

# Statistical report for Dualscan body fat measurement consistency study

2023-12-28

## Data

### Quality control in reading data

The data was initially recorded into a pre-designed, structured EHR via Microsoft Excel. To ensure the precision in reading the data into the analysis environment, the process was automated by specifying the cells to read and their corresponding variable names.

## Data

The data frame read into environment includes eight columns:

- ID: the unique identifier of each subject  
Multiple rows can have same IDs, since each row in the data corresponds to a piece of measurement among 20 repeats of testing (10 for visceral, 10 for abdominal).
- gender: gender of the subjects
- age: age of the subjects, calculated by:

$$Age = 2023 - \text{Year of Birth}$$

- BMI: Body mass index of the subjects, calculated by:

$$BMI = \frac{\text{weight (kg)}}{\text{height (m)}^2}$$

- times: An ordered number distinguishing the time for each repeat among each subject. The value ranges from 1 to 10.
- time\_window: record when the measurement was taken, i.e., fasting or post-meal.
- fat\_value: record the body-fat area ( $cm^2$ ) obtained in each measurement
- fat\_type: record the region of measuring, i.e., visceral or abdominal.

Below is a subset of data for first 5 measures of subject 0202. To exemplify using an example, the first row indicates subject 0202 is a female whose age is 35 year old. Her BMI is 23.384. The first measures at the time window of post-meal for her abdomen body-fat area was  $163cm^2$

Table 1: Subset of the data

ID	gender	age	BMI	times	time_window	fat_value	fat_type
0202	Female	35	23.384	1	fasting	8	visceral
0202	Female	35	23.384	2	fasting	5	visceral
0202	Female	35	23.384	3	fasting	12	visceral
0202	Female	35	23.384	4	fasting	6	visceral
0202	Female	35	23.384	5	fasting	19	visceral

Table 2: Age and BMI of the subjects by gender

	Female(n=4) <sup>†</sup>	Male(n=4) <sup>†</sup>	p <sup>*</sup>
age	37.5 (4.2)	36.0 (7.5)	0.740
BMI	26.1 (5.4)	25.2 (2.4)	0.786

\* mean(sd)

<sup>†</sup> t test

## Demographics

Table 2 shows the age and BMI of the participants by genders. The subjects did not show significant difference in age and BMI across genders. For other summary statistics, see table 3, and figure 1.

Figure 1. Age and BMI distribution of the subjects

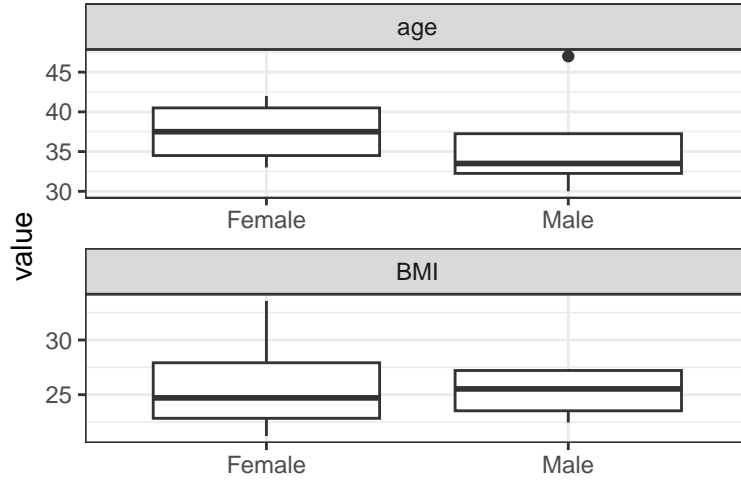


Table 3: Summary statistics for BMI and age

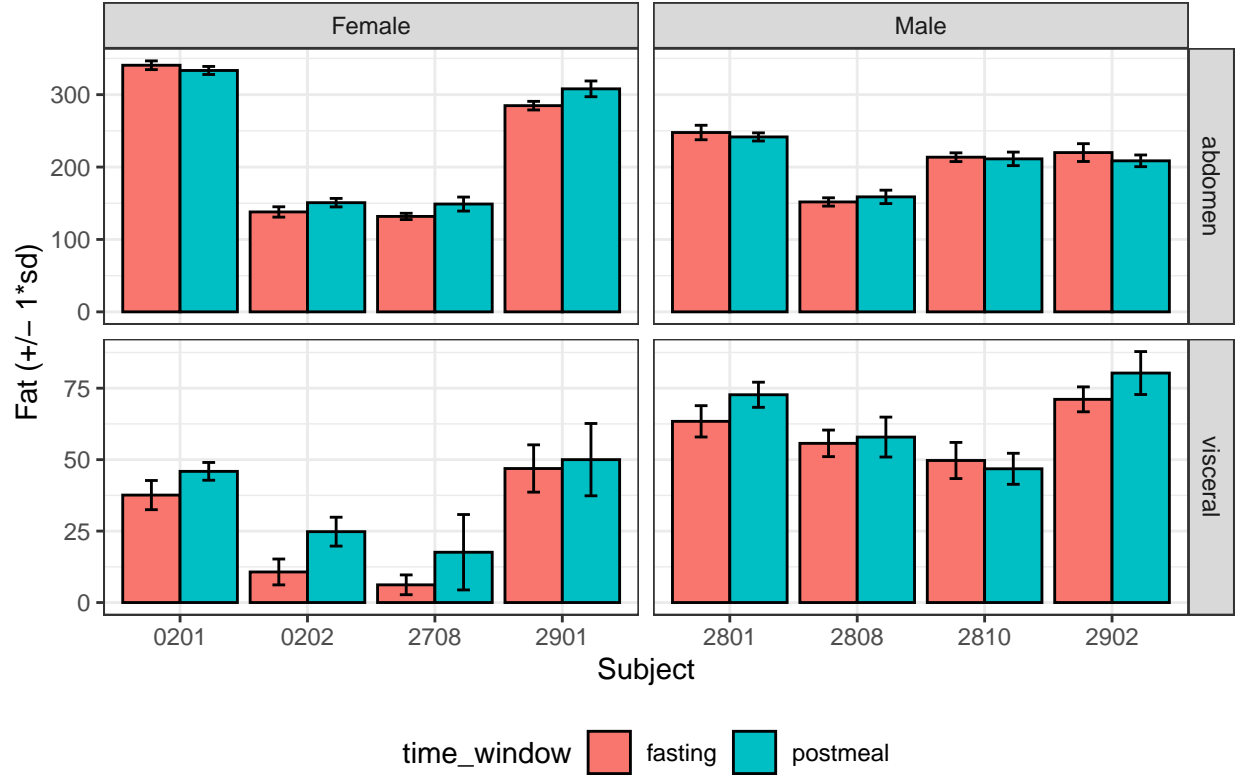
vars	n	mean	sd	median	trimmed	mad	min	max	range	skew	kurtosis	se
BMI	4	25.214	2.427	25.529	25.214	2.556	22.460	27.336	4.876	-0.108	-2.312	1.214
age	4	36.000	7.528	33.500	36.000	2.965	30.000	47.000	17.000	0.633	-1.752	3.764
BMI	4	26.052	5.381	24.710	26.052	3.568	21.224	33.564	12.340	0.469	-1.873	2.690
age	4	37.500	4.203	37.500	37.500	5.189	33.000	42.000	9.000	0.000	-2.281	2.102

# Analysis

## Checking fat area measurements

Before checking CV, we observed the measured fat areas to check if there is any anomaly. Figure 2 shows the Subject-level average of fat areas. No extremely large or small fat area values were observed. The orders of fasting and post-meal fat area are consistent with each other, providing preliminary evidence for measuring robustness.

Figure 2. Subject-level average of fat areas



## Coefficients of Variation (CV)

### Subject-level CV

Table 4 shows the summary statistics (mean, sd, cv) of the 10 repeats for each subject by measuring time and region. CVs(last column) with value  $> 5.6\%$  are considered as low consistency and marked with asterisks (“\*”). Eighteen out of 32 CVs had unacceptably low consistency, most of which were for measuring visceral fat, regardless of fasting or postmeal.

### Context-level CV

Table 5 further takes average across the CVs among same measuring contexts (fasting+visceral; fasting+abdominal; post-meal+visceral; post-meal + abdominal). The results indicate, regardless of time window for measuring, Dualscan gives consistent measurements for abdominal fat (mean CV = 0.036 for fasting, 0.040 for post-meal), whereas inconsistent measurements for visceral fat (mean CV = 0.206 for fasting, 0.208 for post-meal).

Table 4: Summary of 10 repeats for each subject by measuring time and region

Demographics			Measuring context		Fat area, summary of 10 repeats		
gender	age	BMI	time	fat_type	mean	sd	CV
<b>ID 0201</b>							
Female	33	26.037	fasting	abdomen	340.6	6.022	1.8%
Female	33	26.037	fasting	visceral	37.6	5.103	13.6%*
Female	33	26.037	postmeal	abdomen	333.4	5.562	1.7%
Female	33	26.037	postmeal	visceral	45.9	3.107	6.8%*
<b>ID 0202</b>							
Female	35	23.384	fasting	abdomen	138.0	7.134	5.2%
Female	35	23.384	fasting	visceral	10.7	4.523	42.3%*
Female	35	23.384	postmeal	abdomen	150.8	5.884	3.9%
Female	35	23.384	postmeal	visceral	24.8	5.051	20.4%*
<b>ID 2708</b>							
Female	42	21.224	fasting	abdomen	131.8	4.341	3.3%
Female	42	21.224	fasting	visceral	6.2	3.458	55.8%*
Female	42	21.224	postmeal	abdomen	148.9	9.666	6.5%*
Female	42	21.224	postmeal	visceral	17.6	13.193	75%*
<b>ID 2801</b>							
Male	33	27.171	fasting	abdomen	247.7	9.989	4%
Male	33	27.171	fasting	visceral	63.4	5.481	8.6%*
Male	33	27.171	postmeal	abdomen	241.6	5.621	2.3%
Male	33	27.171	postmeal	visceral	72.7	4.398	6%*
<b>ID 2808</b>							
Male	34	23.888	fasting	abdomen	151.8	5.712	3.8%
Male	34	23.888	fasting	visceral	55.7	4.644	8.3%*
Male	34	23.888	postmeal	abdomen	158.8	9.259	5.8%*
Male	34	23.888	postmeal	visceral	57.9	6.983	12.1%*
<b>ID 2810</b>							
Male	30	22.460	fasting	abdomen	213.6	6.041	2.8%
Male	30	22.460	fasting	visceral	49.7	6.325	12.7%*
Male	30	22.460	postmeal	abdomen	211.3	9.370	4.4%
Male	30	22.460	postmeal	visceral	46.8	5.432	11.6%*
<b>ID 2901</b>							
Female	40	33.564	fasting	abdomen	284.8	5.940	2.1%
Female	40	33.564	fasting	visceral	46.9	8.279	17.7%*
Female	40	33.564	postmeal	abdomen	308.0	10.883	3.5%
Female	40	33.564	postmeal	visceral	50.0	12.649	25.3%*
<b>ID 2902</b>							
Male	47	27.336	fasting	abdomen	220.0	12.293	5.6%
Male	47	27.336	fasting	visceral	71.1	4.358	6.1%*
Male	47	27.336	postmeal	abdomen	208.6	8.086	3.9%
Male	47	27.336	postmeal	visceral	80.3	7.514	9.4%*

\* CV &gt; 5.6% (cutoff value for acceptable CV, see study plan)

Table 5: CVs averaging across 4 type of measuring contexts

Measuring time	Measuring location	Average CV	SD of CV
fasting	abdomen	0.036	0.014
fasting	visceral	0.206	0.183
postmeal	abdomen	0.040	0.016
postmeal	visceral	0.208	0.229

\* CV > 5.6% (cutoff value for acceptable CV, see study plan)

## Conclusion

Dualscan gives stable estimates of abdominal fat area, while less stable estimates of visceral fat area.