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ADULTERATION IN FOOD AND DRUG AND DRUG EVALUATION FOR IDENTIFICATION, DETERMINATION OF QUALITY-PURITY AND DETECTION OF ADULTERATION

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ABSTRACT

Medicinal plants constitute an effective source of traditional (e.g., ayurvedic, Chinese, homeopathy and unani) and modern medicine. Herbal medicine has been shown to have genuine utility. Evaluation of a drug ensures the identity of a drug and determines the quality and purity of drugs. The main reasons behind the need for evaluation of crude drugs are biochemical variation in the drug, effect of treatment and storage of drugs, and the adulteration and substitution. Improvements in analytical methods have definitely led to improvements in harvesting schedules, cultivation techniques, storage, activity, stability of active compounds, and product purity. All of these gains have resulted in tremendous improvements in the quality of herbal preparations now available. The further development of analysis of herbs is largely depended upon reliable methodologies for correct identification, standardization and quality assurance of ayurvedic drugs. Methods currently employed in evaluating herbs are organoleptic, microscopic, physical, chemical, and biological parameters.

1. INTRODUCTION

Adulteration in simple terms is debasement of an article. The term adulteration is defined as substituting original crude drug partially or wholly with other similar looking substances. The

substance, which is mixed, is free from or inferior in chemical and therapeutic property. The adulteration is done deliberately, but it may occur accidently in some cases.

1.1 FOOD ADULTERATION

An food article is called adulterated if, It omits a valuable constituent.

1.1.1 Any valuable constituent is substituted with any inferior substance (for example, olive oil diluted with tea tree oil).

1.1.2 Conceals the inferiority or damage of the food article in any manner(such as fresh fruits with food colour on its surface to conceal defects and damage).

1.1.3 Any other substance has been added or packed with it to increase the weight/quantity to make it appear bigger or of great value or reduce its quality. All these practices may or may not render the food article injurious to health.

1.1.4 In a developing nation like India, the adulteration in the food is done either for financial gain or due to carelessness and lack of proper hygienic condition of processing, storing, transportation and marketing. The food adulteration ultimately results that either the consumer is cheated or often becomes the victim of health problems.

1.2 THE LAW RELATED TO FOOD ADULTERATION

The prevention of food Adulteration Act1945 aims at making provisions for the prevention of adulteration of food. This act came into force on June 01, 1955. This law explains following-

1.2.1 Objectives of the food adulteration act

1.2.2 Meaning of adulterant

1.2.3 Definition of food.

1.2.4 Concept of adulteration

1.2.5 Sale of some admixtures prohibited.

1.2.6 Procedures for sampling and analysis.

1.2.7 Penalties

1.2.8 Miscellaneous provisions.

2. Adulteration in food and their ill effects on health

S.no.	Foods/species/drinks involved	Adulterant in food	Effect on health
1.	Mustard seeds	Argemone seeds, argemone oil	Epidemic dropsy, glaucoma, cardiac arrest
2.	Turmeric	Lead chromate	Anaemia, abortion, paralysis, brain damage.

3.	Fruits such as apples sprayed over with lead arsentate.	Arsenic	Dizziness, chills, cramps, paralysis, death.
4.	Edible oils	Rancid oil	Destroys vitamin a and b
5.	Fruit juices, soft drinks etc.in contact with cadmium plated vessels or equipments.	cadmium	Itai-itai (ouch-ouch disease), increased salivation, acute gastritis, liver and kidney damage, prostate cancer.
6.	Water and liquors	cobalt	Cardiac insufficiency and myocardial failure.
7.	Cereal products, custards, puddings, sauce.	Bacillus cereus	Food infection/poisoining (nausea, vomiting, abdominal pain, diarrhoea)
8.	Milk, potato, beans, poultry, tunafish, shrimp, moist mixed foods.	Shigella sonnei	shigellosis
9.	Dairy products, baked foods especially custard or cream filled foods, salads, l ow acid frozen foods, meat products, cream sauces.	Staphylococcus aureus enterotoxins-A,B,E,F.	Increased salivation, vomiting, abdominal cramp, diarrhoea, severe thirst, cold sweats, prostration.
10.	Defectively canned low or medium -acid foods, meats, sausages, smoked vaccum packed fish, fermented food etc.	Clostridium botulinces toxins-A,B,E, F	Botulism(double visions, muscular paralysis ,death due to respiratory failure.
11.	Spinach, amaranth etc.	Oxalic acid	Renal calculi, cramps, failure of blood to clot.

3. Drug adulteration

3.1. A drug is considered as adulterated if it does not meet the prescribed standards because of substitution, deterioration, admixture, sophistication, inferiority, and spoilage rendering the original drug qualitatively lower and sometimes even harmful to health.

3.2. Deterioration- is the impairment in the quality of the drug because of any reason like time expiry and exposure to adverse conditions etc.

3.3. Substitution- is the partial or whole replacement of the original drug with some other similar looking substance which is either free from or inferior in chemical and therapeutical properties.

3.4. Admixture- is the addition of any substance/article due to ignorance or carelessness or by accident

3.5. Sophistication-is the deliberate or intentionally type of adulteration in which a substitute which is look wise superior is added to the drug to improve its appearance.

3.6. Inferiority-refers to any substandard drug which is low in chemical or therapeutical properties as compare to standard pure drug.

3.7. Spoilage- is fall in the quality, nature and therapeutical properties of the drug because of attack of micro-organisms on the drug.

3.8. Mostly, the drug adulteration is done intentionally to get commercial benefits and commonest adulteration is the substitution with substandard commercial varieties, inferior drugs or artificially manufactured commodities.

4. TYPES OF ADULTERATION

Following types of adulterants are commonly used in drug adulteration:

4.1 Substitution with substandard commercial varieties

This is the most common practice of adulteration. The adulterants used in this may be similar to original crude drug in its morphological, chemical or therapeutic characters, but are surely substandard in nature so, they are cheaper in cost. Examples are:

4.1.1 Presence of strychnous potatorum in place of S.nux-vomica.

4.1.2 Capsicum annum is used in place of C. Minimum.

4.1.3 Gentian is substituted by kutki

4.2 Substitution with superficially similar but inferior drugs

The inferior drugs used in this has similar morphological structure with authentic drug but may or may not be having any chemical or therapeutic value as that of original natural drug.

4.2.1 Saffron is admixed with dried flowers of Carthamus tinctorius.

4.2.2 Mother clove stalks are substituted by clove.

4.2.3 Belladonna leaves are mixed with ailanthus leaves.

4.2.4 Bees wax is substituted by Japan wax.

4.3 Substitution with artificially manufactured substances

In this practice, substitutes used are artificially prepared to resemble original drug.

4.3.1 Yellow coloured paraffin wax is substituted for bees wax.

4.3.2 Coffee is replaced by compressed chicory.

4.4 Substitution with exhausted drugs

In this type of adulteration, the same drug is used as substitute but that is devoid of active ingredients as they are already extracted out. This procedure is commonly used in case of volatile oil containing drugs like clove, coriander, caraway etc. In some cases, natural characters of exhausted drugs like colour, taste are first manipulated by adding other additives and then it is used in adulteration.

4.4.1 Exhausted gentian made bitter with aloe.

4.4.2 Exhausted saffron is artificially coloured.

4.5 Presence of vegetative matter from the same plant

It has also been observed that the miniature plants growing along with medicinal plants are used as adulterants. As they resemble the original plant in colour, odour and in some cases constituents so, they are mixed with the drug.

4.5.1 Lower plants growing on bark portion like moss, liver warts are mixed with cascara or cinchona.

4.5.2 Stem portions are substituted with leaf drugs like stramonium, lobelia and senna.

4.6 Harmful adulterants

Many times, the market wastes which are harmful to human health are collected and admixed with authentic drugs. This is particularly noticed for liquids of unorganized drugs.

4.6.1 White oil in coconut oil.

4.6.2 Coloured amber glass pieces are mixed with colophony.

4.6.3 Lime stones in asafoetida.

4.6.4 Lead shot in opium.

4.7 Adulteration of powders

Adulteration is frequently done in powdered form of drugs.

4.7.1 Exhausted ginger powder is mixed in powdered colocynth/ginger.

4.7.2 Red sadal wood in capsicum.

4.7.3 Powdered bark is adulterer with brick powder.

5. DRUG EVALUATION

Drug evaluation means-

5.1 Confirmation of identity of drug.

5.2 Determination of its quality and purity.

5.3 Detection of nature of adulteration.

5.4 The evaluation of crude drug is necessary to find any

5.4.1 Biochemical variation in the drug.

5.4.2 Deterioration due to treatment and storage.

6. SUBSTITUTION AND ADULTERATION AS A RESULT OF CARELESSNESS, IGNORANCE AND FRAUD

The method used for identification and standardization of crude drugs are following

6.1 Morphological or organoleptic evaluation

It is a technique of qualitative evaluation based on study of morphological and sensory profile of whole drug such as colour, odour, taste, size, shape and special features like touch, texture etc. for example- aromatic odour of umbelliferous fruits and sweet taste of liquorice.

6.2 Microscopic evaluation

It is an qualitative evaluation method which allows detailed examination and identification of organized drugs by their known historical characters. This evaluation has been made possible by the use of microscope which permits the minute structures under study to be enlarged. Microscopic evaluation also covers study of constituents by application chemical methods to small quantities of drug in powdered form or to histological sections of drug. Microscopic linear measurements and quantitative microscopy are also covered under this technique e.g., diameter of starch grains, length of stomata of leaves.

The other quantitative microscopy and linear measurements has following aspects

1. Leaf constants
2. Trichomes
3. Stomata
4. Quantitative microscopy.

6.3 Chemical evaluation

Chemical evaluation is done by performing different chemical tests and chemical assays which includes isolation, purification and identification of active constituents which may be a single or present in groups.

6.3.1 Quantitative chemical analysis is helpful in evaluation of resins, volatile oils, e.g., acid value, saponification value etc.

6.3.2 Qualitative chemical tests are helpful in detection of adulteration.

6.3.3 Phytochemical screening is carried out for establishing chemical profile of a crude drug.

6.4 Phyto-chemical investigations

The systemic investigations for Phytochemical behaviour of plant material has four stages

6.4.1 The procurement of raw material and quality control.

6.4.2 Extraction, purification, and characterization of the constituents of pharmaceutical interest and in process quality control.

6.4.3 Investigations of biosynthetic pathways to particular compound.

6.4.4 Quantitative evaluation.

6.4.5 Physical evaluation-for the physical evaluation of drug, following standards are to be determined

6.4.5.1 Moisture content

6.4.5.2 Density

6.4.5.3 Specific gravity

6.4.5.4 Melting point

6.4.5.5 Refractive index

6.4.5.6 Viscosity

6.4.5.7 Volatile oil content.

7. TECHNIQUES USED IN PHYSICAL EVALUATION OF DRUG

7.1 Chromatographic technique

Chromatography includes a group of methods used for separating molecular mixtures which depends on the differential affinities of the solutes between two immiscible phases. Types of chromatography techniques

7.1.1 Thin layer chromatography

7.1.2 High performance thin layer chromatography

7.1.3 Gas liquid chromatography

7.1.4 High performance liquid chromatography

7.1.5 Column chromatography

7.2 Spectrophotometric technique

These are of following types

7.2.1 Ultra-violet and visible spectrophotometry

7.2.2 Infra-red spectroscopy

7.2.3 Fluorescence analysis

7.2.4 Nuclear magnetic resonance spectroscopy

7.2.5 X-ray diffraction.

8. BIOLOGICAL EVALUATION OR BIOASSAY

When standardization of crude drug is not properly done by chemical or physical means then biological evaluation is done for conformity of therapeutic activity of raw materials and products. In this method, potency of crude drugs or its preparation is evaluated by means of its effect on living organisms like bacteria, fungus, animal tissue or entire animal for assessment of biological efficacy. Some biological activities /methods are mentioned below-

8.1 Hepato-protective activity.

8.2 Hepato-glycaemic activity.

8.3 Anti-fertility testing

8.4 Anti-inflammatory activity.

8.5 Anti-amoebic activity.

8.6 Anti-fungal activity.

9. CONCLUSION

Herbal adulteration is one of the common mal practices in herbal raw material trade. Due to adulteration, faith in herbal drugs has declined. Adulteration in market samples is one of the greatest drawbacks in promotion of herbal products. Faced with the challenges of modern medicine, the world is shifting toward ayurvedic theories of health management. This increases the demand for raw materials exponentially. However, production growth is still linear. To fill this deficit, advances in adulteration and substitution are becoming more prevalent. This adulteration and substitution are a burning problem in an industry that threatens the integrity of ayurvedic system of medicine. After understanding adulteration methods, Uther research and information are needed to correct and minimize illegal adulteration to improve consumer safety. WHO, in its publication on quality standards for medicinal plant materials, recommends rejecting any batch of raw material, which has more than 5% of any other plant part of the same plant nevertheless, if they are derived from the authentic plant? Based on these standards, adulteration whether, intentional or unintentional, should be rejected. Also, suppliers and traders should be educated about the authentic sources.

REFERENCES

1. WHO 1988 Quality control methods for medicinal plant materials World Health Organization, Geneva.

2. WHO 1992 Quality control methods for medicinal plant materials, World Health Organization, Geneva.
3. Kokate C K, Purohit A P and Gokhele S B: Pharmacognosy. Chapter-7, 15th edition. Pune:Nirali Prakashan, 2014.
4. Dr. Poonam. Adulteration of crude drugs burning problem. International Journal of Applied Research, 2016; 2(2): 99-10.
5. Sharma. P.V. Dravya-Guna Vigyan. Varanasi: Chaukhambha Bharati Academy, Reprint, 2014; 5.
6. Lakshmi, V., Food adulteration. International Journal of Science Inventions Today, 2012; 1(2): 106-113.
7. Laura Schumm, 2014 Food Fraud: A Brief History of the Adulteration of Foo
8. Lakshmi, V., Food adulteration. International Journal of Science Inventions Today, 2012; 1(2): 106-113.
9. Alauddin S. Food adulteration and society. Global research analysis international, 2012; 1(7): 3-5.
10. Posadzki P, Watson L, Ernst E. Contamination and adulteration of herbal medicinal products (HMPs): an overview of systematic reviews. Eur J Clin Pharmacol., 2013; 69: 295-307.
11. Drug Adulteration.pdf (glocaluniversity.edu.in)
12. Dravyaguna adarsh (naresh kumar Bhargav)
13. Singh, Gurbax, Law of Consutner Protection, Bharat Law Publisher, Jaipur.
14. Drug Adulteration in India (nih.gov)
15. Dravyaguna Adarsh (Volume One) (Kendriya Bharatiya Chikitsa Parishad dwara nirdarit navin Pathyakramnusar)