

**ROLE OF TOMATOES AND DIETARY LYCOPENE IN THE PREVENTION OF  
OSTEOPOROSIS.**

**EXECUTIVE SUMMARY**

**SUBMITTED TO: ONTARIO TOMATO RESEARCH INSTITUTE**

**BY**

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There is convincing evidence which points to an important role played by oxidative stress in the development of chronic diseases including cancer, coronary heart disease and osteoporosis. Lycopene, one of the most potent carotenoid antioxidant that is found predominantly in tomatoes and processed tomato products has been the subject of much research since epidemiological studies showed inverse association between tomato intake or blood lycopene level and the risk of cancer and other chronic diseases. The emphasis of research so far has been on the role of lycopene in the prevention of cancer and cardiovascular diseases. However, more recently, the role of lycopene in osteoporosis has also been recognized. This is based on the hypothesis that reactive oxygen species (ROS), generated via regular metabolic activity and life style factors including diet, can cause the activation of osteoclast cells that are responsible for the loss of bone and inactivation of osteoblast cells that are responsible for the formation of bone, resulting in osteoporosis. Antioxidants such as lycopene by interact with ROS can mitigate their damaging effects on bone cells and prevent the development of osteoporosis.

A study was undertaken with the financial assistance from Ontario Tomato Research Institute (OTRI) with the overall objective of evaluating the role of tomato lycopene on the growth and viability of human bone cells in tissue culture.

Specific objectives were to (a) Study the dose response effect of all trans-lycopene on the proliferation and differentiation of human osteoclast bone cells. (b) Verify that the inhibitory effect of lycopene on osteoclasts is exerted via its antioxidant properties. (c) Compare the antioxidant effect of lycopene on osteoclast bone cells with vitamin E and  $\beta$ -carotene.

Results from our study have indicated the following conclusions:

1. Lycopene inhibited the activity of osteoclast cells in culture in a dose dependent manner from  $10^{-7}$  to  $10^{-5}$  concentrations.
2. Lycopene reduced the ability of osteoclast to produce reactive oxygen species (ROS).
3. Lycopene at  $10^{-6}$  and  $10^{-5}$  M concentrations had significant stimulatory effects on osteoblast cell numbers.
4. The effect of lycopene on osteoblast cells was dependent upon the stage of cell differentiation.

These effects of tomato lycopene on the activity of bone cells was among the first to be reported. These observations have opened an area of health research with far reaching implications in the management of osteoporosis in the future. If future research can support our observations then nutritionists and other health professionals can make recommendations based on scientific evidence to increase the intake of food products such as tomatoes and processed tomato products containing lycopene, in the prevention and management of osteoporosis.

Encouraged by the positive results from our tissue culture studies, we are now undertaking clinical research to study whether oxidative stress, antioxidant status and antioxidant enzyme polymorphism correlate with high bone turnover markers in postmenopausal women who are at risk of osteoporosis. An intervention study is also in progress in which postmenopausal volunteers will be given regular tomato juice, tomato juice rich in lycopene and lycopene capsule to measure serum lycopene levels, markers of oxidation and bone turnover and to assess the role of tomato and lycopene consumption on the prevention of osteoporosis