

The background is a deep blue gradient with a subtle pattern of white dots. On the left side, there are several concentric circles and a large circular scale with degree markings from 140 to 260. Some of the circles have arrows indicating a clockwise direction.

FASTING AND CHEMOTHERAPY

BENEFITS, MECHANISMS, AND IMPLEMENTATION

MARTHA TETTENBORN RD

LEARNING OBJECTIVES

- Learn about the benefits of targeted fasting for the patient undergoing chemotherapy treatment, both physical and psychological/emotional.
- Understand the impact of fasting/intentional short-term starvation on both cancer cells and healthy cells and how that differs.
- Understand the implementation of therapeutic, targeted fasting in the chemotherapy protocol and its impact on the experience of chemo-induced side effects.
- Learn how to decide on timing of fasting depending on the patient characteristics and status, and on the chemo protocol timing.

► [BMC Cancer](#). 2016 Jun 10;16:360. doi: 10.1186/s12885-016-2370-6.

Safety and feasibility of fasting in combination with platinum-based chemotherapy

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PMID: 27282289 PMCID: [PMC4901417](#) DOI: [10.1186/s12885-016-2370-6](#)

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Abstract

Background: Short-term starvation prior to chemotherapy administration protects mice against toxicity. We undertook dose-escalation of fasting prior to platinum-based chemotherapy to determine safety and feasibility in cancer patients.

Methods: 3 cohorts fasted before chemotherapy for 24, 48 and 72 h (divided as 48 pre-chemo and 24 post-chemo) and recorded all calories consumed. Feasibility was defined as $\geq 3/6$ subjects in each cohort consuming ≤ 200 kcal per 24 h during the fast period without excess toxicity. Oxidative stress was evaluated in leukocytes using the COMET assay. Insulin, glucose, ketones, insulin-like growth factor-1 (IGF-1) and IGF binding proteins (IGFBPs) were measured as biomarkers of the fasting state.

Results: The median age of our 20 subjects was 61, and 85 % were women. Feasibility criteria were met. Fasting-related toxicities were limited to $\leq$ grade 2, most commonly fatigue, headache, and dizziness. The COMET assay indicated reduced DNA damage in leukocytes from subjects who fasted for ≥ 48 h ($p = 0.08$). There was a non-significant trend toward less grade 3 or 4 neutropenia in the 48

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Fasting and cancer treatment in humans: A case series report.

Safdie FM¹, Dorff T, Quinn D, Fontana L, Wei M, Lee C, Cohen P, Longo VD.

Author information

Abstract

Short-term fasting (48 hours) was shown to be effective in protecting normal cells and mice but not cancer cells against high dose chemotherapy, termed Differential Stress Resistance (DSR), but the feasibility and effect of fasting in cancer patients undergoing chemotherapy is unknown. Here we describe 10 cases in which patients diagnosed with a variety of malignancies had voluntarily fasted prior to (48-140 hours) and/or following (5-56 hours) chemotherapy. None of these patients, who received an average of 4 cycles of various chemotherapy drugs in combination with fasting, reported significant side effects caused by the fasting itself other than hunger and lightheadedness. Chemotherapy associated toxicity was graded according to the Common Terminology Criteria for Adverse Events (CTCAE) of the National Cancer Institute (NCI). The six patients who underwent chemotherapy with or without fasting reported a reduction in fatigue, weakness, and gastrointestinal side effects while fasting. In those patients whose cancer progression could be assessed, fasting did not prevent the chemotherapy-induced reduction of tumor volume or tumor markers. Although the 10 cases presented here suggest that fasting in combination with chemotherapy is feasible, safe, and has the potential to ameliorate side effects caused by chemotherapies, they are not meant to establish practice guidelines for patients undergoing chemotherapy. Only controlled-randomized clinical trials will determine the effect of fasting on clinical outcomes including quality of life and therapeutic index.

KEYWORDS: Cancer; Chemotherapy; IGF-I; Side-effect; Toxicity; fasting

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GOALS AND BENEFITS OF FASTING DURING CHEMOTHERAPY



Deepen ketosis



Downregulate healthy
cell metabolism



Stress cancer cells
(Press/pulse theory)



Keep circulating blood
sugars low and stable



Keep circulating
insulin levels low and
stable



Protect GI tract lining



Reduce side effects –
resulting in improved
overall nutritional
intake and wellbeing



Provide the patient
with a self-
administered and self-
empowering
intervention



[Oman Med J](#). 2014 Nov; 29(6): 391–398.

doi: [10.5001/omj.2014.107](#)

Starvation Based Differential Chemotherapy: A Novel Approach for Cancer Treatment

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Abstract

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Cancer patients undergoing chemotherapy treatment are advised to increase food intake to overcome the therapy-induced side effects, and weight loss. Dietary restriction is known to slow down the aging process and hence reduce age-related diseases such as cancer. Fasting or short-term starvation is more effective than dietary restriction to prevent cancer growth since starved cells switch off signals for growth and reproduction and enter a protective mode, while cancer cells, being mutated, are not sensitized by any external growth signals and are not protected against any stress. This phenomenon is known as differential stress resistance (DSR). Nutrient signaling pathways involving growth hormone/insulin-like growth factor-1 axis and its downstream effectors, play a key role in DSR in response to starvation controlling the other cell maintenance systems, such as autophagy and apoptosis, that are related to the tumorigenesis. Yeast cells lacking these effectors are better protected against oxidative stress compared to normal cells. In the same way, starvation

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4289501/#> cell lines and mice against high-dose chemotherapeutic drugs. According to a series

➤ PLoS One. 2012;7(9):e44603. doi: 10.1371/journal.pone.0044603. Epub 2012 Sep 11.

Fasting enhances the response of glioma to chemo- and radiotherapy

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Abstract

Background: Glioma, including anaplastic astrocytoma and glioblastoma multiforme (GBM) are among the most commonly diagnosed malignant adult brain tumors. GBM is a highly invasive and angiogenic tumor, resulting in a 12 to 15 months median survival. The treatment of GBM is multimodal and includes surgical resection, followed by adjuvant radio- and chemotherapy. We have previously reported that short-term starvation (STS) enhances the therapeutic index of chemo-treatments by differentially protecting normal cells against and/or sensitizing tumor cells to chemotoxicity.

Methodology and principal findings: To test the effect of starvation on glioma cells in vitro, we treated primary mouse glia, murine GL26, rat C6 and human U251, LN229 and A172 glioma cells with Temozolomide in ad lib and STS mimicking conditions. In vivo, mice with subcutaneous or intracranial models of GL26 glioma were starved for 48 hours prior to radio- or chemotherapy and the effects on tumor progression and survival were measured. Starvation-mimicking conditions sensitized murine, rat and human glioma cells, but not primary mixed glia, to chemotherapy. In vivo, starvation for 48 hours, which causes a significant reduction in blood glucose and circulating insulin-like growth factor

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FACTORS IMPACTING ON IMPLEMENTATION

- Timing of chemo administration:
 - Q 3 weeks
 - Q 2 weeks
 - Weekly
 - Extended (ex: FOLFOX regime)
- Patient condition: Presence of cachexia, eating disorders, underlying metabolic conditions (ex: Type 1 diabetes), psychological readiness, family or caregiver support.

APPROPRIATE FLUIDS FOR A SUPPORTED CHEMO FAST

- Water – cold, hot, room temp, bubbly, with non-sweetened flavor essence if desired.
- Electrolyte supplement in water – LMNT or similar
- Black coffee, black or green tea, herbal infusions. Without any sweetness or cream/milk.
- Bone broth. Home-made, packaged. Boullion, clear. Defatted for fewest calories. Salted for electrolyte support. Maximum 500-750 mls/day.
- Goal is a total of 2-3 L/day.



SAMPLE Q 2-3 WEEKS CHEMO FASTING PROTOCOL

- Day 1 – Eat a well-formulated ketogenic diet until supper, then stop eating.
- Day 2 – Day before chemo. Use allowed beverages ad lib.
- Day 3 – Chemo administration day. Use allowed beverages ad lib.
- Day 4 – Resume eating solids 24 hours after end of chemo administration. This might be lunch or supper, depending on chemo schedule. Expect a light appetite.
- Total about 64-72 hours fasted.

SAMPLE WEEKLY CHEMO ADMIN FASTING SCHEDULE

- Day 1 – Day before chemo – Eat until 24 hours before chemo administration (might be breakfast or lunch) Consume only allowed beverages for remainder of day.
- Day 2 – Chemo administration day – consume allowed beverages ad lib.
- Day 3 – Resume eating solid foods 24 hours after end of chemo infusion.
- Total about 48-50 hours fasted.

SAMPLE DAILY CHEMO ADMINISTRATION SCHEDULE

- If oral chemo drug is taken daily, try taking the pill at the end of a daily fasting period, then eat after another hour or so.
- Example: Fast 14 hours 7 pm to 9 am daily. Take chemo pill at 9 am, then have first meal of the day at 10 am.

[Int J Mol Sci.](#) 2020 Dec; 21(23): 9175.

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How Far Are We from Prescribing Fasting as Anticancer Medicine?

[Maria V. Deligiorgi](#),* [Charis Liapi](#), and [Dimitrios T. Trafalis](#)

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Abstract

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(1) Background: the present review provides a comprehensive and up-to date overview of the potential exploitation of fasting as an anticancer strategy. The rationale for this concept is that fasting elicits a differential stress response in the setting of unfavorable conditions, empowering the survival of normal cells, while killing cancer cells. (2) Methods: the present narrative review presents the basic aspects of the hormonal, molecular, and cellular response to fasting, focusing on the interrelationship of fasting with oxidative stress. It also presents nonclinical and clinical evidence concerning the implementation of fasting as adjuvant to chemotherapy, highlighting current challenges and future perspectives. (3) Results: there is ample nonclinical evidence indicating that fasting can mitigate the toxicity of chemotherapy and/or increase the efficacy of chemotherapy. The relevant clinical research is encouraging, albeit still in its infancy. The path forward for implementing fasting in oncology is a personalized approach, entailing counteraction of current challenges, including: (i) patient selection; (ii) fasting patterns; (iii) timeline of fasting and refeeding; (iv) validation of biomarkers for assessment of fasting; and (v) establishment of protocols

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Book: Hacking Chemo: Using Ketogenic Diet, Therapeutic Fasting and a Kickass Attitude to Power Through Cancer

