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# The effect of obesity on the immune response of hepatitis B virus vaccination

## **Thesis**

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا  
إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ  
الْعَلِيمُ الْحَكِيمُ .

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## List of Abbreviations

|                |                                                          |
|----------------|----------------------------------------------------------|
| <b>AASD</b>    | the American Association for the Study of Liver Diseases |
| <b>ACIP</b>    | Advisory Committee on Immunization Practices             |
| <b>AgRP</b>    | agouti-related peptide                                   |
| <b>AIDS</b>    | Acquired immunodeficiency syndrome                       |
| <b>ALT</b>     | Alanine aminotransferase                                 |
| <b>AST</b>     | Aspartate aminotransferase                               |
| <b>BMI</b>     | body mass index                                          |
| <b>BR</b>      | Biochemical response                                     |
| <b>CABG</b>    | coronary artery by pass grafts                           |
| <b>CART</b>    | amphetamine-regulated transcript                         |
| <b>CCK</b>     | cholecystokinin                                          |
| <b>CDC</b>     | Centre for disease control and prevention                |
| <b>CHB</b>     | Chronic hepatitis B                                      |
| <b>CR</b>      | Complete response                                        |
| <b>CT scan</b> | computed tomography                                      |
| <b>CNS</b>     | Central nervous system                                   |
| <b>DASH</b>    | Dietary Approaches to Stop Hypertension                  |
| <b>DEXA</b>    | dual energy X-ray absorptiometry                         |
| <b>DSM</b>     | Diagnostic and Statistical Manual of Mental Disorders    |
| <b>DTaP</b>    | diphtheria and tetanus toxoids and acellular pertussis   |
| <b>DTP-OPV</b> | tetanus, pertussis and oral polio                        |
| <b>ELISA</b>   | Enzyme-linked immunosorbent assays                       |
| <b>FDA</b>     | Food and drug administration                             |
| <b>GLP-1</b>   | glucagon like peptide-1                                  |
| <b>HBcAg</b>   | Hepatitis B core antigen                                 |
| <b>HBeAg</b>   | Hepatitis B envelope antigen                             |
| <b>HBIG</b>    | Hepatitis B immune globulin                              |

|                                |                                            |
|--------------------------------|--------------------------------------------|
| <b>HBsAg</b>                   | Hepatitis B surface antigen                |
| <b>HBsAg</b>                   | Hepatitis B surface antigen                |
| <b>HBV</b>                     | Hepatitis B virus                          |
| <b>HCV</b>                     | Hepatitis C virus                          |
| <b>HDV</b>                     | Hepatitis D virus                          |
| <b>Hib</b>                     | influenza type b                           |
| <b>HIV</b>                     | Human immunodeficiency virus               |
| <b>hnRNP K</b>                 | Heterogeneous nuclear Ribonucleoprotein K  |
| <b>HR</b>                      | Histological response                      |
| <b>IFN</b>                     | interferon                                 |
| <b>IL-6</b>                    | Interleukin-6                              |
| <b>IPV</b>                     | inactivated poliovirus                     |
| <b>IPV</b>                     | inactivated poliovirus                     |
| <b>LH</b>                      | lateral hypothalamus                       |
| <b>MCH</b>                     | major-histocompatibility-complex           |
| <b>MIF</b>                     | migration inhibitory factor                |
| <b>MIF</b>                     | macrophage migration inhibitory factor     |
| <b>mIU</b>                     | Mili international unit                    |
| <b>MRI</b>                     | magnetic resonance imaging                 |
| <b>MS</b>                      | Multiple sclerosis                         |
| <b>NASH</b>                    | Non-alcoholic steatohepatitis              |
| <b>NCEP</b>                    | National cholesterol education program     |
| <b>NEJM</b>                    | New England journal of medicine            |
| <b>NHLB</b>                    | National Heart, Lung, and Blood Institute  |
| <b>NIH</b>                     | National Institutes of Health              |
| <b>NK cells</b>                | natural killer cells                       |
| <b>NPY</b>                     | neuropeptide Y                             |
| <b>PCR</b>                     | Polymerase chain reaction                  |
| <b>POMC</b>                    | proopiomelanocortin                        |
| <b>PPAR<math>\gamma</math></b> | peroxisome proliferator activated receptor |
| <b>PYY</b>                     | Peptide YY                                 |
| <b>SIDS</b>                    | sudden infant death syndrome               |

|                                |                                 |
|--------------------------------|---------------------------------|
| <b>TNF</b>                     | Tumor necrosis factor           |
| <b>TNF-<math>\alpha</math></b> | tumour necrosis factor $\alpha$ |
| <b>VLCD</b>                    | very low calorie diet           |
| <b>VMH</b>                     | ventromedial hypothalamus       |
| <b>VR</b>                      | Virological response            |
| <b>VSD</b>                     | Vaccine Safety Datalink         |
| <b>WHO</b>                     | World Health Organization       |

## Introduction

Approximately two billion people worldwide, of which 350 million are chronic virus carriers, have serological evidence of HBV infection. One million people die each year from acute and chronic sequelae of HBV infection. Despite recent advances in anti-viral therapy, there remains no cure for chronic HBV infection. So primary prevention with HBV vaccination is the only strategy likely to reduce the morbidity caused by HBV infection. (*Alter, 2003*).

Infection of infants and young children with the hepatitis B virus (HBV) represents an important health hazard, since the younger the age at which the infection is acquired, the greater the predisposition to the carrier state, chronic liver disease and subsequent development of cirrhosis and hepatocellular carcinoma. (*Arnot, 1997*).

The World Health Organization (WHO) has targeted hepatitis B as one of eight infectious diseases that should be controlled by vaccination. In most developing countries, HBV infection is endemic, and attempts to prevent infection must be made very early during childhood. Accordingly, in 1992, Egypt started a programme of universal immunization in infancy. The schedule adopted by the Egyptian Ministry of Health was three doses of a yeast-recombinant HB vaccine administered to all