaline- Green).

Procedure:

• Accurately weigh 1.2g for fishmeal and 2.5g for soluble or homogenized fish and place in a digestion flask.
• Add sequentially 15g Na2SO4, 1g CuSO4, one or two selenized boiling granules and 25ml of conc H2SO4 to the flask.
• Digest until solution is almost colourless or light green (2hrs for inorganic materials) and then at least a further 30minutes. Do not heat any part of the Kjeldahl flask above the level of the digestion moisture.
• Cool (do not allow to solidify), and cautiously add 200ml water. Add additional boiling granules (if necessary) to prevent bumping.
• Pipette 100ml 0.1N HCL into a 500ml Erlenmeyer flask, add 1ml Conway's indicator and place the flask under the condenser ensuring that the condenser tip is immersed in the acid solution.
• Tilt the Kjeldahl flask containing the digested sample and add 100ml of 50% NaOH solution slowly down the side of the flask.
• Heat until all ammonia has passed over into the standard acid.
• Calculation:
• Calculate the percentage nitrogen (wet weight basis) as follows:
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• % Nitrogen (wet) = (A-B) x1.4007 x 100
• Wt (g) of sample
• A = vol. HCL x normality of standard. HCL
• B = vol. NaOH x normality of standard NaOH

Limitation:

• This procedure assumes all nitrogen present
• %Nitrogen (dry) = %Nitrogen (wet) x 100
• (100 - % moisture)
• Where 6.25 is the protein-nitrogen conversion factor for fish and fish by-product.
– in the sample are in form of protein. This assumption is not necessarily true as nitrogen could be in the form of nucleic acid, (RNA, DNA) or urea.
• Different proteins need different correction factors because they have different amino acid sequence.
• The technique is time consuming to carry out.
• The use of concentrated H2SO4 at high temperature pose a considerable hazard as does the use of some of the possible catalyst.

IMPORTANCE OF PROXIMATE ANALYSIS IN NUTRITIONAL STUDY

• Proximate analysis reveals nutrient composition of food and fish and thus it is a significant tool in formulation of balance diet. Before any food item can be taken in right proportion, the first step is determining its nutrient composition and then its classification to nutrient

classes such as carbohydrate, protein, fat, minerals, and vitamins etc. then formulation of balanced diet.
• Proximate analysis also increases our knowledge of minor food constituents.
• It is very important in food quality control as it can be used to determine contamination and adulteration in food products.
• It is the basis for nutritional evaluation of food.

ASSIGNMENTS

• Compare and contrast microkjeldahl and microkjeldahl method of protein determination.
• What are the relationship between nutrients and balance diets.
• Explain the process of defatted a fish sample.
• ***PRACTICAL DEMONSTRATION IS COMPULSORY***