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CHEMICAL ANALYSIS OF FOOD PRODUCTS BY USE OF DIFFERENT TECHNIQUES

Kasarla Naveen Kumar, Maya Datt Joshi, Sandeep Kumar and Rupesh Kumar*

Department of Biotechnology, Shobhit Institute of Engineering & Technology (Deemed-to-be-University), Meerut

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***Corresponding Author**
Rupesh Kumar
Department of Biotechnology, Shobhit Institute of Engineering & Technology (Deemed-to-be-University), Meerut.

ABSTRACT

Food is one of the basic needs of the life required for the normal function of the metabolism and the healthy growth of the individuals. The importance and purpose of food testing techniques employed for chemical analysis of food products to determine the various nutritional parameters in the different food products. Foods are basically consists of carbohydrates, protein, fats & water that is consumed by living organisms as a nutritional supplement and maintain the growth. The items which are considered for food sources obtained from plants and animal and other sources. Therefore food testing essentially considered as efficiently production of useful and valuable commercial products. In present scenario, food industry demands the sound inspection and testing to ensure the quality of food. As adulteration prevails in food industry therefore the food testing has a significant role in the analysis of food products. Thus food testing helps in ensuring the safety and quality improvement of food products. Regulatory risks associated with food products are being analyzed for various reasons like compliance with legal and labeling requirements, assessment of product quality, accurate determination of nutritive value. In present study different food products are taken into account for their chemical analysis and evaluation of nutritive value.

KEYWORDS: Food testing, Nutritional value, Chemical Analysis etc.

INTRODUCTION

Food is essential requirements of the individual. It is required for the normal functioning of the body including its development. Basically it consists of sugars, water, fats & proteins that are essential for any living creatures, including human beings and highly required for their nourishments. The source of food may be animal or plant based. Hence, food technology is an investigation about every specialized part of food, starting with reaping and completion with its cooking and utilization. It is the fusion of ideas from a wide range of fields including microbiology, biotechnology & natural chemistry (Akinyele, 2009). The different sub orders of food sciences are:

1. **Food Processing** – It includes the procedures used to change crude fixings into food or to change food into different structures for utilization by living organisms either domestically or industrially.
2. **Food Safety and Security** – It includes the causes, avoidance and correspondence managing food borne ailments.
3. **Food Microbiology** – It includes the positive and negative connections between small scale life forms (microorganisms) and nourishments.
4. **Food Safeguarding** – It is all about the causes and anticipation of value debasement.
5. **Food Building** –It includes the modern procedures used to make food.
6. **Product Improvement** – It is all about the creation of new food items.
7. **Sensory Investigation** – It is about the investigation of how food is seen by the shopper's detects.
8. **Food Science** – It includes the atomic organization of food and the association of these particles in concoction responses.
9. **Food Packaging** – It includes the investigation of how bundling is utilized to protect food after handling.
10. **Food Material Science** – It includes the physical parts of nourishments as for example, thickness, richness, and surface etc. (Floros, 2010)

Basic Composition of food: For proper functioning of body, there is requirement of carbohydrates, proteins, fats, nutrients and minerals. In any case, our body cannot synthesize every one of these supplements. Therefore, food is the main source to get these supplements in a satisfactory amount. On the other way if we don't get these supplements in adequate amount, at that point we may experience the ill effects of various medical issues. So, a balanced eating regimen is constantly suggested which is characterized as an eating regimen containing sugar, protein, fat, dietary filaments, nutrient and minerals in right proportion. Sugars, proteins, and fats accounts for 90% of the dry load of the eating regimen and 100% of 3 its vitality. Each of them gives vitality (estimated in calories). These supplements likewise contrast in how rapidly they flexibly vitality.

Sugars are the fastest, and fats are the slowest (H O Bang et. al. 1976).

Starches, proteins, and fats are processed in the digestive system, where they are digested into their fundamental units like carbohydrates converted into sugars, proteins converted into amino acids, and fats converted into unsaturated fats and glycerol. The body utilizes these essential units to fabricate substances required for development and support. (N N Potter, et. al. 2012).

Water: Water makes up more than 67% of the body weight of the human body. It is very hard to survive without water. All the cells and organs need water to their proper functioning. It fills in as grease and is the premise of salivation and the liquids encompassing the joints. Water also regulates the internal heat level through sweat. It additionally preempts and lightens clogging by moving food through the intestinal tract *(*Manuel Gómez et. al. 2008.*)*

Carbohydrates: Sugar is a natural compound having empirical formula Cn (H2O) n. It consists of carbon, hydrogen, and oxygen. The sugars (saccharides) may be monosaccharide, disaccharides, oligosaccharides and polysaccharides. Polysaccharides serve for the capacity of vitality (e.g., starch and glycogen) and constitute the basic components (e.g., cellulose in plants and chitin in arthropods). Monosaccharides are the simplest sugars that cannot be hydrolyzed to smaller sugar component. Monosaccharides are the significant carbohydrates, being utilized both as an energy source as well as in biosynthesis. At the point when monosaccharides are not promptly required by numerous cells, they are regularly changed over to more space effective structures in the form of polysaccharides. In most living organisms including human beings, this stockpiling structure is glycogen, mainly present in liver and muscle cells. For plants, starch serves the same function. It is made of two monosaccharides namely D-glucose (left) and D-fructose (right). Two joined monosaccharides are combined to form a disaccharide and these are the most straightforward polysaccharides. They are made of two monosaccharide units bound together by a covalent bond known as a glyosidic linkage. Sucrose is the most abundant disaccharide and made of one D-glucose and one D-fructose molecule. Lactose, a disaccharide made up of one D-galactose molecule and one D-glucose molecule. It's mainly present in mammalian milk (Bhardwaj U., 2012).

Dietary Fiber: Dietary fiber, in some cases it is also called roughage. It is the toxic part of plant nourishments having two principle segments namely solvent (prebiotic, thick) fiber that is promptly aged in the colon and insoluble fiber that is metabolically inactive, retaining water all through the stomach. It acts by changing the idea of the substance of the gastrointestinal tract, and by changing how different supplements and synthetic mixtures are ingested. Food wellsprings of dietary fiber are regularly isolated by whether they give solvent or insoluble fiber. Plant nourishment contains the two different types of fiber and it is indicative of plant's qualities (Amit Arjun Kulthe et. al. 2014).

Fats: Fats involve a wide assembling of molecules that are usually dissolvable in normal solvents and insoluble in water. It may be solid or liquid at room temperature, depending on their structure and association. The words "oils", "fats", and "lipids" are similar in their meaning and "Oils" is ordinarily used to imply fats that are liquids at standard room temperature, while "fats" is commonly used to imply fats that are solids at room temperature. "Lipids" is used to suggest both liquid and solid fats, close by other related substances. "Oil" is used for any substance that have very low mixable with water. These occurrences of fats can be orchestrated into inundated fats and unsaturated fats. Types of fats in food are Unsaturated fat, Saturated fat, Monounsaturated fat Polyunsaturated fat Trans-fat Cis fat Omega fatty acids: omega 3, omega 6, and omega 9(J Bruce German et. al. 2006).

Proteins: Proteins are found in all cells and present in practically all pieces of cell. They constitute practically 50% of the body dry weight. Proteins are significant natural constituents of cellular material and extra cell segments. These are significant dietary constituents and play an important role like giving structure to the body, moving oxygen and different substances inside life forms. (Simon M. Loveday, 2019) Proteins are fundamental as constituents of food as well as have a huge task to carry out in the handling and arrangement of food. For the most part, a protein has roughly the accompanying structure: Carbon, 53%; Hydrogen, 7%; Oxygen, 23%; Nitrogen, 16%; and Sulphur, 1%. Foods containing protein are sources of all the fundamental amino acids are called excellent proteins.

Vitamins and minerals: Though nutrients are natural substances (made by plants or creatures), minerals are inorganic components that originate from the nature and water and are consumed by plants or eaten by creatures. Basically vitamins are of two types: Water soluble such as vitamin B1 thamine, B2 riboflavin, B3 nicotinic acid, B5 pantothenic acid, B7 Biotin, B9 Folic acid, B12 Cyanocobalamin and fat soluble vitamins such as Vitamin A, D, E, K (M Akram et. al.2020).

Minerals: Dietary minerals are required by living organisms, other than the four elements such as carbon, hydrogen, nitrogen, and oxygen present in common synthetic molecules. The dietary minerals have a huge role in organizing several biochemical reactions with the required elemental components. Adequate uptake levels of certain chemical compounds as minerals are thus required to maintain minimum health and growth (K. O. Soetan et. al. 2010). Our body needs bigger measures of certain minerals, for example, calcium, to develop and remain solid. Different minerals like chromium, copper,

iodine, iron, selenium, and zinc are called minor elements since we just need modest quantities of them every day. (Reilly C., 2008).

Techniques used in Chemical testing and Analysis of food

Determination of Moisture in food: In principle, the moisture content of a food can therefore be determined accurately by measuring the number or mass of water molecules associated with known mass of sample. It is not possible to directly measure the number of water molecules present in a sample because of the huge number of molecules present there. A number of analytical techniques commonly used to determine the moisture content of foods are based on determinations of the mass of water present in a known mass of sample. Hot air oven method is one of the methods in which appropriate amount of the sample is taken and grounded for replication purpose. Make sure that the sample is neither too thick nor too powdery and able to pass by 1.0 mm sieve. Exactly 5 gm of sample is an earlier dried out and keeps inside the oven for 4 hours. The time should be calculated from the instant the oven achieves 105°C after the dishes have placed. There after the dish should be put back in the oven for half hour time till steady weight is accomplished. The description for the size of the dish would also be contained (AOAC:930.15, 1930,1999). The formula used for calculation of moisture percentage is:

Moisture percentage = (W1- W2) x 100 / W (1)

Where, W1 is the weight of the dish along with the material prior to drying. W2 is the weight of the dish along with the material after drying and W is the weight of test sample

Determination of total Ash: Ash is the inorganic residue remaining after the removal of water and organic matter by heating in the presence of oxidizing agents, which is measure of the total amount of minerals within a food. Analytical techniques for giving information about the total mineral content are based on the fact that how minerals can be distinguished from all the other components? (AOAC:942.05,). The formula used for calculation of moisture percentage is ;

Percentage of total ash (dry basis) = {(w2 - w) x 100 / w_1 – w} + {100 / 100-m} (2)

Where, w is the weight of empty dish, w1 is the weight of sample and dish, w2 is the weight of dish plus total ash and m is the percentage of moisture content.

Determination of Protein: The Kjeldahl method was developed in 1883 by called Johann Kjeldahl. A food is mixed with a strong acid so that it releases nitrogen which can be determined by a suitable titration technique. The amount of protein present in the food is then calculated from the nitrogen concentration. It is usually considered to be *the* standard method of determining protein concentration, although several other methods are available. Since, the Kjeldahl method does not measure the protein content directly, a conversion factor (F) is needed to convert the measured nitrogen concentration to a protein concentration. A conversion factor of 6.25 (equivalent to 0.16 g nitrogen per gram of protein) is used for calculation purpose. However each protein has a different conversion factor depending on its amino-acid composition and it is the only average value. Though, use of different Nitrogen conversion factors for various matrices may lead to improve precision of results. The Kjeldahl method comprises of three different processes namely digestion, neutralization and titration. (AOAC 2000, 2000). The formula used for calculation of moisture percentage is ;

Protein percentage = (blank – Titre Volume) * 6.25 * 0.001401 * 100 * N of NaOH / 0.1 * Sample Weight. (3)

Determine protein as = N x 6.25 (4)

Protein on dry weight basis = Protein content x 100 / (100 Moisture content) (5)

Determination of Fat: Lipid is main constituents of food and present in various forms like monoglycerides, diglycerides, triglycerides and free fatty acid, phospholipid and carotenoids. Fat is soluble in organic solvent and insoluble in water. Because of this, organic solvents like hexane, petroleum ether have the ability to solubilize fat and fat is extracted from food by dissolving it in the solvent by soxhlet apparatus. The fat is collected by evaporating the solvent by heating at its boiling temperature. The formula used for calculation of moisture percentage is ;

Fat percentage = (Weight. of obtained fat / Sample weight) * 100 (6)

Determination of Carbohydrates: A large number of analytical techniques have been developed to measure the total concentration and type of carbohydrates present in foods. The amount of preparation needed to prepare a sample for carbohydrate analysis depends on the nature of the food being analyzed. Aqueous solutions, such as fruit juices, syrups and honey, usually require very little preparation prior to analysis. On the other hand, many foods contain carbohydrates that are physically associated or chemically bound to other components, *e.g.*, nuts, cereals, fruit, breads and vegetables. In these foods it is usually necessary to isolate the carbohydrate from the rest of the food before it can be analyzed. The formula used for calculation of moisture percentage is ;

Carbohydrate % = 100 – (Moisture % + Ash % + Fat % + Protein %) (7)

Determination of Nutritional Value: The nutritional value is the indicative of nutrient content of the food. The value depends on the quantity of food digested & absorbed and the amounts of essential nutrients which it contains like proteins, fat, carbohydrate and vitamins.The nutritional value of food mainly affected by soil and

growing condition, handling & storage and processing. The formula used for calculation of moisture percentage is ;

Energy in Kilo calories= 4 of fat in grams*(Proteins and Carbohydrates weight in grams) + 9 *mass (8)

Chemical Analysis of certain food products: Chemical analysis of certain food products like wheat flour, rice, bread, paneer, milk and chicken has been done to quantify the moisture %, ash %, fat%, protein%, carbohydrate% and energy content. All these values for different products are summarized below:

Product No: PCIB - 2019017001	**Product Name: Wheat Flour**	**Nutritional Value per 100 gm**
Moisture % - 11.55	Ash % - 0.32	Fat % - 1.25
Protein % - 9.22	Carbohydrate % - 77.66	Energy (Kcal/100 gm) – 358.77

Product No: PCIB-2019017002	**Product Name: Rice**	**Nutritional Value per 100 gm**
Moisture % - 12.12	Ash % - 0.21	Fat % - 1.01
Protein % - 8.45	Carbohydrate % - 78.21	Energy (Kcal/100 gm) – 355.73

Product No: PCIB- 2019017003	**Product Name: Bread**	**Nutritional Value per 100 gm**
Moisture % - 25.32	Ash % - 0.22	Fat % - 1.21
Protein % - 7.25	Carbohydrate % - 66	Energy (Kcal/100 gm) – 10.89

Product No: PCIB- 20190117004	**Product Name: Paneer**	**Nutritional Value per 100 gm**
Moisture % - 52.56	Ash % - 0.12	Fat % - 22.65
Protein % - 4.22	Carbohydrate % - 20.45	Energy (Kcal/100 gm) – 302.53

Product No: PCIB-2019017005	**Product Name: Milk**	**Nutritional Value per 100 gm**
Moisture % - 88.58	Ash % - 0.11	Fat % - 2.21
Protein % - 4.45	Carbohydrate % - 4.65	Energy (Kcal/100 gm) – 56.29

Product No: PCIB-2019017006	**Product Name: Chicken**	**Nutritional Value per 100 gm**
Moisture % - 78.22	Ash % - 0.09	Fat % - 10.22
Protein % - 7.32	Carbohydrate % - 4.15	Energy (Kcal/100 gm) – 137.86

CONCLUSION

Analysis is a key part of the scientific assessment of food in order to safeguard that it is reliable, comprises of acceptable additives and free from harmful toxins. The energy content of wheat flour and rice are quite comparable. While energy content bread is very less about 10.89 kcal per hundred gram of sample. The protein percentage of milk and paneer almost same, but energy content of paneer is almost six time higher than those of milk.

REFERENCES

1. Akinyele, I.O. Ensuring food and nutrition security in rural Nigeria. Available at http://www.ifpri.org/publication/ensuring-food-and-nutrition-security-rural-nigeria, 2009.
2. John D. Floros, Rosetta Newsome, William Fisher, Gustavo V. Barbosa-Cánovas, Hongda Chen, C. Patrick Dunne, J. Bruce German, Richard L. Hall, , Mukund V. Karwe, Stephen J. Knabel, Theodore P. Labuza, Daryl B. Lund, Martina Newell-McGloughlin, James L. Robinson, Joseph G. Sebranek, Robert L. Shewfelt, William F. Tracy, Connie M. Weaver, Gregory R. Ziegler Feeding the World Today and Tomorrow: The Importance of Food Science and Technology, An IFT Scientific review, 2010.
3. H O Bang, J Dyerberg, N Hjøorne et. al. The composition of food consumed by Greenland Eskimos. Acta Med Scand, 1976; 200(1-2): 69-73.
4. N. N. Potter and S. Hotchkiss Assessment of Chemical, Rheological and Sensory Properties of Fermented Maize-Cardaba Banana Complementary Food, Food and Nutrition Sciences, 2013; 4(8).
5. Manuel Gómez, Bonastre Oliete, Christina M Rosell et. al. Studies on cake quality made of wheat–chickpea flour blends, LWT- Food Science and Technology, *2008;* 41(9): 1701-1709.
6. Bhardwaj, U. Biochemistry for Nurses. Pearson Education, 2012.
7. Amit Arjun Kulthe et. al. Development of high protein and low calorie cookies, Journal of Food Science and Technology, 2014; 51(1): 151-157.
8. J Bruce German, Cora J Dillard Composition, structure and absorption of milk lipids: a source of energy, fat-soluble nutrients and bioactive molecules, Crit Rev Food Sci Nutr., 2006; 46(1): 57-92.
9. Simon M. Loveday, Food proteins: Technological, Nutritional, and sustainability attributes of traditional and emerging proteins, Annual Review of Food Science and Technology, 2019; 10: 311-339.
10. M Akram, et. al. Functional Foods and neutaceuticals, Springer, 2020.

11. K. O. Soetan, C. O. Olaiya and O. E. Oyewole The importance of mineral elements for humans, domestic animals and plants: A review, African Journal of Food Science, 2010; 4(5): 200-222,
12. Reilly C., Metal contamination of food,its significance for food quality and human health. Oxford books University, Oxford, 2008.
13. AOAC Official Method, AOAC 930. 15-1930 Loss on drying (Moisture) for feeds, 1999.
14. AOAC Official Method 942.05, Determination of Ash in Animal Feed.
15. AOAC Official Methods of Analysis. 17th Edition, The Association of Official Analytical Chemists, Gaithersburg, MD, USA. Methods, 2000; 925.10, 65.17, 974.24, 992.16.