# Obese Egyptian Children: What About Their Gut Flora ?

**Thesis**

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# *List of Abbreviations*

| | | |
|---|---|---|
| **16s rRNA** | : | 16S ribosomal ribonucleic acid |
| **AgRP** | : | Agouti-Related Protein |
| **AMPK** | : | Adenosine monophosphate-activated protein kinase |
| **ARC** | : | Arcuate nucleus |
| **ARs** | : | adrenergic receptors |
| **ATP** | : | Adenosine triphosphate |
| **BAT** | : | Brown Adipose Tissue |
| **BBS** | : | Bardet-Biedl syndrome |
| **BCFA** | : | Branched chain fatty acids |
| **BMI** | : | Body Mass Index |
| **CB1** | : | Cannabinoid-1 receptors |
| **CCK** | : | Cholecystokinin |
| **CD** | : | Crohn's Diseas |
| **CDC** | : | Centers for Disease Control |
| **CFU** | : | Colony forming unit |
| **CRH** | : | Cytokine receptor homology |
| **CTA** | : | Conditioned Taste Aversion |
| **CVD** | : | Cardiovascular Disease |
| **DEXA** | : | Dual Energy X-ray Absorptiometry |
| **DGGE** | : | Denaturing gradient gel electrophoresis |
| **DMN** | : | Dorsomedial nucleus |
| **Fiaf** | : | Fast-induced adipocyte factor |
| **FISH** | : | Fluorescent in situ hybridization |
| **FTO** | : | fat mass and obesity-associated |
| **GHS** | : | Growth hormone secretagogue |
| **GI** | : | Gastro intestinal |
| **GLP-1** | : | Glucagon like peptide-1 |
| **HC** | : | Hip Circumference |
| **IBS** | : | Irritable bowel syndrome |
| **IOTF** | : | International Obesity Task Force |
| **LHA** | : | Lateral hypothalamic area |
| **LMBS** | : | Laurance Moon Bardet Biedle |

| | | |
|---|---|---|
| **LPL** | : | Lipoprotein lipase |
| **MAMP** | : | Microbe-associated molecular pattern |
| **MCH** | : | Melanin Concentrating Hormone |
| **mRNA** | : | Messenger RNA |
| **NEC** | : | Necrotizing enterocolitis |
| **NPY** | : | Neuropeptide Y |
| **OSAS** | : | obstructive sleep apnea syndrome |
| **PCOS** | : | Polycystic ovary syndrome |
| **PCR** | : | Polymerase chain reaction |
| **POMC** | : | Pro-opiomelanocortin |
| **PP** | : | Pancreatic polypeptide |
| **PTC** | : | Pseudotumour cerebri |
| **PVN** | : | paraventricular nucleus |
| **PWS** | : | Prader-Willi syndrome |
| **PYY** | : | Peptide YY |
| **qPCR** | : | Quantitative polymerase chain reaction |
| **RNA** | : | Ribonucleic acid |
| **SCFA** | : | Short chain fatty acid |
| **SES** | : | Socioeconomic status |
| **SFT** | : | Skinfold thickness |
| **SI** | : | Small intestine |
| **SNS** | : | Sympathetic Nervous System |
| **TGGE** | : | Temperature gradient gel electrophoresis |
| **TNF-α** | : | Tumor necrosis facctor alpha |
| **TrkB** | : | tyrosine kinase B |
| **UC** | : | Ulcerative Colitis |
| **UCP1** | : | uncoupling protein 1 |
| **WAT** | : | White Adipose Tissue |
| **WC** | : | Waist Circumference |
| **WHO** | : | World Health Organiztion |
| **WHR** | : | Waist-to-hip ratio |
| **WHtR** | : | Waist-to-height ratio |

# INTRODUCTION

# Introduction

Obesity has been rising in developing countries. Egypt is one of the countries in the world where the problem of obesity has been nearing an epidemic level ***( Asfaw, 2007 ).***

Obesity is viewed as one of the important public health problems of our times, and the velocity of propagation is highest in children ***(Owen et al., 2005)***.

This is a serious public health concern because obese children and adolescents are at an increased risk for various physical mental, and emotional health problems, including impaired glucose tolerance, insulin resistance, atherosclerosis, coronary heart disease in adulthood, later development of eating disorders and low self-esteem ***(Seo and Sa, 2010)***

Children may find themselves in a vicious circle: obese children often become obese adults and maternal obesity overnourishes the fetus, thereby programming adult size and health with a heightened risk of obesity later in life ***(Lawlor et al., 2007).***

Gut microbiota is essential for intestinal development, homeostasis and protection against pathogenic challenge; moreover, gut microbes are involved in metabolic reactions, with harvest of energy ingested but not digested by the host; they have also trophic effects on the intestinal epithelium, by favouring the development of intestinal microvilli, and play a fundamental role in the maturation of the host’s innate and adaptive immune responses ***(Montalto et al., 2009).***

Overall, a balanced gut microbiota composition confers benefits to the host, while microbial imbalances are associated with metabolic and immune-mediated disorders. The composition of the gut microbiota is influenced by endogenous and environmental factors (diet, antibiotic intake, xenobiotics, etc.).***( Laparra and Sanz, 2010).***

Recent evidence, primarily from investigations in animal models, suggests that the gut microbiota affects nutrient acquisition and energy regulation. Evidence suggests that the metabolic activities of the gut microbiota facilitate the extraction of calories from ingested dietary substances and help to store these calories in host adipose tissue for later use ***( DiBaise et al., 2008).***

In addition to the effect on energy harvest, the bacterial microbiota may also contribute to the inflammatory state present in obesity. Bacterial lipopolysaccharide (LPS) derived from gut microbiota acts as a trigger for systemic inflammation and that chronic metabolic endotoxemia results in obesity and insulin resistance ***(Cani et al., 2007).***

The identification of the gut microbiota as an environmental factor that modulates host energy and lipid metabolism has revealed a novel therapeutic target to treat metabolic diseases ***(Bäckhed, 2010).***

# AIM OF THE WORK

# Aim of the work

1 - A pilot study to identify the predominant gut flora in obese versus non obese Egyptian children.

2 - A trial to assess the interrelashionship between type of gut flora and degree of obesity.

# REVIEW OF LITERATURE

# ***Review of Literature***

## Obesity

Obesity has been rising in developing countries. Egypt is one of the countries in the world where the problem of obesity has been nearing an epidemic level. Nearly 70% of adult women and 48% of men in Egypt are overweight or obese according to 1998 figures ***(Asfaw, 2007).***

Obesity is becoming a major public health problem throughout the world. It is now the second leading cause of death in the United States and is associated with significant, potentially life-threatening co-morbidities ***(Cheah and Kam, 2005).***

The consequences of overweight and obesity are multifaceted, including physical, psychological, social, and economic impairments. On the physical level a range of health related effects may occur, affecting different body parts. Obesity may have several short-term consequences (for example social discrimination, lower quality of life, suffering of chronic diseases) and long-term consequences (for example persistence of obesity, increased morbidity, a higher prevalence of elevated CVD risk factors in adulthood) ***( Reilly et al., 2003).***

Among children and adolescents clinical consequences of overweight and obesity may not appear yet and are therefore less evident at this age. However, elevated levels of CVD risk factors have also been documented in obese children ***(Weiss et al., 2004)***.

## Definition:

Childhood obesity is a medical condition in which a child or teenager has excessive body fat that is accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and/or increased health problems ***(Raj and kumar, 2010***).

The Centers for Disease Control and Prevention (CDC) has defined overweight in children as falling between the 85$^{th}$ and 95$^{th}$ percentile for sex and age on the body mass index (BMI) growth chart. Obesity is defined as exceeding the 95$^{th}$ percentile for sex and age for BMI ***(Ogden & Flegal,. 2010)***

Various organizations have advocated different methods of classifying childhood obesity. For example, according to the CDC, the best tool for monitoring weight in children is the body mass index(BMI), which is first calculated based on the child's weight and height, then plotted according to age and gender on specific charts ***(CDC, 2011).***

The World Health Organization **(WHO)** does not state a preference for one method over another, noting that measuring obesity is challenging because there is no standard definition worldwide. Thus, WHO has developed several charts and tables for clinicians to use to assess a child's weight status. These include weight-for-age, weight-for-height, BMI-for-age and triceps skin fold-for-age, among others ***(WHO, 2011)***.