THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
August, 2017, 68-71
Online popular Article

Identification of different types of Meat

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Introduction

Species identification in food of animal origin is an important subject for food control. Adulteration in food is relevant for economic, religious and public health reasons. Determination of fraud in meat production is not only important for economic, health and ethical reasons but also to ensure fair trade and compliance with legislation. Rapid examination of adulteration are very critical issues for healthical requirements, specific food allergies, religious affairs, fraud and malicious marketing practices in addition to economic and legal concerns. Amongst the commodity groups, meat represents one of the most common foods implicated in food fraud. In order to protect the food and feed industry and consumers, regulatory bodies need to monitor food authenticity and feed contamination by ruminant materials. Reliable, rapid and accurate methods are needed for use in food authentication and in feed control. The identification of species in meat products is thus of paramount importance in controlling food quality, ensuring safety and protecting consumers.

Method of Identification of Meat

It is very crucial to identify the different types of meat of different species. This can be done by following methods:

1. Anatomical Method: Anatomical method of species meat identification based on their colour, texture, odour, structure of bones, flesh and fat. Difference in colour, texture, odour, fat, bone and cartilage of various species of animals. Sex of the animals is recognized on the basis of piece of

genital organs available in the specimens. The normal colour of different meats is very helpful to identify.

- **Beef (Cattle meat):** Reddish in colour with brownish and muscles are intermixed with fat, and fat colour is yellow. In case of older cattle colour of fat becomes yellowish and bone marrow is clear white to reddish yellow. Calf meat is known as "Veal", its fiber is fine and bone marrow is deep pink red colour.
- **Mutton (Sheep meat):** Muscles of sheep is dark red with odour of ammonia. Excessive fat is deposited between groups of muscles. Fat is clear white and not intermixed with muscles but fibers are adhered.
- **Chevon (Goat meat):** Its colour is red but paler than mutton. It has a peculiar goaty smell.
- **Dog meat:** colour of dog's meat is dark red and fat is intermixed with muscles.
- **Pork (Swine meat):** It is mild red in colour and its consistency is soft with odour of ammonia. Fat is white and granulated.
- **Horse meat:** Meat of horse is dark red to brown red in colour. It becomes blackish when exposed to air. Fat is gold colour to dark yellow and bone marrow is greasy.

Marbling of fat is seen in cattle and buffalo while most of the fat in pig is subcutaneous in nature.

2. Physical method: best method is to identify the bones. Meat speciation based on certain physical parameters like Refractive index of fat and Iodine values are sometimes followed in absence of specific anatomical differences.

(i) Measurement of refractive index of fat - Fat is liquefied and refractive index of oil is measured by refractometer. R.I. values of some animals are: horse 53.5, cattle not above 40 and pig not above 51.9.

(ii) Estimation of iodine value - This test measures the amount of iodine absorbed by unsaturated fatty acids present in the fat and varies in different animals. Iodine value of fat in loin is 71 to 86, in cattle 38 to 46, in sheep 35 to 46 and in pig it is 50 to 70.

3. Chemical method: Meats of different animals are differentiated by chemical test such Glycogen content, Lenolenic acid content. Horse flesh has higher glycogen content than other animals. Lenolenic acid - Horse fat contains about 1-2% lenolenic acid, in other animals it is not present in proportions higher than 0.1%.

4**. Biochemical method:** Electrophoresis is the earliest method of meat identification and is used for soluble proteins, namely sarcoplasmic proteins and is implemented in raw meats. SDS-PAGE

Sodium dodicyle sulphate polyacryl amide gel electrophoresis technique separates proteins into characteristic patterns based on differences in molecular sizes of their protein bands. SDS PAGE for identifying peptides weighing below 3-17 KDa (Kilo Dalton) in fresh Pork and Beef. Iso-electric focusing (IEF) is based on differences in isoelectric focusing point (IP). IEF method allows species identification in mixture of minced beef, pork and poultry meat and it is also used in identifying animal species in either raw or cooked meat.

5. **Immunological method:** Meats of different animals are differentiated by immunolgical method such Agar gel precipitation test (AGPT), Counterimmuno electrophoresis (CIEP), Agarose gel electrophoresis (AGE), Enzyme linked immunosorbant assay (ELISA), Peroxidase anti-peroxidase technique (PAP), Radioimmuno assay (RIA), Starch agarose electrophoresis. Immunoassays are widely used for identifying animal species in raw meats. Meats are recognized by precipitation tests. ELISA is the best commonly method to use to detect animal proteins. It is based on the interaction between antigen and antibodies. The ELISA kit is used to identify the type of raw meat, and since this method needs a short time for implementation, it can detect several species of meat simultaneously.

6. Molecular Method: Molecular methods are Novel methods of species meat identification by DNA analysis, DNA based techniques such as polymerase chain reaction (PCR) and gene probes. Conventional PCR has been widely used as a qualitative measure of a target DNA whereas quantitative real-time PCR (qPCR) can also quantify copies of the target sequence. PCR using species-specific primers would allow direct species identification without the need for further analysis of the PCR products. Various methods based on analysis of species DNA is a more stable molecule compared to proteins under most conditions, so methods based on amplification of target. Multiplex PCR is highly repeatable, time saving and more affordable than the other methods. Specific components like protein and DNA have been developed to detect meat and meat products coming from different animal species. Poultry, ovine, equine, donkey, goat and pork materials in industrial meat products are detected by PCR. PCR is a highly repeatable, time saving and affordable method, but it gives only qualitative results. A recently developed PCR technology is digital PCR (dPCR) which provides more accurate quantification of target DNA. In dPCR, the PCR reaction mixture is partitioned into tens of thousands of droplets with each droplet harboring an independent PCR reaction. The dPCR methods can be implemented in routine testing to identify food fraud and to monitor the prohibited animal species in feed chain with enhanced sensitivity, accuracy and

precision without reliance on standard curves. Droplet Digital PCR (ddPCR) assays were developed and evaluated for detection and quantification of bovine, porcine, chicken and turkey DNA in food and feed samples.

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