Unit title: Food Molecules, Additives and thier Roles

Unit code: **R/601/0237**

Level: **5**

Credit value: **15**

Aim

This unit provides learners with an understanding of the relationship between structures of food chemicals within key nutrients and their roles in food.

Unit abstract

This unit is designed for those learners with a specialist interest in food science and, in particular, the role of complex biological molecules within food. The unit will be of value to learners wishing to gain employment within analytical laboratories in the food industry or the County Analyst and Scientific Advisory Service. It would also be valuable for those wishing to pursue a career in nutrition or dietetics.

This unit provides a detailed look at macro-nutrients and their function in foodstuffs. It will give learners the opportunity to see the effect of food processing on each nutrient and, in turn, to identify their nutritional value after this process.

Food additives are also considered in order to show how they can be used positively within the manufacturing of food and why food labelling is so important.

Learning outcomes

On successful completion of this unit a learner will:

1 Understand the relationship between the structure of food carbohydrates and their functions in foodstuffs

2 Understand the structures and functions of food proteins and enzymes

3 Understand the structures and functions of food lipids

4 Understand the nature and functions of additives in food.

Unit content

1 **Understand the relationship between the structure of food carbohydrates and their functions in foodstuffs**

Structure of carbohydrates: simple ring and straight chain forms of monosaccharides; formation of glycosidic bonds to form disaccharides; formation of polysaccharides

Structure and function of carbohydrates: monosaccharide structure (Fischer and Haworth structures); starch granules; amylase; amylopectin; glucose syrups; dextrose equivalent; modified starches; cellulose; pectin; alginate; carageenan; homo- and heteroglycans; linear and branched chains

Properties of food carbohydrates: gelatinisation and retrogradation of starch; effect of chemical modification on properties of starch; importance of hydrogen bonds in thickening and gelling; importance of pH to thickening and gelling eg carboxylate ions in pectin; role of calcium ions in gelling eg alginate egg-box model; importance of branched and linear chains to thickening and gelling; occurrence of junction and super junction zones; properties of glucose syrups eg sweetener, thickener, humectant

Effects of processing on carbohydrates: pH; heat; browning reactions

2 **Understand the structures and functions of food proteins and enzymes**

Protein structure: hydrophilic and hydrophobic nature of proteins; globular and fibrous proteins in foods; isoelectric point and its importance in foods; denaturation and its importance in foods; categories of proteins eg albumins, globulins

Food proteins: milk proteins eg caseins, albumins and globulins and their relative stability to heat and pH; egg proteins eg ovalbumin and phospho and lipoproteins; the effect of age on pH; effect of heat; meat proteins eg actin and myosin; post-mortem glycolysis; myoglobin and its oxidation

Effect of processing on food proteins: heat; pH; emulsification

Occurrence of enzymes in food: phosphatase and lipase in milk; pectinase; phenol oxidase; lipoxygenase

Use of enzymes in food: invertase; glucose oxidase; chymosin; amylases; glucose isomerase; lipase; lactase; proteases; immobilised enzymes

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3 **Understand the structures and functions of food lipids**

Lipid structure: mono and diglycerides as emulsifiers; fatty acid classification eg International Union of Pure and Applied Chemistry (IUPAC) and omega nomenclature; saturated and unsaturated eg cis and trans isomers and their occurrence in foods; phospholipids as emulsifiers

Reactions of lipids: hydrogenation eg production of trans isomers and hydrogenated fat; interesterification and its effect on melting point; hydrolytic and oxidative rancidity (causes and prevention); measurement of rancidity eg peroxide value (PV) and free fatty acids (FFA)

Plasticity in food processing: production of different fat crystal types and their importance in foods such as chocolate and butter; solid fat index and plasticity of fats

4 **Understand the nature and functions of additives in food**

Antioxidants: functions of antioxidants eg ascorbic acid, propyl gallate, butylated hydroxyanisole

Anti-caking agents: functions of anti-caking agents eg magnesium carbonate, calcium hydroxy phosphate

Flavour enhancers: functions of flavour enhancers eg monosodium glutamate, ethyl acetate, ethyl formate

Preservatives: functions of preservatives eg vitamin B12, vitamin A, vitamin D, nicotinic acid, citric acid, acetic acid

Sweeteners: functions of sweetners eg sorbic acid, sulfur dioxide, sodium metabisulfate

Thickeners and emulsifiers: lecithins; pectin; alginates; guar gum; carboxymethyl cellulose

Colouring agents: functions; E-numbers examples; natural eg ß-carotene, chlorophyll, caramel; synthetic eg erythrosine, tartrazine

Codes of practice: legislation; the Food Standards Act 1999, 1994

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	**Assessment criteria for pass** The learner can:
LO1 Understand the relationship between the structure of food carbohydrates and their functions in foodstuffs	1.1 explain how carbohydrates are affected by food processing 1.2 evaluate the relationship between the structure of food carbohydrates and their function as thickeners and gelling agents
LO2 Understand the structures and functions of food proteins and enzymes	2.1 compare the structure of food proteins to their function and properties 2.2 explain how the properties of food proteins affect the methods used in the production of food 2.3 discuss the use of enzymes in food
LO3 Understand the structures and functions of food lipids	3.1 explain how the structure of lipids and modified lipids relates to their properties 3.2 explain the causes and prevention of rancidity 3.3 discuss the effects of plasticity of fats and their role in foods
LO4 Understand the nature and functions of additives in food	4.1 discuss the functions and use of additives in food 4.2 discuss the labelling of food products.

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Guidance

Links

This unit has particular links with the following units within this qualification:

- *Unit reference number J/601/0235: Industrial Microbiology*
- *Unit reference number L/601/0219: Laboratory Techniques for Applied Biology*
- *Unit reference number F/601/0217: Biochemistry of Macromolecules and Metabolic Pathways*
- *Unit reference number F/601/0234: Human Health and Nutrition.*

Essential requirements

Delivery

Tutors must, wherever possible, utilise practical applications relating structures to functions of food chemicals.

Industrial liaison with food manufacturers and food science laboratories would enhance delivery of this unit.

Assessment

Learners must demonstrate a clear understanding of the relationship between the structures of food chemicals and their roles in foods. In order to do this evidence may take the form of a series of laboratory-based experiments/investigations which consider each identified nutrient and the effects of food processing.

Resources

Learners will need access to appropriate laboratory facilities and library and ICT resources.

Employer engagement and vocational contexts

Learners would benefit from being able to see food being manufactured in industry and also how food science is managed within an industrial laboratory. Visiting speakers working within the food industry, and also individuals working in dietetics, would enhance unit delivery.