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Nutrition and the Risk of Cancer Progression (An Overview)

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Abstract:

The cancer risk from eating fresh and / or cooked foods is reported by many authors and researchers due to many potential hazards contaminated consumed food. Such hazards are classified into 4 main classes; natural, physical, biological and chemical hazards. The first 3 classes, mainly resulted an acute effects; vomiting, anorexia, nausea and diarrhea, while the chemical hazards were mainly leads to chronic disorders and cancer. It's worthy to mention that food is exposed to so many chemical hazards (more than 10.000) during food chain, such as the residues of fertilizers, pesticides, hormones, drugs, mycotoxins, PCB's, dioxins ... etc. So far, chemical hazards are classified as suspected carcinogens. Once, the food is contaminated with one or more of these hazards, it could be easily digested and transmitted into human tissues and cells, especially liver cells. Most of chemical hazards act as cancer initiators and / or cancer promoters. Undoubtedly, diet could offer cancer promoters and cancer initiators as well as cancer protective agents, simultaneously to human body. Nutritional habits, food hygiene and safety, environment, immune and genetic factors are the limiting factors affecting the consequences of cancer. It well known that cancer needs long time to develop and progressed, starting from the transmission of the carcinogen into the cell to begin the process of changing the DNA and enhance the development of abnormal cells. The metabolic changes in cancer patients exhibit increased protein turnover and reduced muscle protein synthesis. Wasting associated with cancer, dietary factors either initiators, promoters or protective will be discussed in the current presentation.

Keywords: Tumor, Benign, Malignant, Metastasize, Initiators, Promoters, Carcinogen(s), Antipromoters

1. Cancer(s) and how Cancer Develops

Cancer is incommunicable disease which does not spread from person to another. Genetic background plays a role by placing some individuals at increased risk for developing cancer. Cancer develops by complex processes that are not yet fully understood. Adding to the complexity is the fact that cancer development often does not proceed in a straight line process. Cancer can progress two steps forward and then take a step or two back. The cancer development process had 3 main steps; initiation, promotion and progression. Many researches agreed that cancer begins when “something” goes wrong within cells that modify cell division. To simplify and clear such concept, it is known that about 10 million cells in the body divide every minute, all are controlled by a set of regulatory mechanisms which affect the process of DNA duplication, but when cancer initiate the regulatory mechanisms lose their function (Hoover, 2003).

During the initiation phase of cancer development, the suspected environmental and diet carcinogens could penetrate some cells and alter their DNA to initiate silence and uncontrolled process of duplications. During the promotion phase, the cells with altered DNA divide to produce large number of abnormal cells. This phase of cancer development commonly takes place over a span of 10 – 30 years. Then the abnormal cells continue to divide leading to the progression phase. During this phase, the abnormal cells may migrate to other tissues and consequently cause DNA damage and abnormal cells development in these tissues, too (Brown, 2005).

So, cancers are diseases resulted from the uncontrolled and unchecked growth of malignant tumors. Cancers are classified according to the cells and tissues which they develop; carcinoma (epithelial tissues), sarcoma (connective tissue), adenoma (glandular tissues), lymphoma (lymph tissues)...etc. The genes in normal and healthy body work together in a harmony to regulate cell division to grow, replace dead cells and/ or repairing damaged ones. Normally, the genes act together to ensure that new cell is a replica of the parent cell in structure and capable to act the same function (Brown, 2005).

Therefore, cancer develops from mutations in the genes which regulate cell division. These mutations silence the genes that ordinarily monitor the errors created by the replicating process of DNA. The affected cells thereby lose their built-in brakes for halting cell division, then, 1) the resulted abnormal mass of cells called “tumor” grows, 2) blood vessels form to supply the tumor with the required nutrients to support its growth, 3) the tumor invades more and more healthy tissues and may metastasize. Fortunately, in some cases when tumor stop growing without any intervention or can be removed surgically and most oven pose no threat to health called “malignant tumor” obtained when tumor multiply-out of control, threaten health and life and require certain treatments and interventions.

2. Food Hazards – Cancer Initiators

Undoubtedly, the available literature, so far, could not offer a distinct answer about the question of what extent the diet and food hazards contributes to cancer occurrence and development? Many studies estimated that diet may be linked to up to a third of cancer cases. Consequently, people may easily believe that certain food contaminants and additives are carcinogens (Kelloff, 2000). Actually, food contaminants and additives although they are classified as extremely toxic substances, they are safe at the level(s) permitted. So, it is worthy to report and refer to most of food hazards as possible or suspected carcinogens. Similarly, the more recent terms of cancer “initiators, promoters, and antipromoters” should be used in careful and conscious. Food hazards could be accumulated during food chain when good agricultural practices (GAP) or good manufacturing practices (GMP) were missed. As well, many hazards could be created during the common domestic treatments and processes. The cancer risk from eating such food is unclear because the biological actions and interactions of these suspected carcinogens are modulated by other dietary components of both plant and/ or animal food origin.

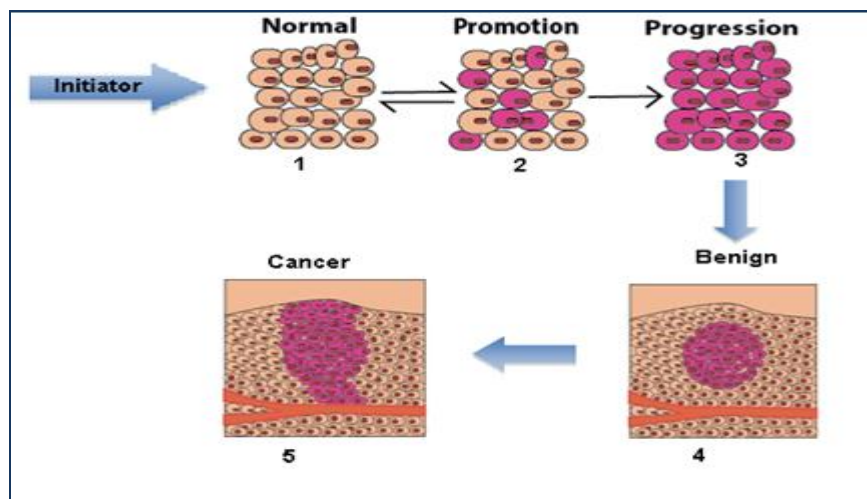


Figure 1: The main steps of cancer incidence and development

Figure 1 gives a simple idea about how cancer occurred and developed. When normal cells were invaded by dietary factors capable to break-through nucleus membrane acting as cancer initiators, the DNA of random cells begin the process of changing. The arrow between 1 and 2 is reversible. Such reversible reaction affected – clock-wise – by the continual exposure to cancer initiators, promoters or carcinogens. Contrary, the reversible reaction – unclock wise – affected by immune and protective dietary agents. Cancer promoters enhance the development of abnormal cells to form non-cancerous tumor (Benign). After a long time 10 – 30 years when the abnormal mass of cells grows, blood vessels were formed to supply the growing cells with its requirement to form cancer tumor. Finally, cancerous tumor (Malignant) releases cells into the blood stream to invade more and more healthy tissues (Metastazise). It is worthy to mention that except the first step, all progressive consequences of cancer are irreversible reactions

3. Dietary Factors – Cancer Promoters

Unlike carcinogens, which initiate cancer, some dietary components could promote cancers. Once, the cancer process has initiated, some potential components could accelerate tumor development (Zock, 2001). Many studies exhibited that there is a highly positive correlation between the qualitative and quantitative properties of fat diet and incidence of cancer. Comparative studies of population around the world revealed that high fat diet often but not always, correlate with high cancer rates. Within a certain population, however, cancer rates implicate meat fats, but not vegetable fats, while consuming fatty fish may be protective (Terry et al., 2001). One attribute of dietary fat is energy density. Diets high in calories do seem to promote cancer, so researches still must work to find the effects of fat alone from those of total energy. The type of fat in the diet may also influence cancer promotion or prevention. There is evidence that both saturated and trans fatty acids are attributed to cancer promotion. On the other hand, omega-3 fatty acids mainly obtained from fish may protect against some cancers (NCPB, 2003).

4. Protective Dietary Factors

Naturally, most food contains anti-initiators and/ or anti-promoters acting against cancer incidence and promotion. Many reports focused on the high positive correlation between eating plenty of vegetables and fruits and reduced incidence of cancer (Kushi et al., 1999). They suggest that fiber-rich diet could protect against some forms of cancer, especially colon and prostate cancers. Many researchers speculated that the fiber contents of the vegetables and fruits may protect against cancer by speeding up the par systolic movement of intestine exposure leading to reduce the exposure time to cancer initiators or promoters, consequently leads to the transmitted undesirable substances capable to occur cancer. In addition to the fiber content of vegetables and fruits, they also contain some biological active substances mainly, phytochemicals and other molecules which are likely to protect against cancer. The high

content of both vitamins C and tissues. As well, phytochemicals could activate certain enzymes which had the capability to destroy carcinogens (ACS, 2001).

5. Consequences of Cancer

It is worthy to mention that, once cancer develops, the consequences depend upon the location of the tumor, its severity and the treatment. The complications arise from the impingement of a tumor on the surrounding tissues. The chance to get an effective treatment are best during early stages, but almost during this time the patient may be unaware of any threat to his health (Goldman and Ausiello, 2004). The metabolic changes in cancer patients exhibit increased protein turnover, while reducing muscle protein synthesis. Simultaneously, gluconeogenesis increases, and triglycerides breakdown, also increases, but fat synthesis decline and serum lipids may be elevated. The metabolic abnormalities help to explain why people suffering from cancer fail to regain lean body mass or maintain healthy body weight, even when they are receiving adequate energy and nutrients (Rolfes et al., 2004).

Loss of appetite, tissues wasting, weight loss and fatigue are commonly occurred and characterized about 80% of people with cancer (Goldman and Ausiello, 2004). Weight loss is often an evident at the time cancer is diagnosed. Unfortunately, once lean body mass is significantly depleted, regardless of the fail to maintain immune defenses, support organ function, absorb nutrients and mend damaged cells and tissues. Recent studies reported many factors appear to play a role in the wasting associated with cancer. Cytokines release by both tumor cells and immune cells involved in the inflammatory response induce a hypermetabolic and catabolic state. The combined effects of a poor appetite accelerated, and abnormal metabolism and diversion of nutrients to support tumor growth result in a lower supply of energy and nutrients at a time when demands are high. Appetite and food intake are further disturbed by the effects of treatments and medications prescribed for cancer patients (Rolfes et al., 2004).

Cancer Sites	Initiators/ Promoters	Protective Agents
Bladder Cancer	Smoking - Alcohols – Chlorinated water	Vegetables – Fruits
Cervical Cancer	Folate deficiency – Viral infection	Adequate folate intake -
Breast Cancer	Obesity – high food energy – low vit. A intake	Monounsaturated fats – Physical activity
Liver cancer	HIV –Alcohols – residues of: mycotoxins – pesticides – dioxins – some food additives & Preservatives.	Vegetables – Fruits – physical activity – Adequate vit. B12
Ovarian Cancer	Obesity – High lactose intake of milk products – contraceptives.	Green leafy vegetables – Adequate zinc – Fruits
Prostate Cancer	High intake of saturated fats – excessive amounts of milk products – viral infection	Cooked tomatoes – soybeans – adequate selenium

Table 1: Some molecules associated with cancer(s) acting as initiators, promoters and protective agents

6. General Discussion and Conclusion

It is well known that any desired and/ or undesired molecule potentially found in human food reached blood stream should pass through certain pathways. The body has 2 mechanisms to avoid and get rid of undesirable substances; the 1 st is to excrete such substances in stool combining the undigested fraction of his food and the 2 nd is to get rid of undesirable molecules through urine excretion with the unmetabolised part of digested food. As a conclusion, any molecule suspected to act as cancer initiators, promoters, carcinogen should have the capability to go through the following successive steps, or has a similar mode of action; 1) digested, 2) metabolized, 3) absorbed, 4) transmitted through blood stream, 5) capable to invade cell membrane, 6) capable to penetrate nucleus membrane, 7) capable to affect or alter DNA, 8) the created error able to silence the genes which regulate cell division and finally, 9) mislead the cell its normal capability to repair the replicating process of DNA.

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