

# **Association of Visceral Fat with Red Blood Cell Count and Bone Mineral Density in a Diabetic South Indian population**

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# Background

- Type 2 Diabetes Mellitus (T2DM) and obesity are associated with increased risk of fractures<sup>1</sup>
- DEXA is the gold standard for bone mineral density estimation<sup>2</sup>
- DEXA is not widely available and the procedure is expensive<sup>3</sup>
- The aim of this analysis was to link visceral adiposity & bone mineral density (measured by DEXA) with hematological parameters, and to look for reliable associations between them

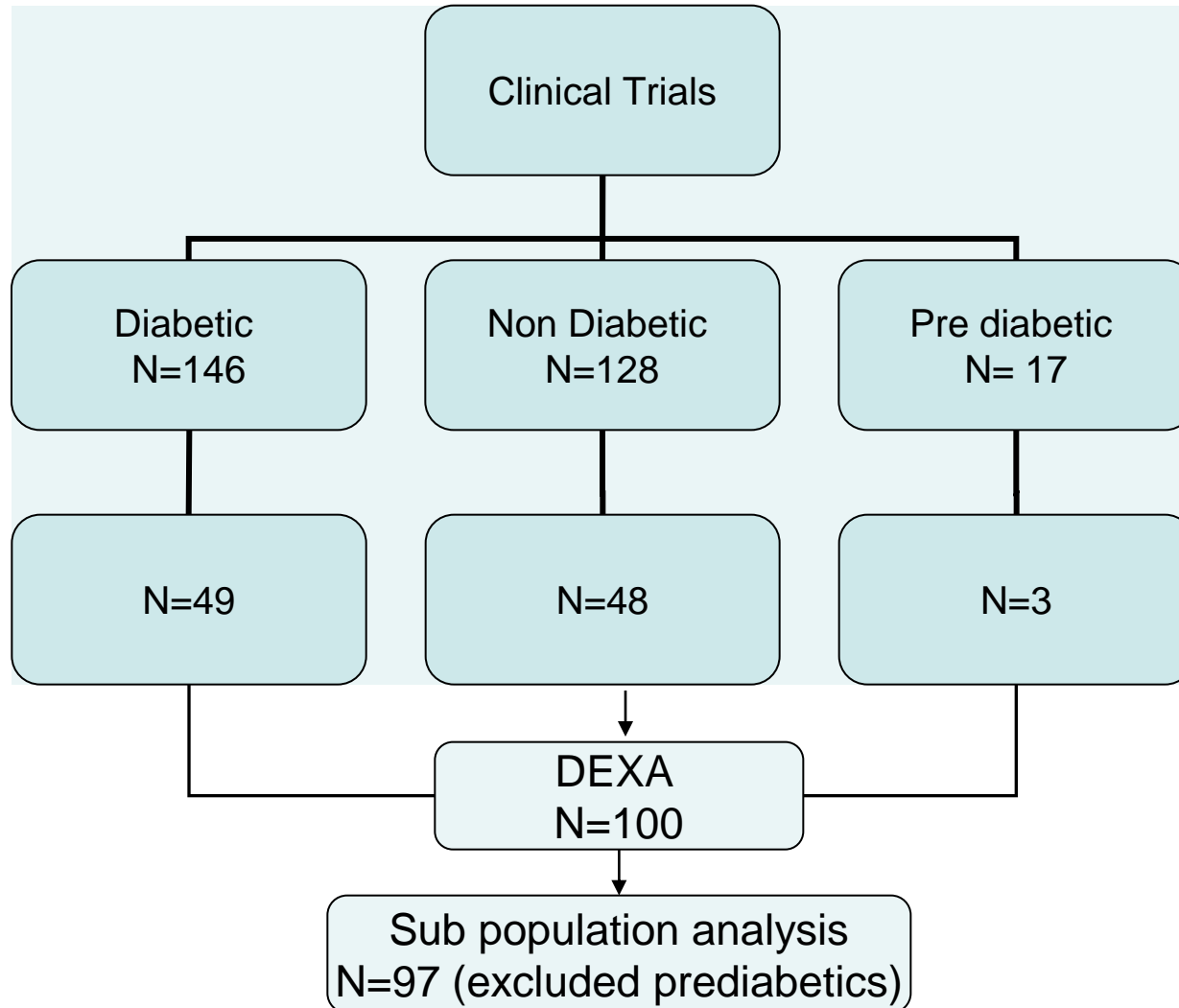
# Introduction

- Longitudinal observational study in 316 subjects in a south Indian population of early diabetics and age matched controls
- Study population phenotyped according to BMI and insulin resistance (HOMA-IR)
- Hematological and biochemical parameters analyzed for further characterization of study population
- LC-MS/MS based serum analysis to identify protein markers linked to organ specific pathophysiology completed
- Validate panel of biomarkers associated with specific phenotypes for
  - diagnosis & prognosis in the clinic
  - patient stratification and for use as companion diagnostics in drug discovery
  - Identified 8 novel protein markers till date

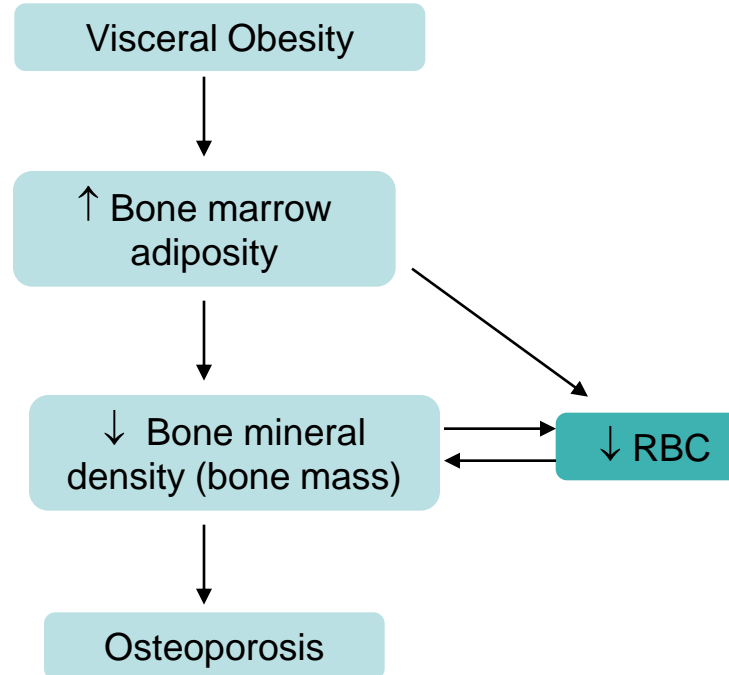
# Methodology and Experimental Protocol

- DEXA was done on 100 randomly selected diabetic and control subjects out of the total 316 subjects
- Subjects were classified into low BMI (20-23 kg/m<sup>2</sup>) and high BMI (27-30 kg/m<sup>2</sup>) categories
- DEXA parameters were correlated with hematological parameters to look for surrogate markers of adiposity and related complications
- All subjects were in the age group of 35-45 and within 5yrs of diagnosis of T2DM
- None of the female patients in this study had attained menopause

# Selection of study subjects



# Hypothesis



# Correlation analysis of visceral fat with other parameters

Parameter	Visceral Fat			
	Low BMI – NDM (n=22)	Low BMI – DM (n=26)	High BMI –NDM (n=26)	High BMI –DM (n=23)
<b>RBC</b>	-0.35	-0.29	-0.49	-0.61
<b>Hemoglobin</b>	-0.58	-0.08	-0.49	-0.62
<b>BMD</b>	0.33	-0.97	-0.41	-0.32
<b>TBF</b>	0.92	0.96	0.94	0.98
<b>Total bilirubin</b>	-0.26	-0.04	-0.13	-0.17

# Lab parameters to rule out confounding factors for RBC count

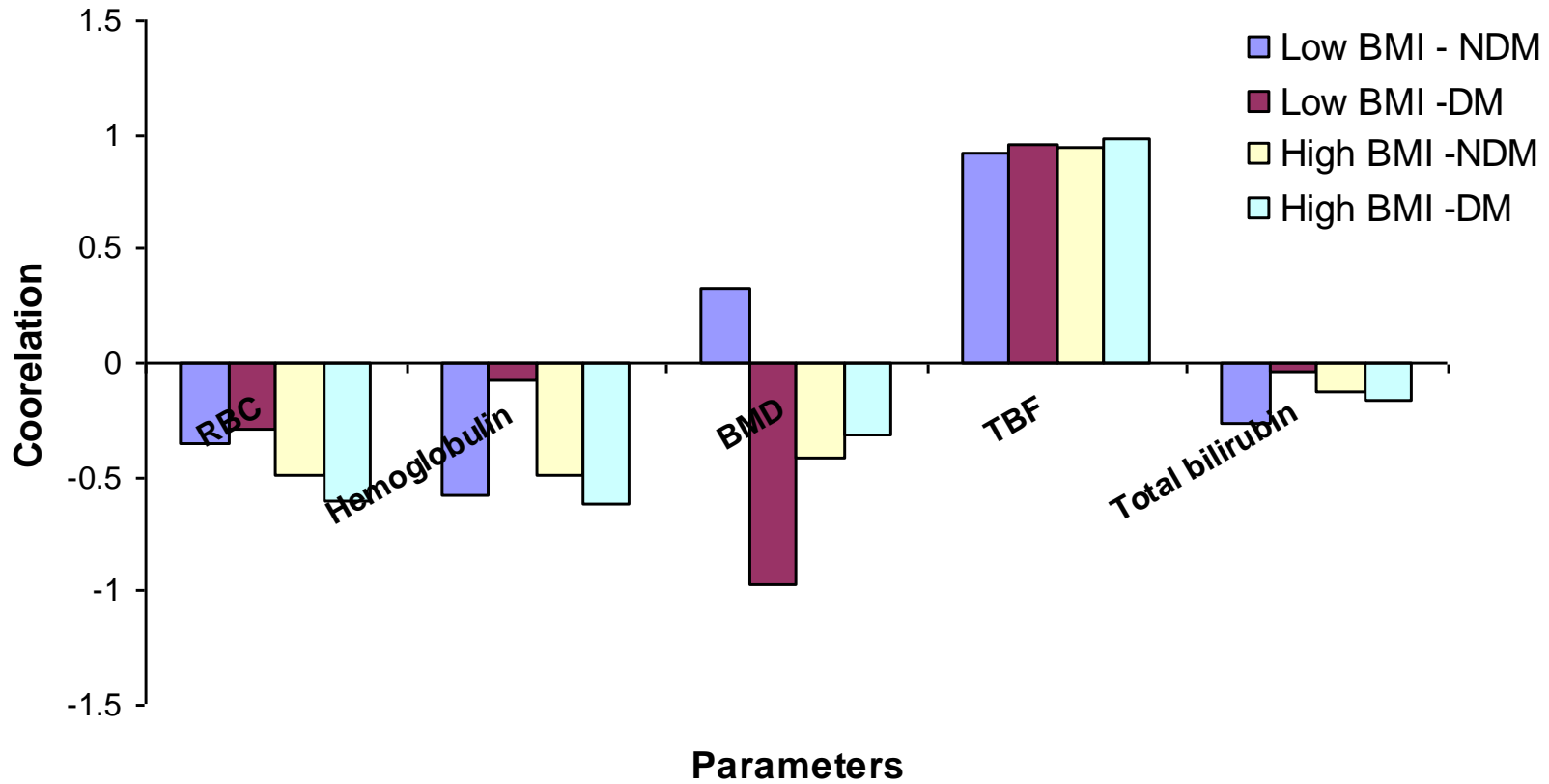
	<b>Normal Values</b>	<b>Diabetic Low BMI (n=26)</b>	<b>Non Diabetic Low BMI (n=22)</b>	<b>Diabetic High BMI (n=23)</b>	<b>Non Diabetic High BMI (n=26)</b>
		<b>Pooled Sample values</b>			
<b>Transferrin (mg/dL)</b>	200 -360	310	350	323	380
<b>Serum Iron (mg/dL)</b>	70 – 180	96.8	94.4	132.6	127.3
<b>Serum TIBC (mg/dL)</b>	250 –450	431	434	420	454
<b>Serum Ferritin (ng/mL)</b>	30 – 400	75.54	52.29	144.4	61.16
<b>Erythropoietin (mIU/ml)</b>	0 -19	23.4	19.7	13.6	13.2
<b>Total bilirubin (mg/dL)</b>	0.2-1.2	0.66	0.83	0.72	0.86
<b>Creatinine (mg/dL)</b>	0.5-1.4	0.79	0.79	0.83	0.89



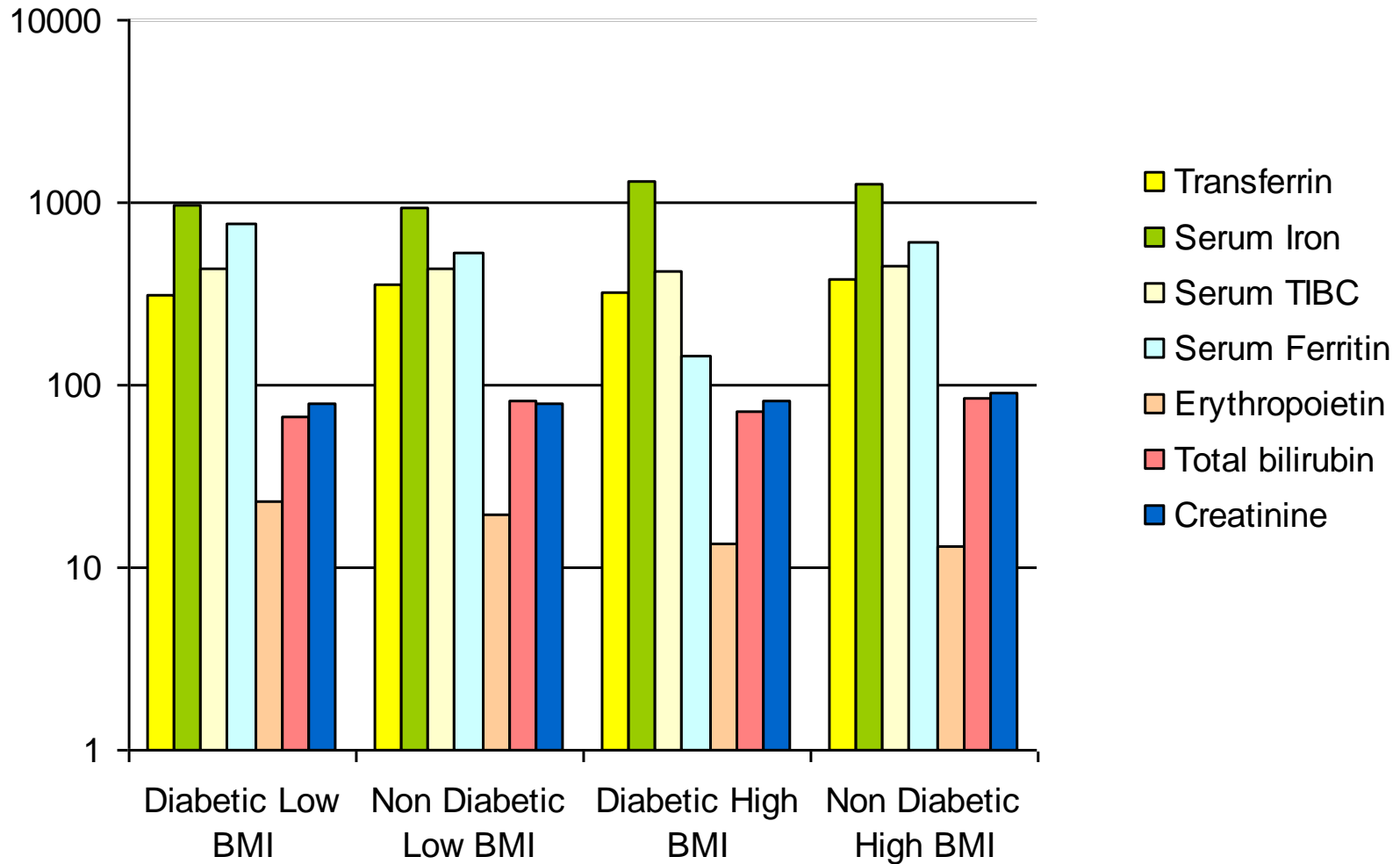
# Results

- Pearson's correlation showed positive correlation between total body fat (TBF) and visceral fat (VF)
- Negative correlation was seen between VF and RBC counts across all groups and it was more pronounced in the high BMI diabetic group
- Negative correlation was seen between VF and bone mineral density (BMD) in diabetics across both low and high BMI while in non-diabetics the negative association was seen only when the BMI was high
- Other likely causes of decrease in RBC counts in these patients were systematically ruled out
- Female patients being pre-menopausal, ruled out hormonal causes of decreased BMD

# Correlation analysis of visceral fat with other parameters



# Lab parameters to rule out confounding factors for RBC count



# Summary and Conclusion

- It is known from literature that the ability of bone marrow to produce mature RBCs is decreased when marrow adiposity is increased<sup>4</sup>.
- It is also known that increase in bone marrow adiposity decreases BMD and thus increases risk of osteoporosis <sup>5,6</sup>.
- We hypothesize based on the results of this study that decrease in RBC counts in diabetes and obesity is due to increased bone marrow adiposity.
- RBC count decrease is an indicator of predisposition towards osteoporosis in diabetic and obese patients, when other causes are ruled out.
- Decreased RBC counts should be considered as an early marker of osteoporosis in diabetic and obese patients to enable further investigation and initiation of therapy.
- Serum based markers of bone marrow adiposity and BMD are being looked for, by using LC- MS/MS, to support the hypothesis.
- This hypothesis needs further confirmation in larger studies.

# References

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