

FOOD ADDITIVES: POTENTIAL RISK FOR CANCER

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ABSTRACT

Cancer is a big scary C word used to describe the malignant, autonomous growth of cells that have undergone epigenetic changes and genetic mutations and thus escaped normal cell cycle and displayed various degrees of similarities to their precursors due to various chemical, physical and biological carcinogenic agents. In 2014 the World Cancer Society reports that second largest and the leading cause of morbidity and mortality worldwide is cancer. Approximately 14 million people were reported to suffer from cancer and 8.2 million cancer related deaths in 2012. This number is anticipated to rise by about 70% over the next 2 decades. Nowadays Food additives, which can be potential carcinogenic agents, are used injudiciously in excess in commercial food production and household cooking to make food more attractive, appealing, appetizing, and informative. This can lead

to serious health problems causing cancer by, -a negative synergistic effect when combined with other additives, -improper storage Conditions, and -unknown carcinogenic by-products occurring during the food processing. The regulation regarding the production and marketing of food additives should be strictly monitored for minimum adverse effects on health although the legal limits of these additives in processed foods are well respected by the manufacturers.

KEYWORD: Cancer, Food Additive, Carcinogenic, Regulation, Legal Limit.

INTRODUCTION

Cancer is a major public health burden in both developed and developing countries. In 2014 the World Cancer Society reports that second largest and the leading cause of morbidity and mortality worldwide is cancer. Among men, the 5 most common sites of cancer diagnosed in 2012 were lung, prostate, colorectum, stomach, and liver. The incidence of breast cancer,^[1] which is most common in women, is highest in Pakistan as compared to South-Central Asian countries.^[2]

Food additives are used both in commercial food production and in domestic cooking to preserve flavor or enhance its taste, appearance, or other qualities. They are of various categories: acidulents (citric acid and vinegar), acidity regulators, anticaking agents (milk powder), antifoaming agents, antioxidants (Vitamin C), coloring agents, color retention agents, bulking agents, flavor, flavor enhancer, preservatives, sweetener, tracer gas, stabilizers etc.

Food additives As Carcinogenic Agent

Out of 12000 substances, More than 2,500 chemical substances are intentionally added to foods to enhance flavor, color, stability, texture, or cost and rests, including components of food-packaging materials, processing aids, pesticide residues, and drugs given to animals, are unintentionally added.^[3] The additives, scientifically and officially proven as safe, are authorized to be used in the food sector after being subjected to toxicological studies for their safety evaluation. Acceptable Daily Intake (ADI) levels of food additives for human are derived from their No-Observed-Adverse-Effects-Level (NOAEL), which has been long determined on the basis of toxicological studies and their legal limits are then established for the food products. However, recent studies demonstrated that consumption of some processed food containing certain food additives increases the risk of cancer in human although the legal limits of these additives in processed foods are well respected by the manufacturers. Possible reasons for increased carcinogenicity risk in processed foods containing these additives can be due to various factors: -interaction of additives with some food ingredients, - food processing may change the chemical formula of food additive to a formula to be acting similarly as carcinogenic compound, -a negative synergistic effects when combined with other additives, -improper storage conditions, and -unknown carcinogenic by-products occurring during the food processing.

Possible causes of carcinogenicity by food additive

- 1) When food additives come in contact with other food ingredients in food products, their chemical structure changes during physical, chemical and enzymatic processing: For instance, nitrates and nitrites are converted to nitrosamines in meat products.
- 2) Various food additives show negative synergistic effects by interacting among themselves producing carcinogenicity : For instance, the additives of potassium sorbate, ascorbic acid and ferric or ferrous salts have the potential to cause mutagenicity and DNA-damaging activity, when all combined together, but not when used separately.
- 3) Interacting with other carcinogenic by products in commercial additives, can induce carcinogenicity For example, some undesirable by-products such as 4-Methylimidazole is also formed during the production of caramels when ammonium is used.
- 4) Improper and longer storage conditions Benzoates (benzoic acid, sodium benzoate, potassium benzoate, and calcium benzoate) are typical examples.
- 5) Exceeding safe limits beyond the provision of a maximum amount that can be added into foods according to these ADI (Acceptable Daily Intake) levels.

Food additive promoting carcinogenicity at high exposure doses

Food additives	Cancer types
Cyclamic acid and its Na and Ca Salts	Colon and Hepatocellular tumors, Prostate adenocarcinoma, Thyroid and Uterus adenomas ^[5]
Allura Red AC	Colon tumor ^[6]
Acesulfame potassium	Urinary track tumor ^[7]
Aspartame	Urinary tract tumor ^[8] Lymphoma, Leukemia and Breast tumor ^[9]
BHA(Butylated hydroxyanisole)	Breast tumor ^[10]
BHT(Butylated hydroxytoluene)	Bladder tumor ^[11] Lung tumor ^[12]
Hexamethylenetetramine	Adrenal gland pheochromocytoma and Harderian gland tumor ^[13]
Carboxymethyl cellulose, Sodium carboxymethyl cellulose	Fibrosarcoma at the side of subcutaneous injection ^[14,15]
Xylitol	Adrenal medulla tumor ^[16]
Nitrates, Nitrites	Colorectal cancer ^[17] Bladder tumor ^[17] Non-hodgkin lymphoma ^[18] Thyroid tumor ^[19] Brain ^[20] Hepatocellular tumor ^[21] Advanced prostate cancer ^[22]
Propionic acid and salts	Fore stomach tumor ^[23]
Saccharin and its salts	Bladder tumor ^[24] Thyroid tumor ^[25]
Talc	Adrenal gland and lung adenoma/carcinoma ^[26] Endometrial cancer (in genital usage of women as talcum powder) ^[27,28,29,30]
Polyoxyethylene stearate	Bladder papilloma ^[31]
4-Hexylresorcinol	Adrenal gland pheochromocytoma and Harderian gland tumor ^[32]

CONCLUSION

Monitoring and surveillance of processed foods containing certain food additives, which have a negligible probability of carcinogenicity in legal limits, must be strengthened from the point of view regarding public health concerns. Therefore, this review will provide a concise piece of information for readers as well as researchers about possible risk of carcinogenicity caused by food additives. Finally it is recommended that an additive, intentionally added to the food during processing must be detected officially for its carcinogenicity.

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