Prisca Gisella Wibowo et al., Int J Cardiovasc Res 2018, Volume 7
DOI: 10.4172/2324-8602-C1-006

Relationship between whole body metabolism and cardiac high-energy phosphate metabolism: The impact of age

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Background & Aim: Cardiac high-energy phosphate metabolism [phosphocreatine-to-ATP (PCr/ATP) ratio] declines with age and it may contribute to the development of heart failure. Diminished body metabolism (i.e. resting metabolic rate, glucose tolerance) is also associated with ageing and increased risk of metabolic diseases.. The aim of the study was to assess i) the effect of age on cardiac high-energy phosphate metabolism and metabolic function and ii) relationship between PCr/ATP ratio and measures of metabolic function.

Methods: Thirty-five healthy women were stratified according to age into young (aged≤ 50 years, n= 20) and old age group (aged≥ 60 years, n=15). All participants underwent Phosphorus-31 magnetic resonance spectroscopy (31P-MRS) to assess PCr/ATP ratio. Fasting and 2-hour glucose levels were assessed using oral glucose tolerance test and each participant underwent indirect calorimetry to determine oxygen consumption and resting metabolic rate.

Results: Compared to the younger, the older age group demonstrated significantly lower PCr/ATP ratio (1.92±0.48 vs 2.29±0.55, p= 0.05) and higher fasting glucose levels (5.22± 0.31 vs 4.61±0.45 mmol/L, p<0.01) and 2-h plasma glucose levels (6.08 ± 1.54 vs 4.62 ± 1.00 mmol/L, p<0.01). No significant difference was found between the young and old age group in oxygen consumption (3.70±0.86 vs 3.65±0.49 mL/kg/min, p= 0.83) and resting metabolic rate (1761.66±287.56 vs 1667.67±200.82 kcal/day, p= 0.30). When all data were combined, there was a non-significant relationship between PCr/ATP ratio and resting metabolic rate (r= -0.09, p = 0.62), relative oxygen consumption (r= -0.11, p = 0.54), fasting plasma glucose (r= -0.31, p= 0.07), and 2-hour plasma glucose (r= -0.10, p= 0.58).

Conclusions: Cardiac metabolism and glucose control decline with age. The lack of relationship between cardiac PCr/ATP ratio and glucose tolerance and/or metabolic rate may suggest that the overall metabolic function does not influence cardiac metabolic function.

Biography

Prisca Gisella Wibowo is a medical student at Universitas Indonesia and decided to take an academic step to study Cardiovascular Science in Health and Disease, MRes at Newcastle University. Back in Indonesia, she was too engrossed in joining organisations and arranging charity events, but now she is determined to focus on research and following current medical advances in hope to be able to give back to her still developing home country in a larger scale. She is passionate in cardiovascular field. She is currently working in a project developed by Dr. Djordje Jakovljevic, who is a Senior Lecturer in Cardiovascular Ageing and Heart Failure.

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