

Correlation of Phase Angle and Body Composition in Bariatric Surgery Patients

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Background

- ✓ Bioelectrical impedance analysis (BIA) is widely used in bariatric surgery patients
- ✓ Body compositions were calculated from equations consisting of body weight and height
- ✓ **Can be inaccurate in extreme BMI ($BMI < 16, > 34 \text{ kg/m}^2$)**

SM = Skeletal muscle

FM = Fat mass

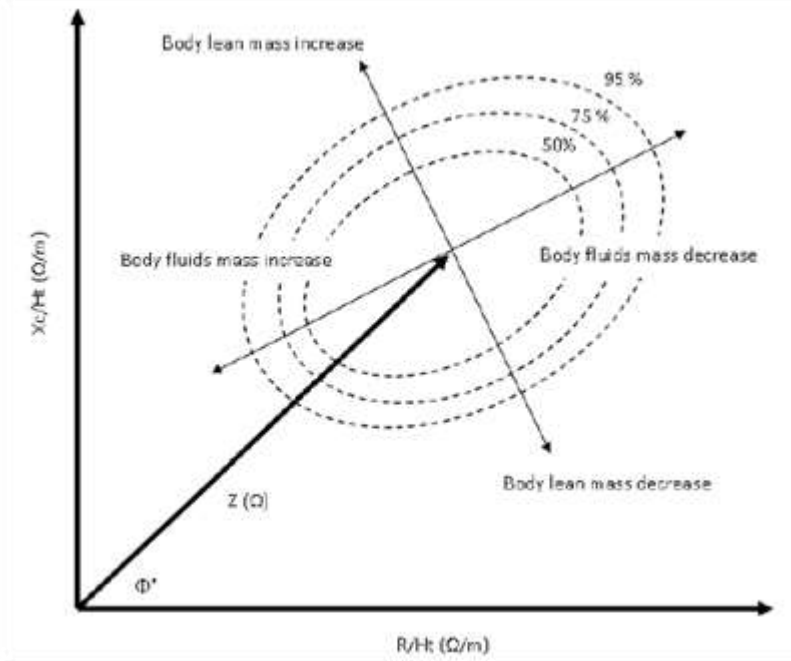
%FM = % Fat mass

SLM = Soft lean mass

TBW = Total body water



Background



Phase angle (PhA) is derived from the electrical properties calculated from **arctangent of cell reactance (X_c) and resistance (R)**



PhA is correlated with nutritional status and good physical condition



PhA is a suitable tracking parameter in bariatric surgery patients

$$\phi = \tan^{-1} \left(\frac{X_c}{R} \right)$$

There is **limited data** regarding the correlation and association between PhA and body composition for bariatric surgery patients.

Methods



Retrospective review of bariatric surgery patients in Thammasat University Hospital between June 2020 and June 2022



Body compositions and PhA from BIA were collected during **To (preoperative), T1 (postoperative 3 months), and T2 (postoperative 6 months)**



The correlation of PhA and body compositions were calculated with Pearson's correlation coefficient



The independent factors of PhA were analyzed with multivariable linear regression

Exclusion criteria

- Patients with history of previous major abdominal surgery
- Pregnancy
- On dialysis
- Ascites
- Congestive heart failure
- Neuromuscular disorders

Overall demographic data (N=33)

Variables	N=33
Age (yrs)	33±6.27
Gender	
- Male (%)	10 (30.3)
- Female (%)	23 (69.7)
BW (kg)	117.49±21.84
Height (cm)	165.13± 8.98
BMI (kg/m ²)	43.09±7.11
SLM (kg)	57.10±11.10
SM (kg)	34.26±6.66
FM (kg)	56.15±15.28
%FM (%)	47.43±6.95
TBW (kg)	44.86±8.71

Operation	
- LSG (%)	17 (51.5)
- LRYGB (%)	7 (21.2)
- LSG+DJB (%)	3 (9.1)
- LSG+PJB (%)	6 (18.2)

	Postop 3 months	Postop 6 months
F/U	33 (100%)	32 (96.96%)

	Preoperative (To)	Post-operative 3 months (T1)	Post-operative 6 months (T2)	
BW (kg)	117.49 ± 21.84	96.68 ± 17.76	87.32 ± 16.56	
BMI (kg/m ²)	43.09 ± 7.11	35.54 ± 6.29	32.04 ± 5.61	
TWL (kg)	-	20.86 ± 6.86	29.96 ± 10.09	
%TWL (%)	-	17.55 ± 4.26	25.23 ± 6.29	
SLM (kg)	57.10 ± 11.10	50.74 ± 9.63	49.39 ± 8.93	Postop ↓
SM (kg)	34.26 ± 6.66	30.44 ± 5.78	29.63 ± 5.35	
FM (kg)	56.15 ± 15.28	42.15 ± 13.21	34.25 ± 12.41	
%FM (%)	47.43 ± 6.95	43.09 ± 8.37	38.58 ± 8.80	
TBW (kg)	44.86 ± 8.71	39.97 ± 7.54	38.92 ± 7.01	
PhA	6.54 ± 1.24	5.98 ± 0.81	5.97 ± 0.76	

Correlations PhA-Body compositions

	T0		T1		T2	
	PhA	P-value	PhA	P-value	PhA	P-value
SM	0.4753*	0.005	0.7246*	<0.001	0.7110*	<0.001
FM	-0.2722	0.125	-0.2311	0.195	-0.0736	0.688
%FM	-0.5602*	<0.001	-0.6292*	<0.001	-0.4862*	0.004
SLM	0.4744*	0.005	0.7245*	<0.001	0.7129*	<0.001
TBW	0.4885*	0.003	0.7245*	<0.001	0.7130*	<0.001

Scale of correlation coefficient	Value
$0 < r \leq 0.19$	Very Low Correlation
$0.2 \leq r \leq 0.39$	Low Correlation
$0.4 \leq r \leq 0.59$	Moderate Correlation
$0.6 \leq r \leq 0.79$	High Correlation
$0.8 \leq r \leq 1.0$	Very High Correlation

Factor associated PhA at To (linear regression + multivariable analysis)

	Coefficiency (95%CI)	P-value	Coefficiency (95%CI)	P-value
Age (yrs)	0.070 (0.002-0.137)	0.044*		0.123
Gender	1.369 (0.532-2.206)	0.002*		0.416
BMI (kg/m ²)	-0.014 (-0.078-0.048)	0.635	0.144 (0.085-0.203)	<0.001*
SLM (kg)	0.053 (0.017-0.089)	0.005*		0.750
SM (kg)	0.088 (0.028-0.148)	0.005*	-5.731 (-7.063—4.400)	<0.001*
FM (kg)	-0.022 (-0.050-0.006)	0.125		
%FM (%)	-0.100 (-0.154- -0.045)	0.001*	-0.199 (-0.263- -0.134)	<0.001*
TBW (kg)	0.069 (0.024-0.115)	0.004*	4.358 (3.338-5.377)	<0.001*

Factor associated PhA at T1 (linear regression + multivariable analysis)

	Coefficiency (95%CI)	P-value	Coefficiency (95%CI)	P-value
Age (yrs)	0.025 (-0.021-0.072)	0.272		0.582
Gender	1.130 (0.639-1.622)	<0.001*		0.973
BMI (kg/m ²)	-0.004 (0.051-0.043)	0.862	0.118 (0.086-0.151)	<0.001*
SLM (kg)	0.061 (0.040-0.083)	<0.001*		0.504
SM (kg)	0.102 (0.066-0.138)	<0.001*		0.953
FM (kg)	-0.014 (-0.036-0.007)	0.196		
%FM (%)	-0.061 (-0.089- -0.033)	<0.001*	-0.126 (-0.151- -0.102)	<0.001*
TBW (kg)	0.078 (0.051-0.105)	<0.001*		0.269

Factor associated PhA at T2 (linear regression + multivariable analysis)

	Coefficiency (95%CI)	P-value	Coefficiency (95%CI)	P-value
Age (yrs)	0.0248 (-0.019-0.068)	0.258		0.611
Gender	0.986 (0.505-1.468)	<0.001*		0.803
BMI (kg/m ²)	0.015 (-0.035-0.065)	0.541	0.145 (0.106-0.184)	<0.001*
SLM (kg)	0.061 (0.038-0.083)	<0.001*		0.065
SM (kg)	0.101 (0.064-0.139)	<0.001*		0.970
FM (kg)	-0.004 (-0.027-0.018)	0.689		
%FM (%)	-0.042 (-0.070- -0.013)	0.005*	-0.111 (-0.136- -0.086)	<0.001*
TBW (kg)	0.077 (0.049-0.106)	<0.001*		0.576

Conclusion

- ✓ PhA was correlated with **skeletal muscle (SM), Soft lean mass (SLM), and total body water (TBW)** but inversely correlated with **%fat mass (%FM)**
- ✓ Correlations between PhA and body compositions **were stronger in the postoperative period when BMI decreased below 35 kg/m²**
- ✓ Independent factors associated with PhA were **BMI and %FM** at every period
- ✓ PhA may be a useful parameter for bariatric surgery care.

Thank you for your attention.

