www.ijdrp.org
Vol. 3, No. 2. 2021

Medically Supervised Water-Only Fasting Followed by a Whole-Plant-Food Diet Reduces Visceral Adipose Tissue

Matthieu Bonjour[a], Sahmla Gabriel[b], Alan C. Goldhamer[a], Toshia R. Myers[b]

Abstract

Visceral adipose tissue (VAT) is associated with chronic metabolic and inflammatory disorders. Normal weight, overweight, and obese people can all be overfat with visceral adipose tissue (VAT). In this case series, we describe the total body composition of three male patients with excess VAT after undergoing prolonged medically supervised water-only fasting followed by an exclusively whole-plant-food diet free of added salt, oil, and sugar. All patients lost a substantially higher percentage of VAT mass than total fat mass. These clinical observations warrant further observation into the efficacy of fasting and diet to reduce VAT.

Keywords: Prolonged water-only fasting; Visceral adipose tissue; Dual-energy X-ray absorptiometry

www.ijdrp.org/article/view/267/5
doi:10.22230/ijdrp.2021v3n2a267

ISSN: 2638-2091

International Journal of Disease Reversal and Prevention

Introduction

The majority of adult humans are overweight or obese and many at normal weight are overfat with excess visceral adipose tissue (VAT) surrounding the heart and abdominal organs.[1,2] Visceral adipose tissue is composed of metabolically active white adipocytes that, when dysregulated, have a strong association with metabolic and inflammatory disorders such as cardiovascular disease, stroke, diabetes mellitus type 2,

cancer, dyslipidemia, dementia, and osteoarthritis.[3,4] All weight loss methods appear to cause some amount of VAT loss, but very low-calorie ketogenic diets cause rapid weight loss that may preferentially target VAT better than other methods.[5,6] Prolonged water-only fasting is a zero-calorie ketogenic diet that may result in higher rates of lipolysis with less lean mass loss than caloric restriction.[7] Medically supervised water-only fasting has been proven safe and tolerable.[8] Here, we present three clinical cases of male patients who had a rapid loss of VAT during a water-only fast that continued throughout refeed on an exclusively whole-plant-food diet free of added salt, oil, and sugar.

Case Presentations

The patients described in this series voluntarily elected to undergo a medically supervised water-only fast and provided written consent to publish their case. The patients were medically approved for water-only fasting based on sufficient nutrient and electrolyte reserves and no contraindications as previously described.[8] The pre-fast diet included ad libitum raw fruits and vegetables and steamed and baked vegetables for at least two days. During the water-only fast, patients consumed a minimum of 40 oz of distilled water per day. Acaloric vegetable broth without added salt was available as needed. Vitals were monitored twice daily by medical staff, and patients met with their attending clinician and had relevant serology to monitor electrolytes and kidney function a minimum of once weekly. Fasting was terminated with a refeed diet that gradually introduced plant foods of increasing complexity until patients were eating an exclusively whole-plant-food diet free of added salt, oil, and sugar. Although the patients initiated fasting for various health-related reasons, they also elected to have their body composition measured using dual-energy X-ray absorptiometry (DXA), which is an accurate, cost-effective, low-radiation tool[9] that measures bone density as well as fat and lean tissue mass distribution.[10,11] This technology is publicly available and is comparable to other methods of assessing body composition.[12] The scans were performed at the start of fast, end of fast, and end of refeed using GE Lunar Prodigy or Hologic Horizon DXA machines as indicated.

Case 1

A 27-year-old male underwent a 15-day medically supervised water-only fast followed by a six-day refeed with the intention of improving mild symptoms related to systemic lupus erythematosus. The patient was not taking any medications and did not report any additional medical history. He reported decreased energy on fasting days 11 and 12 and mild lightheadedness on fasting day 5. He had a GE Lunar Prodigy DXA scan at the start of his fast (Figure 1A). As presented in Table 1, the scan indicated a total weight of 81.04 kg including 56.69 kg of lean mass and 21.09 kg of total fat mass with an android/gynoid (A/G) ratio of 1.09 and 0.40 kg of VAT mass. His body mass index (BMI) was 24 kg/m^2. A second scan performed on his final day of fasting (Figure 1B) indicated a total mass reduction of 9.07 kg (11%) with a corresponding reduction in total lean mass of 6.57 kg (12%), fat mass of 2.49 kg (12%), and VAT mass of 0.11 kg (28%). His A/G ratio decreased to 0.95. A third DXA scan performed at that end of his refeed (Figure 1C) indicated a slight increase in total mass to 73.15 kg corresponding to an increase in lean mass of 2.22 kg. During this period, the patient lost an additional 1.0 kg total fat mass of which 0.10 kg was VAT mass. The A/G ratio decreased further to 0.93. Overall, he lost 16% of total fat and 54% of total VAT mass. There was a net 8% reduction of lean mass from the start-of-fast DXA scan. His bone mineral content (BMC) did not change (Table 1).

Affiliations
[a]TrueNorth Health Center, 1551 Pacific Avenue, Santa Rosa, CA 95404, USA
[b]TrueNorth Health Foundation, 1551 Pacific Avenue, Santa Rosa, CA 95404, USA

Corresponding author
Toshia R. Myers, drmyers@truenorthhealth.org

Patient Consent
The patients consented to the publication of this report.

Funding
None

Conflicts of Interest
All authors attest that they do not have any financial disclosures.

Authorship
All authors attest that they meet the current International Committee of Medical Journal Editors (ICMJE) criteria for Authorship.

Table 1. Changes in Body Composition

		BMI (kg/m^2)	Total Mass (kg)	Lean Mass (kg)	Total Fat (kg)	Total VAT (kg)	Android Fat (kg)	Gynoid Fat (kg)	A/G Ratio
Case 1	SOF (Day 0)	24	81.04	56.69	21.09	0.404	1.45	3.49	1.09
	EOF (Day 15)	21	71.97	50.11	18.59	0.290	1.13	3.13	0.95
	EOR (Day 21)	22	73.15	52.33	17.60	0.186	1.04	2.86	0.93
Case 2	SOF (Day 0)	23	71.34	50.16	18.23	0.639	1.72	3.22	1.13
	EOF (Day 14)	21	63.99	44.85	16.23	0.499	1.40	2.86	1.12
	EOR (Day 29)	21	66.85	48.39	15.51	0.376	1.22	2.86	0.95
Case 3	SOF (Day 0)	25	85.42	63.51	19.03	0.482	1.57	3.68	0.96
	EOF (Day 20)	22	75.05	56.39	15.74	0.406	1.09	3.17	0.86
	EOR (Day 31)	22	76.78	59.09	14.84	0.368	0.94	2.96	0.72

Notes: A/G, android/gynoid; BMI, Body Mass Index; EOF, end-of-fast visit; EOR, end-of-refeed visit; kg, kilogram; m, meter; SOF, start-of-fast; VAT, visceral adipose tissue.

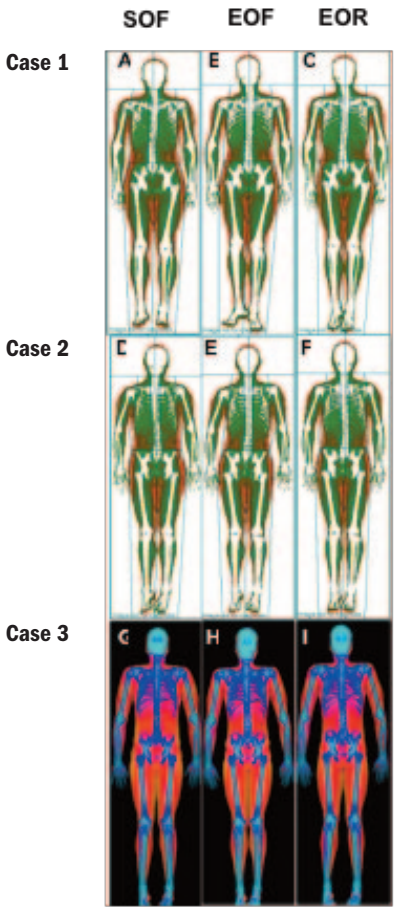

Figure 1. Patient DXA Body Composition Scans

Notes: Shown at start of fast (SOF; A, D, G), end of fast (EOF; B, E, H), and end of refeed (EOR; C, F, I). DXA scans for Cases 1 and 2 were performed on a GE Lunar Prodigy, where the colors white, green, and red represent bone tissue compartment, lean tissue, and fat tissue, respectively. DXA scans for Case 3 were performed on a Hologic Horizon, where the colors blue, red, and yellow represent bone tissue compartment, lean tissue, and fat tissue, respectively.

Case 2

A 38-year-old male patient underwent a 14-day medically supervised water-only fast followed by a 15-day refeed with the intention of maintaining overall health. The patient was not taking any medications and reported a history of obesity that resolved a year prior to intake with dietary changes. While fasting, he reported occasional lightheadedness upon standing, which resolved completely upon refeeding. He had a GE Lunar Prodigy DXA scan at the start of his fast (Figure 1D). As presented in Table 1, the scan indicated a total weight of 71.34 kg including 50.15 kg of lean mass and 18.23 kg of total fat mass with an A/G ratio of 1.13 and 0.64 kg of VAT mass. His BMI was 23 kg/m^2. A second DXA scan performed on his final day of fasting (Figure 1E) indicated a total mass reduction of 7.35 kg (10%) with a corresponding reduction in lean mass of 5.31 kg (11%), fat mass of 2.0 kg (11%), and VAT mass of 0.14 kg (22%). His A/G ratio decreased to 1.12. A third DXA scan performed at the end of his refeed (Figure 1F) indicated a slight increase in total mass to 66.85 kg corresponding to an increase in lean mass of 3.54 kg. During this period, the patient lost an additional 0.73 kg total fat mass of which 0.12 kg was VAT mass. The A/G ratio decreased further to 0.95. Overall, he lost 15% of total fat and 41% of total VAT mass. There was a net 3% reduction of lean mass from the start-of-fast DXA scan. His BMC change was minimum, from 2.99 to 2.95 kg.

Case 3

A 40-year-old male patient underwent a voluntary 20-day medically supervised water-only fast followed by an 11-day refeeding period with the intention of improving metabolic health. The patient was not on any medications and did not have any underlying medical conditions. He did not report any adverse events for the duration of the treatment and consumed acaloric vegetable broth for reasons unrelated to the treatment on fasting days 17–20. He had a Hologic Horizon DXA scan at the start of his fast (Figure 1G). As presented in Table 1, the scan indicated a total weight of 85.42 kg including 63.51 kg of lean mass and 19.03 kg of total fat mass with an A/G ratio of 0.96 and 0.482 kg of VAT mass. His BMI was 25 kg/m^2. A second DXA scan performed on the final day of his fast (Figure 1H) indicated a total mass reduction of 10.37 kg (12%) with a corresponding reduction in lean mass of 7.12 kg (11%), fat mass of 3.29 (18%), and VAT mass of 0.08 kg (16%). His A/G ratio decreased to 0.86. A third DXA scan performed at the end of his refeed (Figure 1I) indicated a slight increase in total mass to 76.78 kg corresponding to an increase in lean mass of 2.7 kg. During this period, the patient lost an additional 0.9 kg total fat mass of which 0.04 kg was VAT mass. The A/G ratio decreased further to 0.72. Overall, he lost 22% of total fat and 24% of total VAT mass. There was a net 7% reduction of lean mass from the start-of-fast DXA scan. His BMC change was minimum, from 2.88 to 2.84 kg.

Discussion

We have reported three cases describing changes in total body composition after prolonged water-only fasting followed by an exclusively whole-plant-food diet. Even though none of the patients were significantly overweight, they all had excess VAT and lost approximately 20% of their VAT mass during the initial water-only fasting period. VAT loss continued throughout refeeding on an exclusively whole-plant-food diet despite increases in total weight. At the end of refeeding, their ratios of android to gynoid fat mass also decreased to below 1.0.

VAT was lost at a higher percentage than other adipose tissue in these patients. This may be because VAT is reportedly more metabolically active, prone to mobiliza-

tion, and has higher rates of lipolysis than subcutaneous adipose tissue (SAT).[13] Additionally, fasting may drive preferential VAT loss through a combination of metabolic, genetic, and sympathetic nervous system changes.[5,13,14] Recent work suggests that prolonged water-only fasting activates non-canonical lipolysis pathways in subcutaneous adipocytes[15] but to our knowledge visceral adipocytes have not been analyzed. There are many open questions with regard to the molecular mechanisms behind SAT and VAT lipolysis during prolonged water-only fasting, if and how it differs from lipolysis during caloric restriction, and how exclusively whole-plant-food diets affect VAT loss in comparison to other diets.

Despite varying fast lengths, the patients all lost approximately 11% of their total lean mass at the end of fasting. This may be a random observation but it may also reflect that prolonged fasting in humans results in an initial period of gluconeogenesis, after which protein sparing occurs because of a switch from glucose to lipid metabolism.[16] This causes a progressive increase in ketone bodies that have both an anti-catabolic and anabolic effect on proteins, thus minimizing protein catabolism.[17] The lean mass was partially regained during the short refeeding period suggesting the loss was likely due to glycogen depletion and/or increased sodium diuresis rather than muscle loss. Additionally, the patient in Case 2 was refed for twice the amount of time as the other patients and gained back a larger percentage of lean mass suggesting that lean mass will continue to increase as feeding progresses. Unfortunately, DXA scanning technology is unable to differentiate whether the measured lean mass is muscle or fluid.

To our knowledge, this is the first report assessing total body composition after a prolonged water-only fast followed by an exclusively whole-plant-food diet. The rapid and continued VAT loss observed warrants additional study and we are further assessing this observation in a formal preliminary study including lean and overweight males and females.

References

1. Maffetone PB, Laursen PB. Revisiting the global overfat pandemic. *Front Public Health*. 2020;8:51. doi:10.3389/fpubh.2020.00051
2. Maffetone PB, Laursen PB. The prevalence of overfat adults and children in the US. *Front Public Health*. 2017;5:290. doi:10.3389/fpubh.2017.00290
3. Ibrahim MM. Subcutaneous and visceral adipose tissue: structural and functional differences. *Obes Rev*. 2010;11:11–18. doi:10.1111/j.1467-789X.2009.00623.x
4. Tchkonia T, Thomou T, Zhu Y, et al. Mechanisms and metabolic implications of regional differences among fat depots. *Cell Metab*. 2013;17:644–656. doi:10.1016/j.cmet.2013.03.008
5. Chaston TB, Dixon JB. Factors associated with percent change in visceral versus subcutaneous abdominal fat during weight loss: Findings from a systematic review. *Int J Obes* (Lond). 2008;32:619–628. doi:10.1038/sj.ijo.0803761
6. Gomez-Arbelaez D, Bellido D, Castro AI, et al. Body composition changes after very-low-calorie ketogenic diet in obesity evaluated by 3 standardized methods. *J Clin Endocrinol Metab*. 2017;102:488–498. doi:10.1210/jc.2016-2385
7. Catenacci VA, Pan Z, Ostendorf D, et al. A randomized pilot study comparing zero-calorie alternate-day fasting to daily caloric restriction in adults with obesity. *Obesity*. 2016;24:1874–1883. doi:10.1002/oby.21581
8. Finnell JS, Saul BC, Goldhamer AC, Myers TR. Is fasting safe? A chart review of adverse events during medically supervised, water-only fasting. *BMC Complement Altern Med.* 2018;18:67. doi:10.1186/s12906-018-2136-6

9. Blake GM, Naeem M, Boutros M. Comparison of effective dose to children and adults from dual X-ray absorptiometry examinations. *Bone*. 2006;38:935–942. doi:10.1016/j.bone.2005.11.007
10. Borga M. et al. Advanced body composition assessment: From body mass index to body composition profiling. *J Investig Med.* 2018;66:1–9. doi:10.1136/jim-2018-000722
11. Gallagher D, Heymsfield SB, Heo M, et al. Healthy percentage body fat ranges: An approach for developing guidelines based on body mass index. *Am J Clin Nutr.* 2000;72:694–701. doi:10.1093/ajcn/72.3.694
12. Ergun DL, Rothney MP, Oates MK, et al. Visceral adipose tissue quantification using Lunar Prodigy. *J Clin Densitom.* 2013;16:75–78. doi:10.1016/j.jocd.2012.09.002
13. Freedland ES. Role of a critical visceral adipose tissue threshold (CVATT) in metabolic syndrome: Implications for controlling dietary carbohydrates: A review. *Nutr Metab* (Lond). 2004;1:12. doi:10.1186/1743-7075-1-12
14. Ding H, Zheng S, Garcia-Ruiz D, et al. Fasting induces a subcutaneous-to-visceral fat switch mediated by microRNA-149-3p and suppression of PRDM16. *Nat Commun.* 2016;7:11533. doi:10.1038/ncomms11533
15. Fazeli PK, Zhang Y, O'Keefe J, et al. Prolonged fasting drives a program of metabolic inflammation in human adipose tissue. *Mol Metab.* 2020;42:101082 doi:10.1016/j.molmet.2020.101082
16. Finn PF, Dice JF. Proteolytic and lipolytic responses to starvation. *Nutrition.* 2006;22:830–844. doi:10.1016/j.nut.2006.04.008
17. Koutnik AP, D'Agostino DP, Egan B. Anticatabolic effects of ketone bodies in skeletal muscle. *Trends Endocrinol Metab.* 2019;30:227–229. doi:10.1016/j.tem.2019.01.006