Title: EXPLORING THE POTENTIAL OF PHASE ANGLE TO INFORM ON NUTRITIONAL STATUS IN ADULT PATIENTS WITH CYSTIC FIBROSIS

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Introduction Poor nutritional status is associated with declining lung function in patients with cystic fibrosis (CF) (King S et al. Nutrition, 2010; 26:753-759). Phase angle (PhA), is a direct measure of the integrity of the cellular membrane and has been shown to be an important biomarker of cellular health and nutritional status in numerous clinical diseases (Garlini L.M et al. Eur J Clin Nutr, 2019; Apr 73(4):495-508). Furthermore, PhA reference values for a healthy population, stratified by body mass index (BMI), gender and age, exist, providing a prognostic potential (Bosey-Westphal A et al. J Parenter Enteral Nutr, 2006; 30(4): 309-316).

Aim This study explored any relationship between PhA, body composition and lung function in adult patients with CF. Additionally, any comparison between measured PhA and published population data tables was explored.

Method Patients attending routine annual reviews were included. Bioelectrical Impedance Assessment (BIA) was performed using a Bodystat Quadscan 4000 multi-frequency device. The patient's weight (minus estimated clothing), age, gender and height were inputted in to the BIA device prior to assessment. PhA, a measure obtained via BIA, was correlated against age, BMI, total body water expressed as a percentage of total body weight (TBW%), fat mass calculated as fat mass index (FMI) and fat free mass calculated as fat free mass index (FFMI). Predicted forced expiratory volume in 1 second (FEV_1), performed in the same clinic was also recorded and compared against PhA. Additionally, measured PhA was compared against published data for a healthy European population (n = 213,748), stratified by BMI, age and gender, particularly comparing 5^{th} centile data. All analysis was run using RStudio Version 1.2.1335.

Results In total 112 patients (43 female), 93 (83%) pancreatic insufficient, mean age 30.3 years (range 17-59), mean FEV_1 73% predicted (range 12-133) underwent BIA.

Table 1: Comparison of PhA versus body composition, FEV_1 and population based data

Phase Angle compared to:	Spearman's correlation (r)	p value
BMI (kg/m^2)	0.33	<0.001
FMI (kg/m^2)	-0.28	<0.003
FFMI (kg/m^2)	0.68	<0.001
TBW (%)	0.32	<0.001
FEV_1 (predicted %)	0.33	<0.001
5^{th} centile of a reference population	0.60	<0.001

Conclusion PhA correlates with recognised prognostic markers of BMI and FEV_1, additionally, PhA also correlates with body composition derived via BIA. However, as PhA is a direct measure it avoids the need to rely on population and disease specific body composition reference values and therefore may prove to be a useful biomarker of nutritional status in adult patients with CF.

A significant correlation between PhA and a healthy population control group suggests a prognostic potential for PhA in adult patients diagnosed with CF. However data exploring PhA in adult patients with CF is limited therefore further studies are recommended.