




INTERMITTENT FASTING IN OLDER ADULTS: BENEFITS VS. RISKS

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LEARNING OBJECTIVES

1. Describe the concept of intermittent fasting (IF) and the different regimens commonly being used
2. Understand the purported benefits and safety concerns associated with intermittent fasting in adults & older adults
3. Assess the research evidence supporting or disproving benefits vs risks of IF
4. Understand our role in educating and counseling our patients and clients who are curious about intermittent fasting

REAL-LIFE CASE

- I'd like to start with a story...about me 😊
- Family Hx of Metabolic Syndrome
- Diagnosed with Type 2 DM a month before my 40th birthday
- A1c at time of Dx was 6.9
- Very active lifestyle since 13 years old
- Diet...not so much...
- Weight kept creeping up
- Came across this thing called IF...



ME

- Decided to give IF a shot...
- Decided to go “slow and steady”
- Skipped breakfast for a week or so...wasn't too bad
- Last meal dinner around 6 pm
- Cut out sugar and reduced carb intake around the second week...started to get painful...
- Progressed to skipping lunch as well – small snack around 2ish, then dinner at 5-6 pm
- Settled on this regimen and have been doing this for the past 4 or so years...
- We'll come back to me at the end of this presentation and discuss what my plans are moving forward



Dr. Oz Explains Intermittent Fasting | TODAY

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How Do You Figure Out if... 3 moments



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NOTE FROM TED: Please do not look to this talk for medical advi...

CC

Intro | Sugar burners vs fat... 6 chapters

What is Intermittent Fasting?



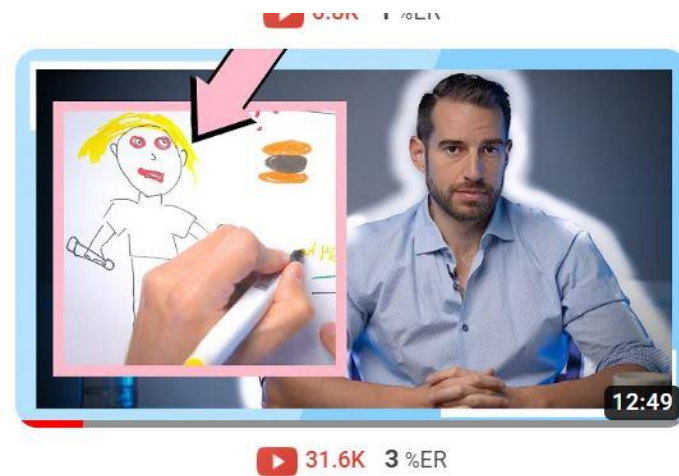
Intermittent Fasting for SERIOUS Weight Loss - Dr. Berg

2.4M views • 1 year ago • 423 VPH

Dr. Eric Berg DC 10.1M subscribers

Intermittent fasting is the most powerful tool you can use for he...

Introduction | Intermittent... 5 chapters



Intermittent Fasting's Darkest Secret

997K views • 5 months ago

Doctor Mike Hansen 1.07M subscribers

Intermittent fasting means that you don't eat for a period of...

10:42 31 of the 40 publications involved 'intermittent f...

4K



Types of Intermittent Fasting

OVERVIEW: TYPES OF INTERMITTENT FASTING

Time-Restricted Feeding (TRF):

- Time-restricted feeding involves consuming food within a specific time window each day, typically ranging from 6 to 12 hours.
- A popular example of TRF is the 16:8 method, where individuals fast for 16 hours and eat within an 8-hour window.
 - Eg., skipping breakfast and having the first meal around noon, then consuming the rest of their food intake within the 8-hour window, and finishing the last meal by 8 pm.

OVERVIEW: TYPES OF INTERMITTENT FASTING

Alternate-Day Fasting (ADF):

- Alternate between days of normal eating and days of fasting
- Proponents suggest ADF can lead to:
 - Significant weight loss
 - Purported improvements in cardiovascular and metabolic health
 - How realistic is this approach? Rapid results compared to other intermittent fasting approaches??

OVERVIEW: TYPES OF INTERMITTENT FASTING

5:2 Diet:

- Normal, balanced diet for 5 days a week, calorie restriction on the remaining 2 non-consecutive days
- More flexibility, more manageable
- Suggested to have positive effects on weight loss, metabolic and cardiovascular health
- Mechanisms of action behind intermittent fasting and older adults next...

MECHANISMS OF ACTION: POTENTIAL BENEFITS FOR OLDER ADULTS

Intermittent fasting supposedly works through various mechanisms, including:

- Hormonal regulation
- Autophagy and cellular repair
- Metabolic adaptation

Vasim I, Majeed CN, DeBoer MD. *Nutrients*. 2022 Jan 31;14(3):631. doi: 10.3390/nu14030631. PMID: 35276989; PMCID: PMC8839325.

Alirezai M et al. *Autophagy*. 2010 Aug;6(6):702-10. doi: 10.4161/auto.6.6.12376. Epub 2010 Aug 14. PMID: 20534972; PMCID: PMC3106288.

POTENTIAL BENEFITS FOR OLDER ADULTS

- Cardiovascular benefits:
 - Blood pressure regulation
 - Reduced inflammation
- Cognitive function and neuroprotection:
 - May promote a longer healthspan by reducing the risk of age-related diseases and promoting cellular repair

Barnosky AR et al. *Transl Res.* 2014 Oct;164(4):302-11. doi: 10.1016/j.trsl.2014.05.013. Epub 2014 Jun 12. PMID: 24993615.

Mindikoglu AL et al. *Sci Rep.* 2020 Oct 27;10(1):18341. doi: 10.1038/s41598-020-73767-w. PMID: 33110154; PMCID: PMC7592042.

POTENTIAL BENEFITS FOR OLDER ADULTS

- Weight Management:
 - Intermittent fasting may help older adults manage their weight by reducing overall caloric intake and promoting fat loss
- Improved metabolic health:
 - Blood glucose control
 - Insulin sensitivity

Are these assertions validated by evidence-based studies? Let's take a deep-dive...



The Studies


LET'S DIVE INTO THE CLINICAL STUDIES...

HOME > SCIENCE TRANSLATIONAL MEDICINE > VOL. 13, NO. 598 > A RANDOMIZED CONTROLLED TRIAL TO ISOLATE THE EFFECTS OF FASTING AND ENERGY...

RESEARCH ARTICLE | METABOLISM



A randomized controlled trial to isolate the effects of fasting and energy restriction on weight loss and metabolic health in lean adults

IAIN TEMPLEMAN , HARRY ALEX SMITH , ENHAD CHOWDHURY , YUNG-CHIH CHEN , HARRIET CARROLL , DRUSUS JOHNSON-BONSON, AARON HENGIST,

ROWAN SMITH , JADE CREIGHTON , [...], AND JAMES ALEXANDER BETTS  [+9 authors](#) [Authors Info & Affiliations](#)

SCIENCE TRANSLATIONAL MEDICINE • 16 Jun 2021 • Vol 13, Issue 598 • DOI: 10.1126/scitranslmed.abd8034

Intermittent Fasting Vs. Plain old Caloric Restriction: Which is Better?

TEMPLEMAN ET AL. – TREATMENT #1

Day 1

✓ **FAST**

Day 2

EAT!!!

2X

Day 3

✓ **FAST**

TEMPLEMAN ET AL. – TREATMENT #2

Day 1

✓ **FAST**

Day 2

EAT!!!

1.5X

Day 3

✓ **FAST**

Overall: Eating 75% less than usual intake - Zero on the fasting days, 150% on the eating days, averaged out, 75%.
In other words, they cut back 25% of their calories.

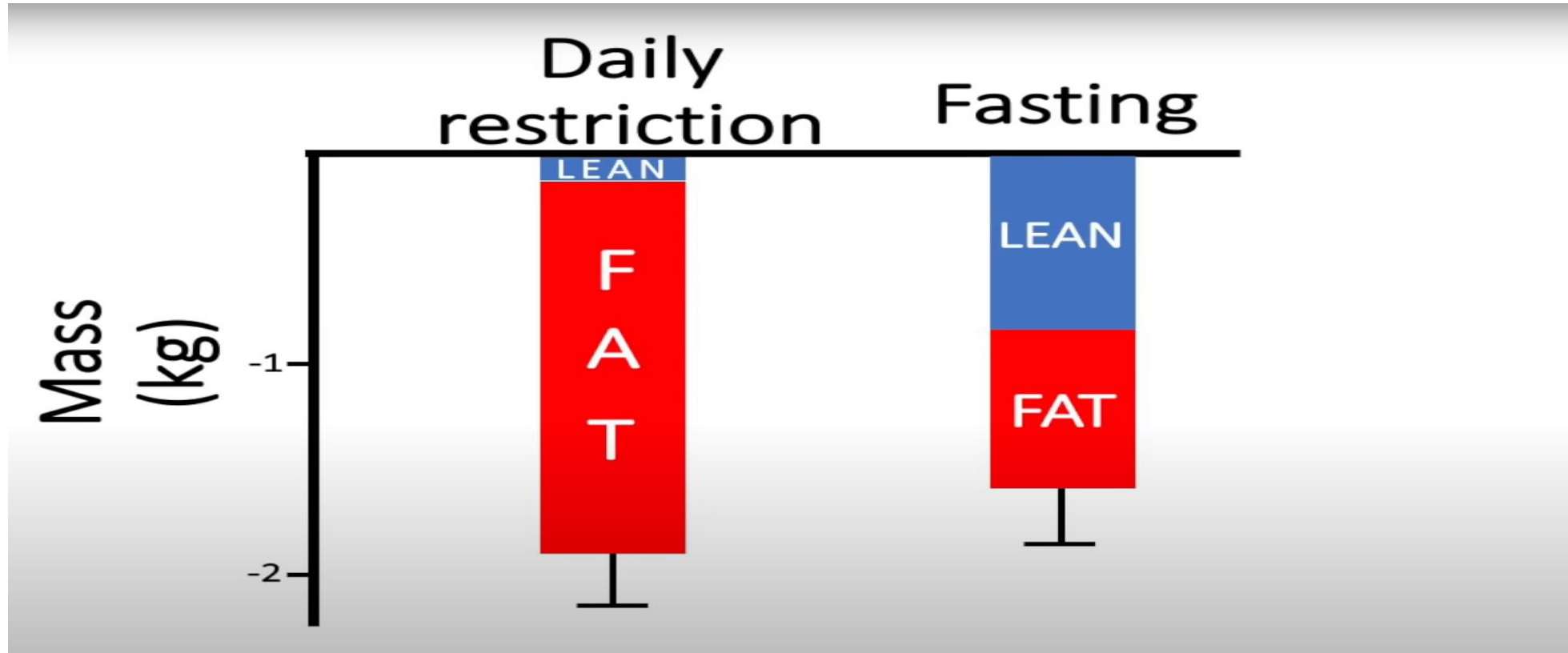
Vs. Group that ate 25% less WITHOUT fasting – so, consistent diet with calorie restriction.

TEMPLEMAN ET AL. – TREATMENT #2

Results:

- Both groups lost weight
- Weight lost about the same

TEMPLEMAN ET AL. – TREATMENT #2



Researchers: “Alternate day fasting less effectively reduces body fat than matched energy restriction, without evidence of fasting-specific effects on metabolic regulation or cardiovascular health.”

WAS THE TEMPLEMAN STUDY AN OUTLIER???

- Much hyped study, received a lot of press
- Was it an outlier? Do other studies align with its results?
- Let's dig deeper...

CIOFFI ET AL – INTERMITTENT FASTING VS. CONTINUOUS CALORIE RESTRICTION

Cioffi et al. *J Transl Med* (2018) 16:371
<https://doi.org/10.1186/s12967-018-1748-4>


Journal of
Translational Medicine

REVIEW

Open Access



Intermittent versus continuous energy restriction on weight loss and cardiometabolic outcomes: a systematic review and meta-analysis of randomized controlled trials

Iolanda Cioffi¹, Andrea Evangelista², Valentina Ponzio³, Giovannino Ciccone², Laura Soldati⁴, Lidia Santarpia¹, Franco Contaldo¹, Fabrizio Pasanisi¹, Ezio Ghigo³ and Simona Bo^{3*} 

CIOFFI ET AL – INTERMITTENT FASTING VS. CONTINUOUS CALORIE RESTRICTION

- **Primary outcome:** Changes in body weight or in percent body weight
- **Secondary outcomes were:**
 - Changes in body mass index (BMI)
 - Waist circumference
 - Fat Mass (FM)
 - Fat-free Mass (FFM)
 - Arterial BP
 - Fasting glucose and insulin, insulin resistance, insulin sensitivity, HbA1c, total cholesterol, HDL- and LDL-cholesterol, and triglycerides

CIOFFI ET AL – INTERMITTENT FASTING VS. CONTINUOUS CALORIE RESTRICTION

- Systematic review and meta-analysis reviewing IF vs. CER
- Included studies with the following characteristics:
 - Randomized controlled trials
 - Detailed description of the IER regimen
 - 75% of energy restriction on “fast” days, with a maximum cut-off of 500/660 Calories/day for females/males, respectively
 - Weekly intermittency of energy restriction (from 1 up to 6 “fasting” days per week)
 - Trial duration >4 weeks
 - Containing as comparator a group on a CER regimen
 - Including changes in body weight or percent body weight as one of the study’s outcome.
- **Both intermittent and continuous energy restriction achieved a comparable effect in promoting weight-loss and metabolic improvements.**

CIOFFI ET AL – INTERMITTENT FASTING VS. CONTINUOUS CALORIE RESTRICTION

■ **Weight Loss:**

- All RCTs reported weight loss in the IER arms during the intervention, ranging from 5.2% of initial weight to 12.9%, while in the CER arms, changes ranged from 4.3% to 12.1% (So, virtually identical)

■ **Anthropometric Measures:**

- Pooled results showed no difference between-arms in FM (WMD: -0.23 kg, 95% CI -1.23 to 0.77 ; $p=0.66$) as well as in FFM (WMD: -0.22 kg, 95% CI -1.01 to 0.56 ; $p=0.58$)

■ **Cardiometabolic Biomarkers:**

- Changes in fasting glucose and HbA1c values were reported respectively in 7 trials.
- Random-effect analysis showed no difference either on glucose (WMD: -0.49 mg/dL, 95% CI -1.98 to 0.99 ; $p=0.51$) or HbA1c (WMD: -0.02% , 95% CI -0.10 to 0.06 ; $p=0.62$)
- Fasting insulin values were significantly reduced with IER (WMD= -0.89 μ U/mL; 95% CI -1.56 to -0.22 ; $p=0.009$; $I^2=0\%$)
- 5:2 regimens were associated with increased insulin reductions over CER regimens

HARRIS ET AL – IER VS. CER

Meta-Analysis > JBI Database System Rev Implement Rep. 2018 Feb;16(2):507-547.

doi: 10.11124/JBISRIR-2016-003248.

Intermittent fasting interventions for treatment of overweight and obesity in adults: a systematic review and meta-analysis

Leanne Harris¹, Sharon Hamilton^{2 3}, Liane B Azevedo^{2 3}, Joan Olajide^{2 3}, Caroline De Brún^{2 3}, Gillian Waller^{2 3}, Vicki Whittaker^{2 3}, Tracey Sharp⁴, Mike Lean¹, Catherine Hankey¹, Louisa Ells^{1 3}

Affiliations + expand

PMID: 29419624 DOI: 10.11124/JBISRIR-2016-003248

HARRIS ET AL – IER VS. CER

- **Objective:** Effectiveness of intermittent energy restriction in the treatment for overweight and obesity in adults, when compared to usual care treatment or no treatment
- **Inclusion criteria:**
 - Overweight or obese (BMI ≥ 25 kg/m) adults (≥ 18 years)
 - IER defined as consumption of ≤ 800 kcal on at least one day, but no more than six days per week.
 - IER interventions were compared to no treatment or usual
 - Interventions had a minimum duration of 12 weeks from baseline to post outcome measurements.
- **Primary outcome:**
 - Change in body weight
- **Secondary outcomes:**
 - Anthropometric outcomes, cardio-metabolic outcomes, and lifestyle outcomes
- **Conclusion: IER was comparable to CER for short term weight loss in overweight and obese adults**

TEMPLEMAN ET AL – MEAL TIMING AND IER IN WEIGHT MANAGEMENT & METABOLIC HEALTH

Review > [Proc Nutr Soc. 2020 Feb;79\(1\):76-87. doi: 10.1017/S0029665119000636.](#)

Epub 2019 Apr 26.

The role of intermittent fasting and meal timing in weight management and metabolic health

Iain Templeman¹, Javier T Gonzalez¹, Dylan Thompson¹, James A Betts¹

Affiliations + expand

PMID: 31023390 DOI: [10.1017/S0029665119000636](#)

“The efficacy of these temporally defined approaches appears broadly equivalent to that of standard daily energy restriction”

ESTRADA-DELEON ET AL: FASTING & LE FUNCTIONING

> [Br J Nutr.](#) 2021 Nov 14;126(9):1347-1354. doi: 10.1017/S0007114520005218. Epub 2020 Dec 29.

Prolonged nightly fasting and lower-extremity functioning in community-dwelling older adults

Daniela B Estrada-deLeón ^{1 2 3}, Ellen A Struijk ^{1 2 3}, Francisco Félix Caballero ^{1 2 3}, Mercedes Sotos Prieto ^{1 2 3 4}, Fernando Rodríguez-Artalejo ^{1 2 3 5}, Esther Lopez-Garcia ^{1 2 3 5}

Affiliations [+ expand](#)

PMID: 33371909 PMCID: [PMC8505711](#) DOI: [10.1017/S0007114520005218](#)

[Free PMC article](#)

ESTRADA-DELEON ET AL: FASTING & LE FUNCTIONING

- Cross-sectional analysis of data obtained from the Seniors-ENRICA-II (Study on Nutrition and Cardiovascular Risk in Spain) cohort, **among 3273 community-dwelling individuals aged 64 years or older**
- Objective: To assess prolonged nightly fasting in association with performance-based lower-extremity function (LEF) in a large population of community-dwelling older adults.
- Fasting time was classified into the following categories: ≤ 9 , 10–11 **and** ≥ 12 h/d (**prolonged nightly fasting**).
- Performance-based LEF was assessed with the Short Physical Performance Battery (SPPB)
- **Outcome: A longer fasting period was associated with a higher likelihood of impaired LEF**
- Fasting time showed a significant association with the SPPB subtests balance impairment
- **≥ 12 h fasting = 3X higher risk than among those with ≤ 9 h fasting (with low physical activity). Prolonged nightly fasting = higher LLE balance impairment, and difficulty to rise from a chair in older adults, especially among those with low levels of physical activity.**

ANTON ET AL – INTERMITTENT FASTING IN MIDDLE-AGE & OLDER ADULTS



Experimental Gerontology



Volume 156, December 2021, 111617





The effects of intermittent fasting regimens in middle-age and older adults: Current state of evidence

[Stephen Anton](#)^{a,b}  , [Armin Ezzati](#)^{c,d}, [Danielle Witt](#)^a, [Christian McLaren](#)^a, [Patricia Vial](#)^e

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<https://doi.org/10.1016/j.exger.2021.111617> 

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Confirms weight loss in TRE and 5:2 regimens, aligning with other studies cited here; BUT, authors found effects of BP reduction to be inconsistent across studies.

HUSSAIN ET AL - HOT OFF THE PRESSES: LOSS OF BODY WEIGHT = ↑ ↑ ↑ DEATH?

Original Investigation | Geriatrics



April 10, 2023

Associations of Change in Body Size With All-Cause and Cause-Specific Mortality Among Healthy Older Adults

Sultana Monira Hussain, PhD^{1,2}; Anne B. Newman, PhD³; Lawrence J. Beilin, MD⁴; [et al](#)

[» Author Affiliations](#) | [Article Information](#)

JAMA Netw Open. 2023;6(4):e237482. doi:10.1001/jamanetworkopen.2023.7482

Key Points

Question Is change in body size associated with increased mortality risk among healthy older adults?

Findings In this cohort study of 16 523 community-dwelling healthy participants, 1256 died over a mean (SD) of 4.4 (1.7) years of follow-up. Among men, loss of 5% to 10% of body weight and loss of more than 10% of body weight were associated with a 33% and 289% increase in mortality, respectively; among women, loss of 5% to 10% of body weight and loss of more than 10% of body weight were associated with a 26% and 114% increase in mortality, respectively.

Meaning This study suggests that weight loss was associated with an increase in mortality, particularly among men, highlighting the need to monitor and investigate weight loss in older adults.

HUSSAIN ET AL : LOSS OF BODY WEIGHT = ↑ ↑ ↑ DEATH?

- **Objective** To examine the associations of changes in body weight and waist circumference with all-cause and cause-specific mortality
- **Design, Setting, and Participants:**
 - Post hoc analysis of data from the Aspirin in Reducing Events in the Elderly (ASPREE) randomized clinical trial
 - Community-based older adults without evident CVD, dementia, physical disability, or life-limiting chronic illness
 - Body weight and WC were measured at baseline and at annual visit

HUSSAIN ET AL: LOSS OF BODY WEIGHT = ↑ ↑ ↑ DEATH?

■ Results:

- 16,523 participants (mean [SD] age, 75.0 [4.3] years; 9193 women [55.6%])
- 1256 deaths were observed over a mean 4.4 years
- **Men:**
 - Compared with men with stable weight, those with a 5% to 10% weight loss had a 33% higher (HR, 1.33; 95% CI, 1.07-1.66) risk of all-cause mortality
 - Those with more than a 10% decrease in body weight had a 289% higher (HR, 3.89; 95% CI, 2.93-5.18) risk.
- **Women:**
 - Compared with women with stable weight, those with a **5% to 10% weight loss had a 26% higher** (HR, 1.26; 95% CI, 1.00-1.60) risk of all-cause mortality,
 - Those with **more than a 10% decrease in body weight had a 114% higher** (HR, 2.14; 95% CI, 1.58-2.91) risk.
- **Weight loss was associated with a higher cancer-specific mortality**
- **A decrease in WC was also associated with mortality.**



REFLECTION

PRACTICAL IMPLEMENTATION OF INTERMITTENT FASTING FOR OLDER ADULTS – IS IT HYPE OR IS THERE BENEFIT?

- Majority of studies are from animal models: The logic leap that rat studies translate to humans may be a stretch
- Marketing and Sales Pitches: Beware the hype
 - Excerpt from Templeman (2020): “Bluntly, the number of diet books advising how intermittent fasting can be incorporated into our daily lives is several orders of magnitude greater than the number of scientific papers examining whether intermittent fasting should be encouraged at all”

RISKS AND CONSIDERATIONS IN OLDER ADULTS

***** Possibly THE MOST IMPORTANT SLIDE in this presentation!!!*****

- Potential nutrient deficiencies
- Loss of muscle mass and sarcopenia (and loss of lean mass also includes body water and glycogen)
- **Individual medical conditions and contraindications:**
 - **Diabetes**
 - **Cardiovascular disease**
 - **Cognitive disorders**
 - **Interactions with medications**
 - **Importance of personalized approach and monitoring**
- **Importance of non-judgmental listening, teaching, and counseling**



Back to Me...

- Has the data I uncovered changed my viewpoint and stance?
- What's the plan moving forward?
- Monitoring?
- When will I know to change the plan?

REFERENCES

- de Cabo R, Mattson MP. Effects of intermittent fasting on health, aging, and disease. *N Engl J Med*. 2019 Dec 26;381(26):2541-2551. doi: 10.1056/NEJMra1905136.
- Mattson MP, Longo VD, Harvie M. Impact of intermittent fasting on health and disease processes. *Ageing Res Rev*. 2017 Oct;39:46-58. doi: 10.1016/j.arr.2016.10.005.
- Sutton EF, Beyl R, Early KS, Cefalu WT, Ravussin E, Peterson CM. Early time-restricted feeding improves insulin sensitivity, blood pressure, and oxidative stress even without weight loss in men with prediabetes. *Cell Metab*. 2018 Jun 5;27(6):1212-1221.e3. doi: 10.1016/j.cmet.2018.04.010.
- Tinsley GM, La Bounty PM. Effects of intermittent fasting on body composition and clinical health markers in humans. *Nutr Rev*. 2015 Oct;73(10):661-674. doi: 10.1093/nutrit/nuv041.
- Anton SD, Moehl K, Donahoo WT, Marosi K, Lee SA, Mainous AG 3rd, et al. Flipping the metabolic switch: understanding and applying the health benefits of fasting. *Obesity (Silver Spring)*. 2018 Feb;26(2):254-268. doi: 10.1002/oby.22065.
- Malinowski B, Zalewska K, Węsierska A, Sokołowska MM, Socha M, Liczner G, et al. Intermittent fasting in cardiovascular disorders—an overview. *Nutrients*. 2019 Mar 20;11(3):673. doi: 10.3390/nu11030673.
- Patterson RE, Sears DD. Metabolic effects of intermittent fasting. *Annu Rev Nutr*. 2017 Aug 21;37:371-393. doi: 10.1146/annurev-nutr-071816-064634.
- Moro T, Tinsley G, Bianco A, Marcolin G, Pacelli QF, Battaglia G, et al. Effects of eight weeks of time-restricted feeding (16/8) on basal metabolism, maximal strength, body composition, inflammation, and cardiovascular risk factors in resistance-trained males. *J Transl Med*. 2016 Oct 13;14(1):290. doi: 10.1186/s12967-016-1044-0.
- Li L, Wang Z, Zuo Z. Chronic intermittent fasting improves cognitive functions and brain structures in mice. *PLoS One*. 2013 Jun 3;8(6):e66069. doi: 10.1371/journal.pone.0066069.
- Mattson MP, Arumugam TV. Hallmarks of brain aging: adaptive and pathological modification by metabolic states. *Cell Metab*. 2018 Jun 5;27(6):1176-1199. doi: 10.1016/j.cmet.2018.03.017.
- Longo VD, Panda S. Fasting, circadian rhythms, and time-restricted feeding in healthy lifespan. *Cell Metab*. 2016 Jun 14;23(6):1048-1059. doi: 10.1016/j.cmet.2016.06.001.

REFERENCES

- Vasim I, Majeed CN, DeBoer MD. Intermittent Fasting and Metabolic Health. *Nutrients*. 2022 Jan 31;14(3):631. doi: 10.3390/nu14030631. PMID: 35276989; PMCID: PMC8839325.
- Alirezaei M, Kemball CC, Flynn CT, Wood MR, Whitton JL, Kiosses WB. Short-term fasting induces profound neuronal autophagy. *Autophagy*. 2010 Aug;6(6):702-10. doi: 10.4161/auto.6.6.12376. Epub 2010 Aug 14. PMID: 20534972; PMCID: PMC3106288.
- Mindikoglu AL, Abdulsada MM, Jain A, Jalal PK, Devaraj S, Wilhelm ZR, Opekun AR, Jung SY. Intermittent fasting from dawn to sunset for four consecutive weeks induces anticancer serum proteome response and improves metabolic syndrome. *Sci Rep*. 2020 Oct 27;10(1):18341. doi: 10.1038/s41598-020-73767-w. PMID: 33110154; PMCID: PMC7592042.
- Templeman I, Smith HA, Chowdhury E, Chen YC, Carroll H, Johnson-Bonson D, Hengist A, Smith R, Creighton J, Clayton D, Varley I, Karagounis LG, Wilhelmsen A, Tsintzas K, Reeves S, Walhin JP, Gonzalez JT, Thompson D, Betts JA. A randomized controlled trial to isolate the effects of fasting and energy restriction on weight loss and metabolic health in lean adults. *Sci Transl Med*. 2021 Jun 16;13(598):eabd8034. doi: 10.1126/scitranslmed.abd8034. PMID: 34135111.
- Cioffi I, Evangelista A, Ponzio V, Ciccone G, Soldati L, Santarpia L, Contaldo F, Pasanisi F, Ghigo E, Bo S. Intermittent versus continuous energy restriction on weight loss and cardiometabolic outcomes: a systematic review and meta-analysis of randomized controlled trials. *J Transl Med*. 2018 Dec 24;16(1):371. doi: 10.1186/s12967-018-1748-4. PMID: 30583725; PMCID: PMC6304782.
- Harris L, Hamilton S, Azevedo LB, Olajide J, De Brún C, Waller G, Whittaker V, Sharp T, Lean M, Hankey C, Ells L. Intermittent fasting interventions for treatment of overweight and obesity in adults: a systematic review and meta-analysis. *JBI Database System Rev Implement Rep*. 2018 Feb;16(2):507-547. doi: 10.1111/24751247JBISRIR-2016-003248. PMID: 29419624.
- Templeman I, Gonzalez JT, Thompson D, Betts JA. The role of intermittent fasting and meal timing in weight management and metabolic health. *Proc Nutr Soc*. 2020 Feb;79(1):76-87. doi: 10.1017/S0029665119000636. Epub 2019 Apr 26. PMID: 31023390.
- Hussain SM, Newman AB, Beilin LJ, Tonkin AM, Woods RL, Neumann JT, Nelson M, Carr PR, Reid CM, Owen A, Ball J, Cicuttini FM, Tran C, Wang Y, Ernst ME, McNeil JJ. Associations of Change in Body Size With All-Cause and Cause-Specific Mortality Among Healthy Older Adults. *JAMA Netw Open*. 2023 Apr 3;6(4):e237482. doi: 10.1001/jamanetworkopen.2023.7482. PMID: 37036703; PMCID: PMC10087052.
- Estrada-deLeón DB, Struijk EA, Caballero FF, Sotos Prieto M, Rodríguez-Artalejo F, Lopez-García E. Prolonged nightly fasting and lower-extremity functioning in community-dwelling older adults. *Br J Nutr*. 2021 Nov 14;126(9):1347-1354. doi: 10.1017/S0007114520005218. Epub 2020 Dec 29. PMID: 33371909; PMCID: PMC8505711.



Questions?