



Changes in Bone Marrow Adipose Tissue (BMAT) Are Associated With Weight Loss in People Receiving Diabetes Care



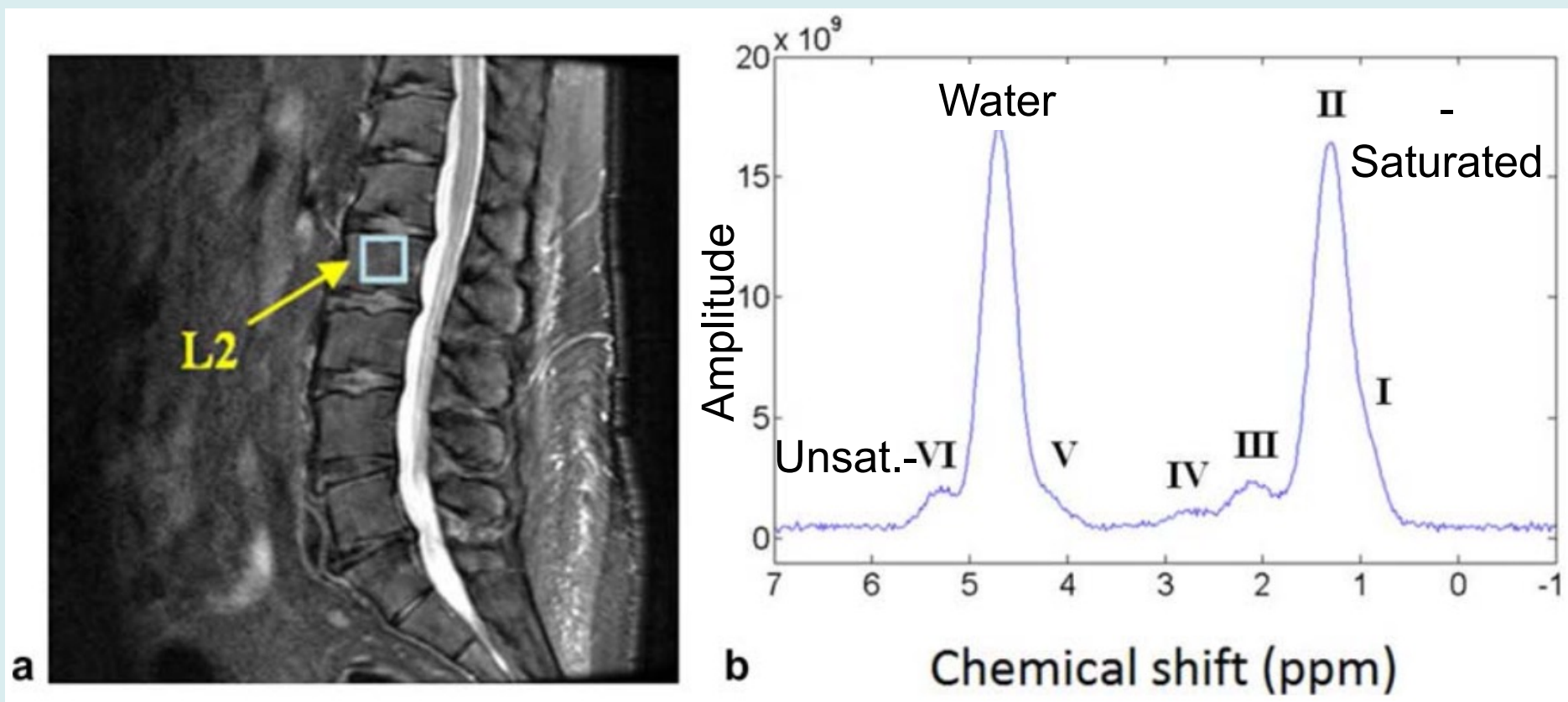
INTRODUCTION

- Increased fracture risk in people with type 2 diabetes (T2D), in part due to intrinsic skeletal fragility
- BMAT is a metabolic fat depot, may play a negative role in skeletal disease and specifically in T2D
- After gastric bypass surgery, changes in glycemic control were associated with changes in BMAT
- Gap: It is unknown whether medical management of diabetes can improve BMAT and skeletal health
- Objective: Determine longitudinal effects of improved glycemic control on BMAT and skeletal outcomes in Veterans receiving medical management of T2D

METHODS

- Prospective observational cohort:** Men and postmenopausal women, age 50-80, T2D duration >5 years, recent A1c >8.5%, receiving care at the SFVA
- Exclusion:** Smoking, estimated glomerular filtration rate <30 ml/min/1.73 m², recent hip fracture, use of medications that affect bone and glucose metabolism
- DXA:** Horizon A Hologic
- MR Imaging:** 3T GE MR (Fig. 1a), single-voxel MRS at L3/L4 (Fig. 1b)
 - Total BMAT: total lipids / (total lipids + water)
 - Unsat. BMAT: Unsat, lipid / (total lipids + water)
 - Sat. BMAT: Sat. lipid / (total lipids + water)

Fig. 1



- Analysis:** Wilcoxon signed-rank and paired t tests to assess change in outcomes; Mann-Whitney and t tests to assess between group differences; Spearman's rank and Pearson's correlation tests to assess unadjusted relationships; linear regression models adjusted for weight loss, GLP1 use

RESULTS

Table 1. Baseline characteristics (n=54)

Age, years	66.4 ± 8.7
Sex, male	90%
Race, ethnicity	
White, non-Hispanic	31 (57%)
White, Hispanic	4 (7%)
Black, non-Hispanic	8 (15%)
Black, Hispanic	2 (4%)
Asian	3 (6%)
Pacific Islander	1 (2%)
Native American	1 (2%)
Multiple or declined	4 (8%)
Weight, kg	89 (79 to 110)
BMI, g/m ²	28.9 (27.1 to 35.8)
Total BMAT L3/L4, %	61.6 ± 9.6
Unsat. BMAT L3/L4, %	3.1 ± 1.1
Sat BMAT L3/L4, %	44.7 ± 7.7

Table 2. Longitudinal 1-year change (n=30)

A1c Δ, %	-1.6 (-2.0 to -0.5), p<0.01
Weight Δ, kg	-2.0 (-5.6 to +0.9), p=0.01
Fem. neck BMD Δ, %	-1.2 ± 2.9, p=0.02
Tot. hip BMD Δ, %	-0.7 ± 2.0, p=0.09
Spine BMD Δ, %	-0.7 ± 2.0, p=0.75
Total BMAT L3/L4 Δ, %	-1.0 ± 6.2, p=0.40
Unsat. BMAT L3/L4 Δ, %	-0.3 ± 1.0, p=0.12
Sat. BMAT L3/L4 Δ, %	-0.3 ± 5.5, p=0.74

Mean ± standard deviation
Median (interquartile range)
N (%)

Table 3. Longitudinal BMAT parameters correlated with weight changes

	Total BMAT L3/L4 Δ	Unsat. BMAT L3/L4 Δ	Sat. BMAT L3/L4 Δ
Age	r= 0.28, p=0.13	r= -0.09, p=0.65	r= 0.22, p= 0.24
A1c Δ	rho= 0.19, p=0.34	rho= -0.06, p=0.80	rho= 0.16, p=0.42
Weight Δ	rho= 0.43, p=0.02	rho= 0.19, p=0.32	rho= 0.40, p=0.03
Fem. Neck BMD Δ	r= -0.25, p=0.18	r= -0.02, p=0.90	r= -0.29, p=0.12
Tot. hip BMD Δ	r= -0.08, p=0.68	r= 0.09, p=0.65	r= -0.10, p=0.60
Spine BMD Δ	r= 0.27, p=0.16	r= 0.11, p=0.59	r= 0.22, p=0.25

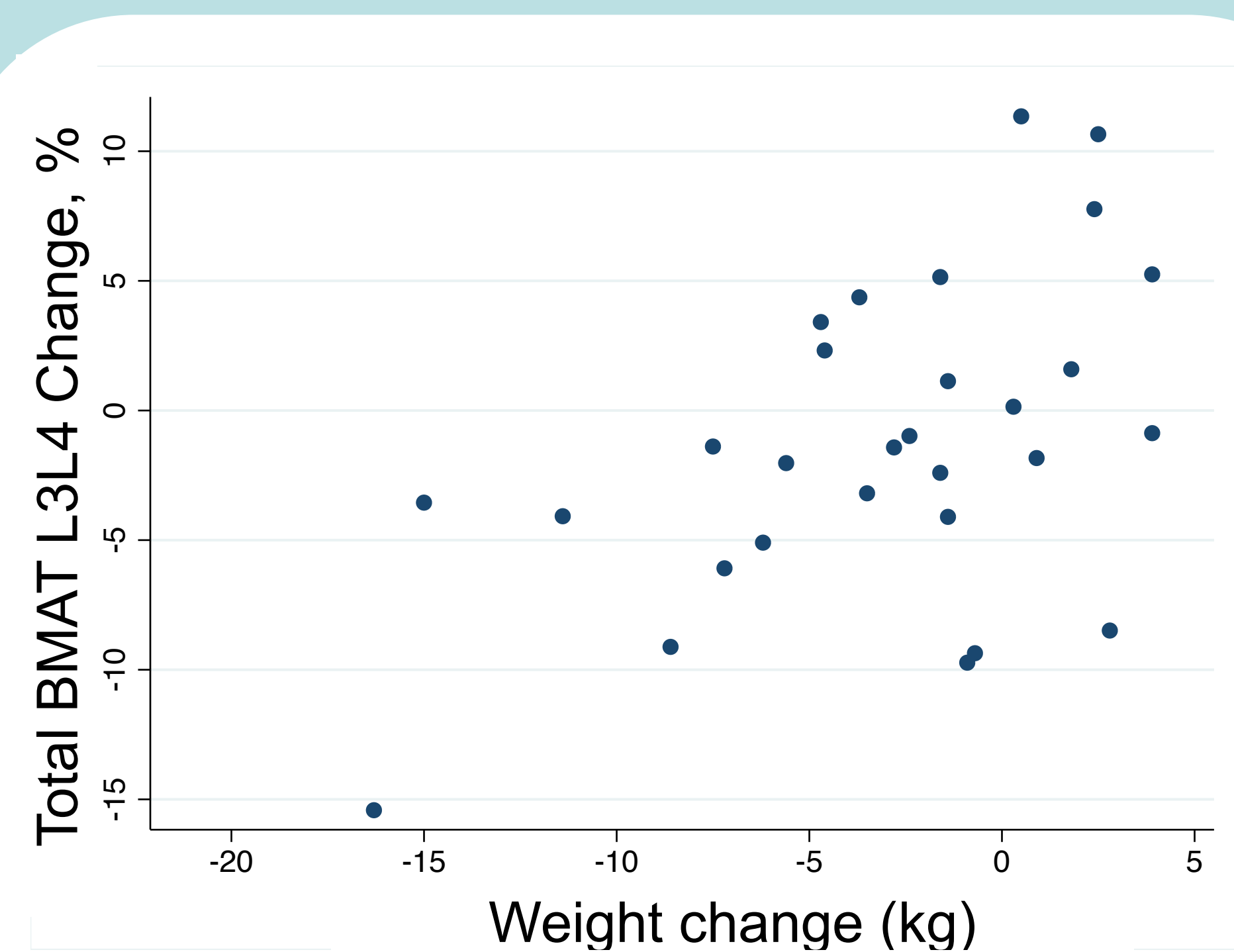


Fig 2. BMAT declines correlate with weight loss

Participants worked with their SFVA providers to improve glycemic control, which included initiation of glucagon-like peptide-1 (GLP-1) agonist medications that are known to improve glycemic control and cause weight loss.

In linear regression models, change in total BMAT was associated with weight loss and not GLP1 use.

After adjustment for weight loss, there was a trend for a negative relationship between changes in femoral neck and BMAT (p=0.07). In other words, declines in BMAT were associated with mitigated femoral neck BMD loss.

Table 4. GLP-1 initiators lost more weight than non-users

	Non-GLP1 users (n=13)	GLP-1 initiators (n=14)	P-value
A1c Δ, %	-1.6 (-1.8 to -1.2), p<0.01	-1.8 (-2.5 to -0.8), p<0.01	0.50
Weight Δ, kg	-1.4 (-2.4 to +1.8), p<0.01	-5.6 (-11.4 to -3.5), p<0.01	0.02
Fem. neck BMD Δ, %	+0.4 ± 2.5, p=0.74	-1.8 ± 3.2, p=0.06	0.08
Tot. hip BMD Δ, %	-0.2 ± 1.4, p=0.69	-1.2 ± 2.8, p=0.19	0.32
Spine BMD Δ, %	+0.4 ± 4.0, p=0.84	-0.3 ± 2.7, p=0.81	0.75
Total BMAT L3/L4 Δ, %	+0.3 ± 3.4, p=0.79	-2.5 ± 7.3, p=0.28	0.27
Unsat. BMAT L3/L4 Δ, %	-0.3 ± 0.7, p=0.19	-0.3 ± 1.3, p=0.42	0.93
Sat. BMAT L3/L4 Δ, %	+0.8 ± 3.7, p=0.47	-1.5 ± 6.4, p=0.46	0.32

CONCLUSION

- In this cohort, older Veterans with T2D achieved significant improvement in glycemic control
- In this interim analysis, there was not a statistically significant change in BMAT parameters
- Declines in total BMAT were associated with weight loss
- Participants who were initiated on GLP1 therapy by their clinicians had more weight loss compared to non-users, but weight loss – rather than GLP1 treatment – was associated with BMAT changes
- Declines in BMAT with weight loss may mitigate BMD loss in the medical management of T2D

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