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The Relationship of Nutrition and Leptin in Cancer

Beslenme ve Leptinin Kanserle İlişkisi

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Abstract

Leptin hormone has an important role in the consumption of excessive food intake and energy expenditure. While leptin acts as a neuroendocrine hormone, it has an important role in metabolic function. Leptin shows peripheral effects on glucose metabolism and gluconeogenesis, and it is aimed to emphasize its importance in its relationship with nutrition. Malnutrition, which is a serious risk for cancer development and progression, also causes bad negative results in many tumor types. Nutritional balance and energy balance are affected at the level of insulin and leptin hormones, and functionality is important on the relationship between nutrition and leptin and cancer. The negative effects on adipose tissue caused by unbalanced nutrition are effective in cancer formation and insulin, insulin resistance, that is, leptin levels. In addition, many studies have reported that unbalanced nutrition tumor damage.

Özet

Leptin hormonunun aşırı besin alımı ve enerji harcamasında önemli bir rolü vardır. Leptin nöroendokrin bir hormon gibi davransa da metabolik fonksiyonda önemli bir role sahiptir. Leptinin glukoz metabolizması ve glukoneogenez üzerinde periferik etkiler gösterdiği ve beslenme ile ilişkisinde öneminin vurgulanması amaçlanmaktadır. Kanserin gelişimi ve ilerlemesi açısından ciddi bir risk olan yetersiz beslenme, birçok tümör türünde de kötü olumsuz sonuçlara neden oluyor. Beslenme dengesi ve enerji dengesi insülin ve leptin hormonları düzeyinde etkilenmektedir ve beslenme ile leptin ve kanser arasındaki ilişkide işlevsellik önemlidir. Dengesiz beslenmenin yağ dokusu üzerinde yarattığı olumsuz etkiler kanser oluşumunda ve insülin yani insülin direnci yani leptin düzeylerinde etkilidir. Ayrıca birçok çalışma dengesiz beslenmenin tümörlere zarar verdiğini bildirmiştir.

1. INTRODUCTION

Cancer, which is the second leading cause of death in the world, is defined as "metastasis" by growing excessively within the body's own limits. As it spreads in the organs, an abnormal increase in the number of cells occurs. As a result of excessive cell proliferation in this way, common cells with deterioration in their properties are called cancer (Futreal *et al.* 2001 and Haber 2000). Metastasis is the most common cause of death from cancer. Most of the deaths that occur are types of cancer in men; stomach, lung, liver, prostate, colorectal and esophagus; In women, breast, stomach, lung and colorectal cancers are observed. Cancer differs according to type, age, gender and geographical regions (Parkin 2000).

It has been reported that the increase in the number of cancers and therefore the morbidity and mortality associated with cancer may be a continuation of the increase (Pisani *et al.* 1999 and Eaton 200). Mutagenic substances, which are particularly effective in the formation of cancer, bind to the DNA of carcinogenic agents

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and cause damage. Nutrition is important as the protective mechanism of the gene in this type of damage. Conservation of genes can be achieved largely through nutrition (Doll *et al.* 1981 and Alexandro *et al.* 2002).

Leptin is a regulator of body weight and energy balance acting in the hypothalamus in 1994. Leptin is a protein hormone consisting of 146 amino acids. Leptin hormone is secreted from adipocytes. High levels of plasma leptin are stored by adipose tissues. Fat cells secrete leptin. In animals and humans, leptin is an important regulator of energy balance The energy balance created by this hormone affects the immune system (Zhang, *et al.* 1994; Bjorbaek *et al.* 2004; Correia *et al.* 2004; Hukshorn *et al.* 2004; Mark *et al.* 2004; Meier *et al.* 2004; Hussain *et al.* 2017).

Leptin hormone is secreted from adipocytes. It acts as a neuroendocrine hormone in energy expenditure to regulate excessive food intake (Faust *et al.* 1977). Therefore, it has a significant impact on metabolic function (Sari 2013). For example, in studies on the mechanism of adipose tissue derived cancers; Hormonal related organs such as breast cancer, excessive adipose tissue increase are associated with tumor growth (Sierra-Honigmann *et al.* 1998; Ahima *et al.* 2000; Miyazawa-Hoshimoto 2004).

Nutrition and energy balance are very important. Insulin and leptin hormones are affected in this balance, and it is important on the relationship between nutrition, leptin and cancer. It is aimed to emphasize that the studies on this subject are very important.

Leptin levels should be known in cancer patients. The relationship of cancer with nutrition is known and its importance in this regard should be evaluated in all aspects. Cancer nutrition and leptin relevance should be considered as a study.

1.1. Cancer and Nutrition

Bacteria, viruses, radiation, heredity, the effect of the environment and wrong habits in nutrition and the effects of chemicals on cancer have been proven (Williams 1992 and Williams 2001). The idea that nutrition carries a risk for cancer was expressed by Yong-He Yan in 1270. It was reported by Wisemen in 1676 that malnutrition would effectively cause cancer (Nixon 1990).

Studies have shown that cancer can be prevented and reduced by at least a third with dietary changes (Terry *et al.* 2002 and Peeters 2005). The interaction of glucose, which is a carbohydrate, with insulin level is known. The effect between cancer and dietary carbohydrates has been investigated. The relationship is not clear. However, an interaction between glucose and insulin levels has been reported (Warren 2016).

Consuming fibrous food ensures regular functioning of the intestines. It has a role in preventing constipation. It was determined that dietary fiber reduces the excretion of carcinogenic substances from the intestines and the risk of cancer (Byers *et al.* 2002). In some studies, it has been shown that wheat bran is not protective (Alberts *et al.* 2004). From carbohydrates, whole grains (processed consumption of products such as rice, millet, wheat, barley, oats, corn and barley) vegetables, fruits, vitamins and minerals are anticarcinogenic compounds. There are studies showing that cereal shells are rich in fiber and reduce the risk of cancer, but this decrease is not significant (Cui *et al.* 2006). Cancer cells use sugar more than healthy cells. It is known that sugar feeds cancer and leads to obesity and insulin resistance that occur with excessive consumption of flour and sugar. It has also been found that fasting hyperglycemia and/or diabetes increase the risk of cancer (Ha Jee *et al.* 2005 and Cooney *et al.* 2005). Cancer mortality increases in individuals with high glucose concentrations (Kakehi *et al.* 2018).

Proteins serve as building blocks of cells in the body. Treatment methods such as cancer, chemotherapy and radiotherapy increase the need for protein (Roslan *et al.* 2022). The effect of selenium and vitamin E in prostate cancer has been determined (Clark *et al.* 1996). Selenium has been reported as an anticarcinogenic substance (Redman *et al.* 1998 and Thompso *et al.* 1994). In addition, vitamin E has the ability to stop the growth of many cancers (Israel *et al.* 1995). The World Cancer Research Fund (WCRF)/American Institute for Cancer Research (AICR) and the American Cancer Society state that care should be taken in the diet of

cancer patients, especially red and processed meat consumption should be limited. Emphasizes plant based natural intensity consumption (Mourouti *et al.* 2017).

Vegetables and fruits should be consumed more frequently in the diet. Also, carbohydrates such as processed sugars (cakes, biscuits, etc.) should be reduced. It should be fed with a diet low in fat. Food should be consumed fresh. Processed, cooked at high temperatures or fried should not be preferred. It is important to be at a healthy weight. It should be of plant origin and a small amount of nutrition and low calorie intake. Physical activities and daily exercise programs should be done. It has been observed that such a lifestyle especially reduces the risk of cancer (Slat Tery *et al.* 1997). Alcohol intake should be reduced. It has been reported that the risk of cancer increases with the increase and continuation of alcohol consumption (World Cancer Research Fund 1997). In a study in women, an association was found between increased alcohol intake cancer (Smith-War ner *et al.* 1998). A decrease in cancer is observed with fish consumption, and it is reported that the risk of cancer decreases with omega-3 fatty acids obtained from fish (Kim *et al.* 2009). It has been found that dietary intake of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are in the omega-3 fatty acid group, reduces the risk of cancer (Carol *et al.* 2015).

Calcitriol is a steroid hormone. It has been found to have broad spectrum anti-tumor activity in many studies (Ma *et al.* 2015).

In studies investigating the relationship between vitamin B12 and cancer, it was observed that there was no consistency between plasma vitamin B12 concentrations and cancer, except for liver cancer. Less consistent associations with cancer have been identified between vitamin B12 intake from food or supplements. However, it is stated that low vitamin B12 concentrations are detected in the plasma of cancer patients (Obeid 2022).

It is known that there is a relationship between nutrition and vitamins in cancer treatment. Data based on very new information about the micronutrient group as cancer preventive agents are presented. Folate, methionine, vitamins B6, B12, micronutrients with antioxidant properties (such as vitamins E, selenium) have an important role in cancer. Consumption of vitamin B6 with food is significantly anticancer in cancer. In addition, dietary selenium has a significant positive effect in cancer sites. Nutritional vitamins E and C were statistically significant in cancer (Kune and Watson 2006).

An unbalanced diet with micronutrients in foods (vitamins A, B, E, D, C, K zinc, iron, selenium, and iodine) may also increase the risk of cancer and cause cellular damage (Venturelli *et al.* 2021). Vitamin C also plays a protective role in cancer types in which nitrosamines play a role, by inhibiting the formation of nitrosamines (Byers and Perry 1992).

Iron deficiency is very important in terms of nutrition and has been associated with cancers of the upper digestive tract (Benamouzing and Chaussade 1999).

Carotenoid group foods, especially tomatoes containing lycopene, have positive effects in many cancer types, especially in cancer (Hadley *et al.* 2002).

1.2. Cancer and Leptin

Many studies have stated that leptin has antiapoptotic and mitogenic effects in different cancer cell lines in vitro (Hardwick *et al.* 2001 and Aparicio *et al.* 2005). It is known to examine the effects of nutrition and leptin in cancer treatment and prevention. The leptin concentration in serum rises with the adverse effects of unbalanced nutrition, which is a process associated with increased fat mass and growth of adipocytes and increased leptin secretion (Hamilton *et al.* 1995 and Kolaczynski 1996). While leptin is known to be essential for mammary gland development in humans, subsequent studies have suggested that it plays a role in mammary carcinogenesis (Smith-Kirwin *et al.* 1998; O'Brien *et al.* 1999; Cleary *et al.* 2003). Leptin is observed to be significantly increased in cancer tissue (Ishikawa *et al.* 2004). The relationship between leptin signaling and cancer is now known (Hardwick *et al.* 2001 and Rouet-Benzineb *et al.* 2004). In vitro studies have demonstrated the level of activity of leptin on epithelial cells (Liu *et al.* 2001).

There are studies of leptin on the development of cancer. It has been reported that leptin has an effect that can enlarge and increase cancer cells (Cioffi *et al.* 1996; Stattin *et al.* 2001 and Somasundar *et al.* 2004). It has been suggested that the risk of developing cancer increases as a result of an unbalanced diet (Moller *et al.* 1994; Michaud *et al.* 2001 and Calle *et al.* 1995).

Although the serum leptin concentration is significantly higher in the cancerous organ, leptin levels return to normal with the balanced formation of insulin values during the treatment process (Popovic *et al.* 1998). Cancer patients, low leptin concentration is associated with increased insulin resistance (Barber *et al.* 2004). Recent studies have drawn attention to the possible role of leptin in cancer development and progression. Disturbances caused by malnutrition are associated with increased leptin levels. It has been determined that the hormone leptin is indirectly effective as a risk factor in cancer (Hoda *et al.* 2007). When patients with thyroid cancer were compared with the control group, it was determined that elevated serum leptin levels were significant (Hedayati *et al.* 2011).

2. CONCLUSION

It is very important to draw attention to this issue in order to examine the molecular mechanisms, effects and role of leptin in cancer. Several studies have addressed the possible role of leptin in cancer development and progression. It is inevitable to concentrate on studies on leptin nutrition and cancer. The number of cancer survivors is increasing and one of the factors affecting this issue is nutrition. Its relationship with nutrition and physical activity has been observed in studies.

Author Contributions

In this study, the final version of the draft was read and approved.

Conflict of Interest

The author declares that he is the only author with whom he has no conflict of interest.

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