THE EFFECTS OF SHORT – TERM ENERGY RESTRICTION IN OVERWEIGHT / OBESE FEMALES ON REPRODUCTIVE OUTCOMES

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Commonwealth Scientific Industrial Research Organization
Health Science and Nutrition
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Thesis abstract

In the general population, one in five couples experiences difficulty in conceiving a child. The role of obesity on women’s fecundity has become a focus of attention in recent years.

Successful treatment of infertility through Assisted Reproductive Technology (ART) is also compromised by the presence of obesity, which occurs in 30% of women seeking treatment. A negative correlation exists between increased body mass index (BMI) and the number of collected oocytes and a lower birth rate after ART. Furthermore, a number of studies have established that weight loss improves natural conception rates in overweight women. Whether weight management can improve success rates in overweight / obese women undergoing in vitro fertilisation (IVF) has not been studied.

The purpose of this project was to explore the role of short-term weight loss on potential pregnancy outcomes in overweight / obese women undergoing IVF programme. However, to establish this relationship, we proposed to carry out two studies to assess the following:

(I) The feasibility of very low calorie diet (VLCD) during IVF treatment with respect to duration, level of restriction and tolerability of the diet during hormonal down regulation in women (Chapter 2).

(II) How energy restriction may affect the quality of an early embryo in diet-induced obese mice with respect to various body weight and caloric intake (Chapter 3).

In study (I), women preferred a shorter dietary intervention with greater energy restriction (456 kcal per day) to gradual energy restriction (1200 kcal / day for the first week, and afterward, 456 kcal / day) prior to oocyte transfer. Women were able to comply with the VLCD during IVF treatment and both dietary groups achieved a significant weight loss (mean 6.3%).
In study (II), by using obese mice, the effect of rapid weight loss (mean 12 %) was observed after 5 days of energy restriction. Ovulation rate was greater in the Obese group (HFD) (55.6%) and equal in both Control (CD) and Energy Restricted (HF / ER) (44.4 %) groups. The HF / ER group showed higher fertilisation rate (80 %) than HFD and CD (55% and 45.5%, correspondingly). The blastocyst stage was reached by half of the cultured embryos in both HF / ER and HFD groups and 33 % in the CD group. The quality of embryos that completed blastocyst formation did not differ between groups. However, postfertilisation development in females fed a high fat diet was slower compared to CD and HF / ER groups.

In conclusion, this work illustrated a weight management prior conception and use of VLCD during IVF treatment in clinical study needs further investigation with regard to the dietary duration, level of energy restriction and how this combination will influence IVF treatment outcomes. Furthermore, as we were unable to determine the question of how the dietary intervention affects the quality of oocytes and the animal study illustrated a promising result, thus further studies are required.
Statement

I hereby state that this thesis contains no material which has been accepted for the award of any other degree or diploma in any University or other tertiary institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except where stated.

I give consent for this thesis to be available for photocopying and loan purposes after depositing in The University of Adelaide library.

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The experiments reported in this work were performed by myself and any assistance received from others is acknowledged. To my knowledge, there are no intellectual property issues or conflicts of interest with other persons or organizations with respect to the data presented in this thesis.

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Minge CE, Bennett BD, Tsagareli V, Lane M, Owens JA, Norman RJ, Robker RL. Ovulation and Oocyte quality are adversely affected by a High fat diet. In press.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>ACTH</td>
<td>Adrenocorticotropic hormone</td>
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<tr>
<td>ART</td>
<td>Assisted Reproductive Technology</td>
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<td>BMI</td>
<td>Body mass index</td>
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<td>CC</td>
<td>Clomiphene Citrate</td>
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<td>CD</td>
<td>Control diet</td>
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<td>CSIRO</td>
<td>Commonwealth Scientific Industrial Research Organization</td>
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<tr>
<td>CVD</td>
<td>Cardiovascular disease</td>
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<tr>
<td>DHEA-s</td>
<td>Dehydroepiandrosterone sulphate</td>
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<tr>
<td>DHT</td>
<td>Dihydrotestosterone</td>
</tr>
<tr>
<td>DIVA</td>
<td>Diet and IVF assessment</td>
</tr>
<tr>
<td>DNA</td>
<td>Deoxyribonucleic acid</td>
</tr>
<tr>
<td>DOB</td>
<td>Date of birth</td>
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<tr>
<td>ESHRE</td>
<td>European Society for Human Reproduction &amp; Embryology</td>
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<tr>
<td>ET</td>
<td>Embryo transfer</td>
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<tr>
<td>FET</td>
<td>Frozen embryo transfer</td>
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<tr>
<td>FSH</td>
<td>Follicle stimulating hormone</td>
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<tr>
<td>GH</td>
<td>Growth hormone</td>
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<tr>
<td>GIFT</td>
<td>Gamete intra fallopian transfer</td>
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<tr>
<td>HC</td>
<td>High carbohydrate</td>
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<tr>
<td>hCG</td>
<td>Human chorionic gonadotrophin</td>
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<tr>
<td>HDL - C</td>
<td>High density lipoprotein cholesterol</td>
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<td>HFD</td>
<td>High fat diet</td>
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<tr>
<td>HF / ER</td>
<td>High fat / Energy restricted</td>
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<tr>
<td>HP</td>
<td>High protein</td>
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<tr>
<td>ICSI</td>
<td>Intracytoplasmic sperm injection</td>
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<tr>
<td>IUD</td>
<td>Intrauterine device</td>
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<td>IUGR</td>
<td>Intrauterine growth retardation</td>
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<tr>
<td>IUI</td>
<td>Intrauterine insemination</td>
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<td>IVF</td>
<td>In vitro fertilisation</td>
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<td>LC</td>
<td>Low carbohydrate</td>
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<td>Low calorie diet</td>
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<tr>
<td>LDL - C</td>
<td>Low density lipoprotein cholesterol</td>
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<tr>
<td>LH</td>
<td>Luteinizing hormone</td>
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<td>NHANES</td>
<td>National Health and Nutrition Examination Survey</td>
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<td>NH&amp;MRC</td>
<td>National Health and Medical Research Council</td>
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<tr>
<td>OC</td>
<td>Oral contraceptives</td>
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<tr>
<td>OPU</td>
<td>Oocyte pick up</td>
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<tr>
<td>PCO</td>
<td>Polycystic ovaries</td>
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<tr>
<td>PCOS</td>
<td>Polycystic ovarian syndrome</td>
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<tr>
<td>RDI</td>
<td>Recommended dietary intake</td>
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<tr>
<td>RM</td>
<td>Recurrent miscarriage</td>
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<tr>
<td>RMU</td>
<td>Reproductive Medicine Unit</td>
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<tr>
<td>SHBG</td>
<td>Serum testosterone-binding globulin</td>
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<td>SEM</td>
<td>Standard Error Mean</td>
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<td>STIs</td>
<td>Sexually transmitted infections</td>
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<td>TWD</td>
<td>The Total Wellbeing Diet</td>
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<tr>
<td>VLCD</td>
<td>Very low calorie diet</td>
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<td>WHO</td>
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