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Body-composition Assessment using Air Displacement Plethysmography in Healthy Term infants: An Observational Study

A thesis presented in partial fulfilment of the requirements for the degree
of

Masters of Science
in
Nutrition and Dietetics

at Massey University, Albany
New Zealand

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2016

Abstract

Background:

Infant body weight and composition at birth have been recognised to be important indicators of fetal growth, maternal and offspring health, and later health outcomes. While it is well documented that average birth weight varies significantly between New Zealand-born infants of different ethnicities, there is limited evidence on body composition in new-born infants. Ethnic differences in body composition have been reported in New Zealand adults and children and it is currently unknown whether these differences are evident shortly after birth. The aim of this study was to examine the differences in fat mass (FM) and fat free mass (FFM) using Air Displacement Plethysmography (ADP) between NZ European (reference group), Māori, Pacific, Asian and South Asian healthy term infants.

Method:

Healthy term infants (37 to 42 weeks' gestation) were recruited from Auckland City Hospital (ACH). Birth parameters were recorded and weight, length, and head circumference and waist circumference were measured using standardised techniques. Air Displacement Plethysmography (ADP) was used to measure fat mass (FM) and fat free mass (FFM) of the infants. Ethnicity of all infants and their mothers was classified using standard ethnicity data protocols. Dummy variable multiple linear regression analysis and t-tests were used to compare FM and FFM of Māori, Pacific, Asian, and South Asian infants with New Zealand European (NZE) infants.

Results:

Body composition was assessed in 214 healthy term infants at a mean age of 1.7 ± 0.85 days, while adjusting for gender and postnatal age. South Asian infants had significantly lower FFM (2691.7 ± 389.7 g vs 2938.6 ± 364.0 g, $P = 0.006$) and weight than NZE infants (3045.5 ± 535.2 g vs 3352.3 ± 575.8 g, $P = 0.014$). They also had the smallest head (34.2 ± 1.7 cm vs 35.4 ± 1.7 cm, $P = 0.002$) and waist circumference (31.5 ± 3.0 cm vs 33.2 ± 2.1 cm, $P = 0.003$). Waist circumference of Asian infants was also significantly smaller than NZ European infants (32.3 ± 2.1 cm vs 33.2 ± 2.1 cm, $P = 0.044$). When categorised by gender, males had significantly greater FFM, weight, length and head circumference ($P < 0.05$). No gender or ethnic difference was noted in FM (g) or %FM.

Conclusion:

This is the first study in New Zealand to report body composition in healthy term infants using ADP. While no differences in FM were seen between NZE and each of the other ethnicities, the differences noted in FFM and weight between NZE and South Asian infants were comparable to other studies. Longitudinal assessment of changes in FM and FFM is needed to establish the significance of ethnic differences.

Acknowledgements

I am very fortunate to have the support of a number of people who have helped make this thesis project possible. First and foremost, I would like to thank Dr. Cath Conlon for providing me with the opportunity to be part of this project and for her tremendous support during my research. I would also like to thank Dr. Pamela von Hurst for the insight and feedback that she provided throughout my thesis. I have learned so much from you both and very much appreciate your wisdom and commitment to this thesis from start to finish.

I am especially grateful to all the participating infants and their family members who took the time to participate in the study and without which none of this research would have been possible. Also, a huge thank you to all staff on Ward 96, Ward 98 and Tamaki Ward at Auckland City Hospital for facilitating the conduct of this study.

Thank you to Louise van Dorp, who not only trained me in using this novel technology but also put in many hours organising the participants and collating the data. Also, to Owen Mugridge for his assistance with data collection. Dr. Pepe Romeo for being readily available to provide statistical guidance and patiently answering all my questions. I am grateful for each and every one of you for your time and making this project happen.

My family: Dad, Mum, Grandma and many more. I simply would not be at this juncture without you. Your positivity, selflessness, support and compassion through the ups and downs have meant the world to me. To my incredible group of friends and classmates, thank you for your brilliance and encouragement. I learned so much from our conversations in and out of nutrition and I am so proud of your accomplishments.

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Abbreviations

ACH	Auckland City Hospital
ADHB	Auckland District Health Board
ADP	Air displacement plethysmography
AGA	Appropriate for gestational age
LBW	Low birth weight
LGA	Large for gestational age
BF	Body fat
BIA	Bioelectrical impedance analysis
BMI	Body mass index
BW	Body weight
CT Scan	Computerized tomography scan
DXA	Dual-energy X-ray absorptiometry
FM	Fat mass
FFM	Fat free mass
GA	Gestational age
GDM	Gestational diabetes mellitus
GWG	Gestational weight gain
HDEC	Health and Disability Ethics Committee
LGA	Large for gestational age
MRI	Magnetic resonance imaging
NZE	New Zealand European
SGA	Small for gestational age
SAA	Surface area artifact
TBW	Total body water
UWW	Underwater weighing

