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# **Exploring the fat mass and fat free mass of term and moderate to late preterm infants: an observational study**

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

Master of Science  
in  
Nutrition and Dietetics

at Massey University, Albany  
New Zealand

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2015



## Abstract

### Background:

Moderate to late preterm infants (32-36<sup>+6</sup> weeks' gestation) make up 83% of preterm births in New Zealand. Preterm birth is associated with having a higher risk of obesity, diabetes and cardiovascular disease in later life. Preterm infants demonstrate postnatal growth restriction followed by a period of accelerated growth. When compared to term infants at equivalent ages, preterm infants have been found to have a higher % fat mass. Nutrition is a modifiable factor contributing to the growth of preterm infants. While the goal is for these infants to be breast-fed, this is often not possible in early postnatal life due to delayed maternal milk supply and immaturity of the infant. Evidence is limited for the optimal feeding strategy for these infants until full breast-feeds can be established and there is great variability in practice.

### Aims:

To measure the % fat mass and fat free mass of moderate to late preterm infants and term infants after birth at Auckland City Hospital; to explore the relationship between feeding strategies currently used within Auckland City Hospital and the acquisition of fat and fat free mass in moderate to late preterm infants after birth.

### Methods:

Moderate to late preterm infants and term infants were recruited from Auckland City Hospital. Air displacement plethysmography (ADP) was used to measure the fat mass and fat free mass of the infants. Preterm infants were measured once they were medically stable and term infants were measured within 72 hr of birth. Eleven preterm infants were measured a second time prior to discharge from hospital. Information regarding what the preterm infants were fed within the first five days after birth was collected from their medical notes and the infants were prospectively grouped according to which feeding strategy they predominantly received, either: breast-milk, infant formula, 10% dextrose, or parenteral nutrition. Statistical analysis was performed using independent t-tests, Pearson's Chi square tests, Mann-Whitney tests, paired sample t-tests, one-way ANOVA, and Kruskal-Wallis tests.

### Results:

Forty seven preterm moderate to late preterm infants and sixty nine term infants were recruited. Term infants had a mean  $\pm$  SD % FM of  $10.9 \pm 4.2\%$ , when broken down by sex males had  $9.4 \pm 3.5\%$  and females had  $12.2 \pm 4.8\%$  ( $P = 0.018$ ). Preterm infants measured within the first week of birth ( $n = 25$ ) had a mean  $\pm$  SD % FM of  $8.7 \pm 4.4\%$  and those measured within the second week of birth ( $n = 19$ ) had a mean  $\pm$  SD % FM of  $8.1 \pm 2.9\%$  ( $P = 0.6$ ). Twenty two

preterm infants were measured at  $\geq 36$  weeks' postmenstrual age and had a mean  $\pm$  SD % FM of  $10.9 \pm 5.0\%$ , which did not differ from the % FM of term infants measured after birth ( $P = 0.98$ ). Eleven preterm infants were measured twice during their hospital admission and their mean  $\pm$  SD % FM increased from  $8.5 \pm 3.5\%$  to  $15.0 \pm 4.2\%$  ( $P < 0.001$ ). The median [25<sup>th</sup>-75<sup>th</sup> quartiles] % increase in FM for infants with two measurements was 98.9 [70.1, 114.9] %. One-way ANOVA revealed significant differences in FFM ( $P = 0.004$ ), weight ( $P = 0.013$ ), and length ( $P = 0.036$ ) between the feeding groups. Post hoc analysis showed that infants in the parenteral nutrition group had significantly less FFM than infants in the formula group ( $P = 0.008$ ) and were lighter and shorter than the breast-milk group ( $P = 0.013$ ,  $P = 0.036$ ).

**Conclusions:**

Moderate to late preterm infants experience a rapid increase in FM during hospital admission and reach the % FM of a term infant before term corrected age. Moderate to late preterm infants in the parenteral nutrition group were the lightest, shortest and had the least FFM. This study also highlights considerations to be made for future research using ADP in the Newborn Intensive Care Unit at Auckland City Hospital.

## Acknowledgements

I would like to acknowledge and sincerely thank a number of people who have contributed to the study and completion of this thesis.

Firstly, I would like to thank all the participating infants and their family members who accompanied them during measurements for making the research possible.

I am very appreciative of my supervisors, from whom I have learnt so much. Thank you to my academic supervisor, Dr Cath Conlon, who provided support, guidance and encouragement every step of the way. Thank you also to Professor Frank Bloomfield for his expert advice and input into the study.

I would like to thank Owen Mugridge for his assistance with recruitment, measurements, and overall management of the study. Thank you also to our research nurse Sabine Huth for being so helpful with the recruitment and measurement of the preterm infants. Thank you to Barbara Cormack for her contribution during the development of the study and advice throughout.

I would also like to thank all the staff in the NICU, Ward 96, Ward 98, and Tamaki Ward of Auckland City Hospital for being so accommodating to the study. In particular, thank you to the nurses and midwives who assisted in identifying eligible participants and assisted with measurements when required.

Finally, a huge thank you to all my family and friends for all the support and encouragement over the past two years.

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## Abbreviations

ACH	Auckland City Hospital
ADP	Air displacement plethysmography
AGA	Appropriate for gestational age
BIA	Bioelectrical impedance analysis
BMI	Body mass index
CA	Corrected age
CVD	Cardiovascular disease
DXA	Dual-energy X-ray absorptiometry
ELBW	Extremely low birth weight
FFM	Fat free mass
FM	Fat mass
GA	Gestational age
GI	Gastrointestinal
HDL	High density lipoprotein
IUGR	Intrauterine growth restriction
LBW	Low birth weight
LDL	Low density lipoprotein
LGA	Large for gestational age
MRI	Magnetic resonance imaging
NICU	Newborn Intensive Care Unit
PIS	Participant information sheet
SGA	Small for gestational age
SAA	Surface area artefact
TBW	Total body water
TCA	Term corrected age
USA	United States of America
QC	Quality control
VLBW	Very low birth weight

WLR

Waist length ratio