

RMR Residuals

One of the two Primary Endpoints of the study is resting metabolic rate (RMR) corrected for changes in body composition. This endpoint variable is referred to as the RMR Residual.

To correct RMR for changes in body composition, a multiple regression equation will be created to predict RMR using Fat Mass (FM), Fat Free Mass (FFM), age and gender from baseline data using all participants who have at least one RMR during the baseline period. The regression coefficients from this prediction equation will be used to calculate predicted RMR for each participant at Months 6, 12, 18 and 24, using age, sex, FM and FFM from those visits. For each post-baseline visit, the Residual RMR will be derived as the measured RMR minus the predicted RMR.

Linear Regression model to derive prediction equation**Dependent variable:**

RMRA.RMR where VISIT=0: the mean of the two Baseline RMR values, measured on two consecutive days.

Independent variables:

AGE: Age at Baseline Visit 1, defined as (SUBJECT1.BL1DT – SUBJECT1.DOB DT) /365.25

SUBJECT1.FEMALE: 1 if female, 0 if male

DXAA.FM where VISIT=0: mean of the two Baseline Fat Mass measures

DXAA.FFM where VISIT=0: mean of the two Baseline Fat Free Mass measures

See regression model results on page 2, from the GLM Procedure in SAS version 9.

Prediction equation:

RMR at the Months 6, 12, 18 and 24 Visits is predicted by

$$\text{Predicted RMR} = 489.1398841 + (-0.6477106 \times \text{Current age}) + (10.1533361 \times \text{SUBJECT1.FEMALE}) + (2.2939312 \times \text{DXAA.FM}) + (18.3264115 \times \text{DXAA.FFM})$$

Using the Visit specific records in DXAA.

Current age is age on the date DXA was performed at each visit, calculated in SAS using the yrdif function : yrdif(SUBJECT1.DOB DT, DXAA.BSCANDT, 'actual')

RMR Residual = RMRA.RMR – Predicted RMR

This variable is found in the RMRRESID dataset.

The GLM Procedure

Dependent Variable: rmr RMR

Number of Observations Read	238
Number of Observations Used	219

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	5486800.625	1371700.156	89.61	<.0001
Error	214	3275753.192	15307.258		
Corrected Total	218	8762553.817			

R-Square	Coeff Var	Root MSE	rmr Mean
0.626165	8.775366	123.7225	1409.884

Source	DF	Type I SS	Mean Square	F Value	Pr > F
agebl	1	54509.574	54509.574	3.56	0.0605
female	1	3806186.659	3806186.659	248.65	<.0001
fm	1	190716.715	190716.715	12.46	0.0005
ffm	1	1435387.676	1435387.676	93.77	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
agebl	1	4515.575	4515.575	0.29	0.5876
female	1	1029.075	1029.075	0.07	0.7957
fm	1	19063.792	19063.792	1.25	0.2657
ffm	1	1435387.676	1435387.676	93.77	<.0001

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	489.1398841	121.2230043	4.04	<.0001
agebl	-0.6477106	1.1925406	-0.54	0.5876
female	10.1533361	39.1592117	0.26	0.7957
fm	2.2939312	2.0555329	1.12	0.2657
ffm	18.3264115	1.8925246	9.68	<.0001

TEE Residuals

TEE Residuals refer to Total Energy Expenditure (TEE) corrected for changes in body composition (Age, Sex, FM and FFM).

TEE Residuals are derived in a manner similar to the RMR Residuals, using a regression model to predict TEE from age, sex, FM and FFM during the baseline period. However, since there are two separate TEE measurements at Baseline, with two corresponding DXA assessments, taken two weeks apart, a repeated measures regression model will be used. The regression coefficients from this prediction equation will be used to calculate predicted TEE for each participant at Months 6, 12, 18 and 24, using age, sex, FM and FFM from those visits. For each post-baseline visit, the Residual TEE will be derived as the measured TEE minus the predicted TEE.

Repeated measures regression model to derive prediction equation**Dependent variable:**

TEERQ.TEERQ where VISIT=4 or 5: TEE at Baseline Visits 1 and 2.

Independent variables:

AGE: Age at Baseline Visit 1, defined as (SUBJECT1.BL1DT – SUBJECT1.DOB DT) /365.25

SUBJECT1.FEMALE: 1 if female, 0 if male

DXAA.FM where VISIT=4 or 5: Fat Mass at Baseline Visits 1 and 2

DXAA.FFM where VISIT=4 or 5: Fat Free Mass at Baseline Visits 1 and 2

See repeated measures regression model results on page 4, from the Mixed Procedure in SAS version 9, using the unstructured covariance type.

Prediction equation:

TEE at the Months 6, 12, 18 and 24 Visits is predicted by

$$\text{Predicted TEE} = 551.23 + (4.4143 \times \text{Current age}) + (42.2751 \times \text{SUBJECT1.FEMALE}) + (-1.7359 \times \text{DXAA.FM}) + (35.8767 \times \text{DXAA.FFM})$$

Using the Visit specific records in DXAA.

Current age is age on the date DLW was performed at each visit, calculated in SAS using the yrdif function : yrdif(SUBJECT1.DOB DT, TEERQ.DLW DSEDT, 'actual')

TEE Residual = TEERQ.TEERQ – Predicted TEE

This variable is found in the TEERESID dataset.

The Mixed Procedure

Model Information	
Data Set	WORK.V45B
Dependent Variable	teerq
Covariance Structure	Unstructured
Subject Effect	subjno
Estimation Method	REML
Residual Variance Method	None
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Between-Within

Class Level Information		
Class	Levels	Values
subjno	219	not printed
visit	2	BL Sub 1 BL Sub 2

Dimensions	
Covariance Parameters	3
Columns in X	5
Columns in Z	0
Subjects	219
Max Obs per Subject	2

Number of Observations	
Number of Observations Read	438
Number of Observations Used	438
Number of Observations Not Used	0

Iteration History			
Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	6055.33539247	
1	2	5889.27493818	0.00000000

Convergence criteria met.

Covariance Parameter Estimates		
Cov Parm	Subject	Estimate
UN(1,1)	subjno	61556
UN(2,1)	subjno	46941
UN(2,2)	subjno	66779

Fit Statistics	
-2 Res Log Likelihood	5889.3
AIC (Smaller is Better)	5895.3
AICC (Smaller is Better)	5895.3
BIC (Smaller is Better)	5905.4

Null Model Likelihood Ratio Test		
DF	Chi-Square	Pr > ChiSq
2	166.06	<.0001

Solution for Fixed Effects					
Effect	Estimate	Standard Error	DF	t Value	Pr > t
Intercept	551.23	225.51	216	2.44	0.0153
agebl	4.4143	2.2808	216	1.94	0.0542
female	42.2751	73.3098	216	0.58	0.5648
fm	-1.7359	3.8281	216	-0.45	0.6507
ffm	35.8767	3.4770	216	10.32	<.0001

AREE Residuals

AREE Residuals refer to Activity Related Energy Expenditure (AREE) corrected for changes in body composition (Age, Sex, FM and FFM). AREE is defined as $(0.9 \times \text{TEE}) - \text{RMR}$.

AREE Residuals are derived in a manner similar to the RMR Residuals, using a regression model to predict AREE from age, sex, FM and FFM during the baseline period. The regression coefficients from this prediction equation will be used to calculate predicted AREE for each participant at Months 6, 12, 18 and 24, using age, sex, FM and FFM from those visits. For each post-baseline visit, the Residual AREE will be derived as the measured AREE minus the predicted AREE.

Repeated measures regression model to derive prediction equation**Dependent variable:**

PAL.PA where VISIT=0: Baseline AREE calculated from mean TEE and RMR at Baseline.

Independent variables:

AGE: Age at Baseline Visit 1, defined as $(\text{SUBJECT1.BL1DT} - \text{SUBJECT1.DOB DT}) / 365.25$

SUBJECT1.FEMALE: 1 if female, 0 if male

DXAA.FM where VISIT=0: mean of the two Baseline Fat Mass measures

DXAA.FFM where VISIT=0: mean of the two Baseline Fat Free Mass measures

See regression model results on page 8, from the GLM Procedure in SAS version 9.

Prediction equation:

AREE at the Months 6, 12, 18 and 24 Visits is predicted by

$\begin{aligned} \text{Predicted AREE} = & -45.44351627 + (4.51451726 \times \text{Current age}) + (70.01599173 \times \text{SUBJECT1.FEMALE}) \\ & + (-6.81762828 \times \text{DXAA.FM}) + (16.05133209 \times \text{DXAA.FFM}) \end{aligned}$

Using the Visit specific records in DXAA.

Current age is age on the date DXA was performed at each visit, calculated in SAS using the yrdif function : `yrdif(SUBJECT1.DOB DT, DXAA.BSCANDT, 'actual')`

AREE Residual = PAL.PA – Predicted AREE

This variable is found in the AREERESD dataset.

The GLM Procedure
Dependent Variable: aree

Number of Observations Read	238
Number of Observations Used	217

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	4	3858870.48	964717.62	24.15	<.0001
Error	212	8469730.40	39951.56		
Corrected Total	216	12328600.88			

R-Square	Coeff Var	Root MSE	aree Mean
0.313001	25.32491	199.8789	789.2578

Source	DF	Type I SS	Mean Square	F Value	Pr > F
agebl	1	402848.197	402848.197	10.08	0.0017
female	1	2355435.604	2355435.604	58.96	<.0001
fm	1	23062.087	23062.087	0.58	0.4482
ffm	1	1077524.589	1077524.589	26.97	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
agebl	1	213837.643	213837.643	5.35	0.0217
female	1	46947.963	46947.963	1.18	0.2796
fm	1	166224.284	166224.284	4.16	0.0426
ffm	1	1077524.589	1077524.589	26.97	<.0001

Parameter	Estimate	Standard Error	t Value	Pr > t
Intercept	-45.44351627	198.8274992	-0.23	0.8194
agebl	4.51451726	1.9513542	2.31	0.0217
female	70.01599173	64.5885792	1.08	0.2796
fm	-6.81762828	3.3423578	-2.04	0.0426
ffm	16.05133209	3.0907533	5.19	<.0001