



Impacts of tomato extract on the mice fibrosarcoma cells

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ABSTRACT

Introduction: The anticancer effect of tomato lycopene has been approved in some cancers. This study was aimed to determine the prohibitive and therapeutic effects of tomato extract on the growth of fibrosarcoma in mice.

Materials and Methods: In this experimental study 3 groups of 10 male Balb/c mice were injected subcutaneously with 5×10^5 WEHI-164 tumor cells in the chest area. Prevention group was fed tomato extract (5 mg) for a 4 week period (from 2 weeks before tumor cell injection up to 2 weeks after injection) and the treatment group was fed simultaneously with tumor cell injection up to two weeks after injection daily by an oral gastric tube. The tumors areas were measured and recorded on days 10, 12, 14, 16, 18, 20 and 22. The data were analyzed using Kruskal-Wallis and Mann-Whitney tests.

Results: The results showed that the tumor areas in control group were significantly more after the intervention than two groups of treatment and prevention ($p < 0.05$). The difference was not statistically significant between the two groups of prevention and treatment.

Conclusion: With emphasize on antioxidant of tomato, it seems that tomato extract has an important role in prevention and control fibrosarcoma growth.

Implication for health policy/practice/research/medical education:

Tomato possesses an important role in prevention and control of fibrosarcoma. This effect seems to be, at least in part, related to its antioxidant property. Lack of difference between the treatment and prevention groups may suggest that pretreatment has no extra effect on the tomato activity against fibrosarcoma.

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Introduction

Fibrosarcoma is a tumor of mesenchymal cell origin that is composed of malignant fibroblasts in a collagen background. This tumor often affects fascia of muscle deeply and is diagnosed when it is very big. This tumor is seen often in individuals younger than 20 years old (1). In clinical examination performed on these patients mass or pain or both can be seen and biopsy is necessary to make diagnosis. Well differentiated fibrosarcoma can be cured by wide local removal while developed and poorly differentiated types are treated by wide surgery and marginal removal of tumor that includes removal of bone and potentially affected muscles (2–4). Common and known treatments for fibrosarcoma include pharmaceutical treatment, surgery and pursuit (5). Treatment of fibrosarcoma similar to other tumors treatment is hard and torturous. In addition, different side effects

of long term or incomplete treatment using radiation therapy as an auxiliary method are developed that limit efficiency of cancers treatment methods (6). All treatment methods including surgery, amputation, radio therapy and chemotherapy have many side effects such as calvities, *ad nauseam*, puke, itch, increased possibility of infection following immune system weakness while biological methods are effective and noninvasive (7). The studies have shown that antioxidants play an important role in prevention and treatment of cancers. Antioxidants eliminate free radicals of oxygen which harm DNA and cause gene mutation. Many oncologists suggest that antioxidants decrease chance of developing cancer and increase healing procedure during chemotherapy and radiotherapy and decrease side effects of these two treatment methods. Carotenoids are of the antioxidants that are found in colored fruits, vegetables, and

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support cells being harmed by free radicals produced by chemical materials and others. Studies have shown that consuming foods full of carotenoids decrease risk of cancer significantly (8). Lycopene is of carotenoid family of pigments that in human is found in blood and tissues. Lycopene provides the red color for tomato and other fruits like watermelon (9). The most important effect of lycopene is antioxidant effect (10). It also controls growth of the tumor cells and increases natural differentiation of cells (11). Studies have approved that lycopene is effective in treatment of colon, lung, oral cavity, larynx, rectum, pancreas, and cervix cancer (12) and reduce the risk of developing cancers (13). Cooking and heating tomato make lycopene get free. So that there is 300 mg of lycopene in cooked tomato while 30-70 of it is found in a fresh tomato (11,13,14). With regard to special properties of effective materials available in tomato and limited studies conducted about anti-fibrosarcoma effect of tomato this study was aimed at determining effect of tomato extract on growth of the WEHI-164 fibrosarcoma in mice.

Materials and Methods

In this experimental study three groups of ten Balb/c mice that were the same in age and sex (8 weeks old and male) were selected and then kept in single cages. These mice were treated in same condition of darkness and brightness for 2 weeks. Different groups were injected WEHI-164 tumor cell in the chest area. Cells and mice were provided from cell bank and experimental animals center of Iran Pasteur Institute, respectively. Prevention group was fed tomato extract (5 mg) for a 4 weeks period (from 2 weeks before injection up to 2 weeks after tumor cell injection) and the treatment group was fed simultaneously with tumor cell injection up to two weeks after injection daily. The third group namely control group was only injected tumor cell and no extract was consumed. To prepare extract healthy tomatoes were first washed and then were heated slowly until tomato sauce was made. Obtained tomato sauce was measured by digital balance and 5 mg of it was consumed by mice (15,16). This extract was fed to mice using oral gastric tube. Tumors were measurable from day of ten. To measure the mean of tumor area two perpendicular diameters were measured; added and the obtained sum was divided by 4. The obtained number was raised to the power of 2 and finally was multiplied by 3.14. Measurements were recorded each two days one time by special caliper accurate to 0.02 mm on days of 10, 12, 14, 16, 18, 20 and 22, then the results were compared (17). Obtained results were analyzed using statistical tests of Man-Whitney and Kruskal-Wallis.

Results

In this study tumors were measurable from day of ten after injection of cancer cells. The Man Whitney test showed significant difference between two groups of intervention and control and area of tumor in control group was significantly more than two groups of prevention and control ($p < 0.05$). But this difference was not significant statistically between two treatment and prevention groups ($p > 0.05$; Figure 1).

Discussion

In this study the effect of tomato extract on growth and development of fibrosarcoma cells produced in Balb/c mice was considered. The results of experiment showed that the average

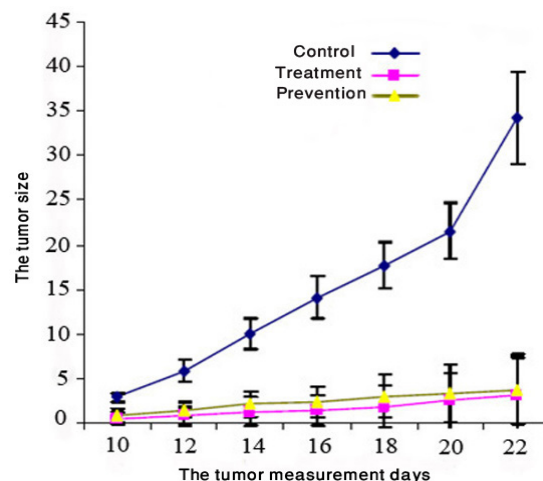


Figure 1. The tumor size in different groups during experimental period

tumor area in mice that were consumed tomato extract (treatment and prevention groups) was lower significantly than control group. The similar studies have not been conducted to consider the tomato extract effect on Balb/c mice but tomato extract has been studied on other types of cancers in animal models that results similar to results of this study were obtained. Sengupta *et al.* studied the effect of antioxidant materials on gastric cancer in rat. They concluded that tomato products decreased risk of free radicals significantly (18). Many studies have shown the effects of lycopene consumption in decreasing risk of developing prostate cancer. The results of these studies showed that tomato controls prostate cancer growth. They presented antioxidant properties of tomato produced by its carotenoid, Gap junction communication increase, control of insulin-like factor and interleukin-6 expression, induction of phase 2 enzyme and control of androgenic activity that these properties are related to anticancer effects of tomato specially in prostate cancer (14, 19). Garcia *et al.* concluded in their study that prescription of retinoid before, during and after first tumor excision is helpful in prevention of tumor recurrence (20) and this conform to finding of present study. Smith *et al.* also resulted that concentrated tomato used with E vitamin decreased growth of melanocytes in medium that this also conform to present study (21). In present study also induction in tumor size was seen in two groups of consuming tomato extract. Pan *et al.* have studied the antitumor effects of lycopene on tumor size, safety and antioxidant performance and concluded that lycopene consumption cause proliferation and antitumor effects that possibly are resulted from safety and antioxidant performance of lycopene (22). Huang considered the effects of the lycopene consumption in high and below dosages on weight of tumor and its metastasis in mouse. The results suggest that lycopene supplementation decrease metastasis of tumor that this is possibly related to proliferation, angiogenesis and attenuation tumor invasion (23). Scolstici *et al.* have considered the chemoprotective effects of lycopene and has recognized it as a chemoprotective (24). The results of these studies conform to results of the present study and justify possible mechanism of treatment and preventive effects of tomato against fibrosarcoma in this study. In this study no significant difference was seen in tumor dimensions between two groups that consumed tomato and this finding is caused

possibly by low dose of extract and efficiency of safety response against distributed tumors than solid ones since distributed cells are more exposed by safety system. Tomato as a rich source of Lycopene is a Single-Oxygen quenching potential carotenoid that beside antioxidants properties has biologic, antimutagenic and anti anticarcinogenic properties. Lycopene reacts to oxygen and free radicals and antioxidant effect of this substance is due to its chemoprotective effects. This reaction also justifies reason of quick transformation of all-trans forms to Cis-isomers mixture in blood and tissue. Many epidemiologic retrospective studies and prospective studies showed the negative relationship between lycopene and risk of prostate cancer and on the other hand empirical studies showed that in addition to antioxidant properties, lycopene has another chemoprotective mechanism including apoptosis induction, antiproliferative effects in cancer cells and metastasis effects and upregulation. In result it is concluded that consumption of tomato and its products and possibly lycopene decrease risk of cancers especially prostate. It seems that micronutrients available in vegetables and fruits like E and C vitamins, carotenoid, polyphenol and trace elements play key role in protective mechanisms against cancer by eliminating free radicals that tomato as one of the most consumed fruits can plays an important role in preventing and treatment of different type of cancers. Different studies have suggested effects of this plant in decreasing risk of cancers like prostate cancer and gastrointestinal cancer (24–26).

Conclusion

Tomato possesses an important role in prevention and control of fibrosarcoma. This effect seems to be, at least in part, related to its antioxidant property. Lack of difference between the treatment and prevention groups may suggest that pretreatment has no extra effect in the tomato activity against fibrosarcoma.

Authors' contributions

All the authors wrote the manuscript equally.

Conflict of interests

The authors declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, misconduct, data fabrication, falsification, double publication or submission, redundancy) have been completely observed by the authors.

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