In Vitro Cytotoxicity of Xylitol to Cancer Cell Lines

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Abstract

Xylitol is a well-known preventative product that has been used by dentistry for decades. Previously published research demonstrated inhibitory properties of xylitol with many cancer cell lines when administered via diet and systemically. Modern diet, especially with the increased consumption of processed food containing high fructose corn syrup, may be contributing to more chronic illnesses and possibly cancer. The purpose of this study was to determine the cytotoxicity of polyols and carbohydrates utilized as sweeteners on cancer cell lines by use of the CellTiter 96® Aqueous One Solution Cell Proliferation Assay (MTS).

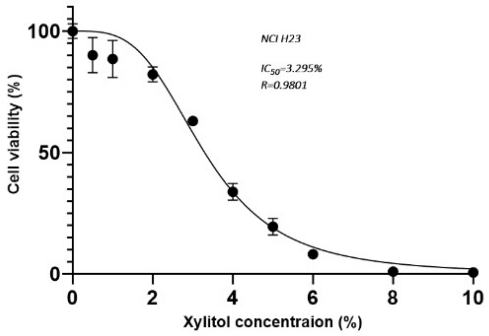
Methods

This study included ten cancer cell lines and human dermal fibroblasts to evaluate the viability after adding different concentrations of xylitol, sucrose, glucose and fructose to their media. Cancer cell lines included: MTS assays were performed by adding a small amount of the CellTiter 96® Aqueous One Solution Reagent directly to culture wells, incubating for 1-4 hours, and then recording the absorbance at 490nm with a 96-well plate reader. These assays are used to measure cellular metabolic activity as an indicator for cell viability, proliferation and cytotoxicity.

Results

The carbohydrates all displayed anti-cell activity that may have been related to the osmolarity of the solutions. Statistical analysis confirmed that increased carbohydrate concentration inhibited cell growth and cytotoxicity. The exception was fructose, which, at higher concentrations, increased the growth of several cancer cell lines.

Xylitol		
cell line	IC50 (in %)	R
SCC-15	3.683	0.9789
MeWo	4.805	0.9877
K562	3.112	0.946
HEK293	3.112	0.9895
SK Mel2	4.712	0.9858
NCI H460	4.717	0.9668
NCIHL60	1.605	0.9755
MCF7	5.846	0.9665
MCF7	5.656	0.9865
HCT-15	4.057	0.9937
NCI H23	3.295	0.9801
Hela	5.576	0.9577
NHDF	5.153	0.9391



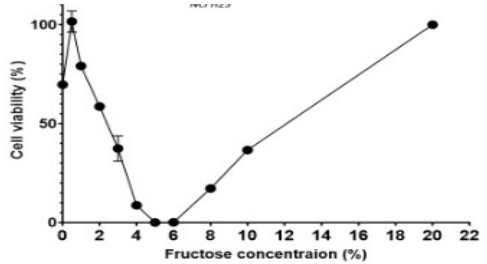


Figure 1
IC50 concentrations of cancer cell lines as a measure of 50% reduction in cell viability

SSC-15: oral squamous cell carcinoma
MeWo: skin melanoma
K562: myelogenous leukemia
HEK293: kidney
SK Mel2: melanoma
NCI H460: large lung carcinoma
NCIHL60: leukemia
MCF7: breast cancer
HCT-15: colon cancer
NCI H23: non-small lung carcinoma cell
HeLa: cervical cancer
NHDF: normal fibroblast

Figure 2
Cell viability in a human non-small cell lung carcinoma decreasing over time with xylitol introduced in media

Figure 3
Cell viability in a human non-small cell lung carcinoma increasing over time with fructose introduced in media

Discussion

High fructose diets have been repeatedly associated with metabolic disease and obesity, cardiovascular disease, and cancer. On the contrary, xylitol has repeatedly been demonstrated to inhibit cancer cell growth and metastasis in both cell line cultures and animal model studies. As xylitol is a naturally occurring non-synthetic sweetener with a long history of safety and efficacy in both oral disease prevention and preventing insulin resistance, the utilization of xylitol for oral disease prevention, especially in cancer patients, would seem both logical and beneficial.

This initial study seems to correlate well with previously published research within the confines of an in vitro study. Higher fructose concentrations provided a metabolic boost to the cancer cell lines, whereas no cancer cell lines responded with increased growth following xylitol supplementation.

Xylitol is relatively inexpensive, provides oral and systemic health benefits, and may inhibit cancer cell proliferation and metastasis.

Conclusions

Within the limitations of an *in vitro* study, higher concentrations of fructose may stimulate growth and viability of certain cancer cell lines, while xylitol has shown decrease in tumor growth and metastasis. This raises concern for the continued utilization of high fructose corn syrup as an added sugar.

References

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