

Effect of Polyunsaturated Fats on Lipolytic Activity of Adipose Tissue in Obese and in Insulin Resistant Rats

Thesis

Submitted for partial fulfillment of MD degree in Physiology

By

Rasha Ali Abd El-Razik El-Deeb
M.B.B.CH

Supervisors

Prof. Dr. Mohamed Hany Gamal El-Dien Mostafa

Professor of Physiology
Faculty of Medicine
Cairo& MUST Universities

Prof. Dr. Effat Abd El-Halim Khowailed

Professor of Physiology
Faculty of Medicine
Cairo University

Dr. Mohamed El-Sayed Saleh

Assistant Professor of Physiology
Cairo University

Dr. Mona Mohamed Fathy Taher

Lecturer of chemical & clinical pathology
Faculty of medicine
Cairo University

Faculty of Medicine
Cairo University
2009

Abstract

The purpose of this study was to detect the effect of polyunsaturated fats (PUF) on the lipolytic activity of adipose tissue in obese and insulin resistant rats.

Both obesity and insulin resistant conditions were induced in rat then PUF was added to the diet of both groups.

Rats in both groups were subjected to the following measurements: body weight (BW), systolic blood pressure, lipid profile (triglyceride, cholesterol, HDL, LDL), blood glucose and Insulin levels assessment as well as studying the lipolytic activity of SC and visceral adipose tissue before and after adding PUF to their diet.

Animals fed with PUF showed significant decrease in BW, systolic blood pressure, and blood levels of glucose, insulin, TG, cholesterol, and LDL while it increased HDL level in both groups.

Adding PUF to the diet increased significantly lipolytic activity of SC and Visceral adipose tissue in both obese & insulin resistant rats, being more effective in visceral adipose tissue and more prominent in obese group.

On the basis of these finding, it is suggested that adding polyunsaturated fats (PUF) to the diet of obese and insulin resistant improve their conditions.

Key words: Obesity, Insulin resistant, polyunsaturated fats (PUF), Adipose tissue, Lipolytic activity.

Acknowledgment

To begin with thank God for giving me the strength to fulfill this work,

*I owe supreme gratitude and appreciation to **Professor Dr. Mohammed Hany Gamal El-Dien Mostafa**, Professor of Physiology Faculty of Medicine Cairo and Must University, for his keen supervision and care, without his support it would not have been possible to achieve this work ,he is more than one can expect.*

*I owe a big debt of gratitude to **Dr. Effat Abd El-Halim Khowailed**, Professor of Physiology, Faculty of Medicine Cairo University, for her constant help, valuable comment, inspiration and encouragement throughout the work, her supports cannot be rewarded and make me speechless.*

*Great thanks and appreciation goes to **Dr, Mohamed El-Sayed Saleh** Assistant Professor of Physiology, Faculty of Medicine, Cairo University for his kind supervision and support.*

*Sincere thanks and appreciation goes to **Dr. Mona Mohamed Fathy El-Laffat**, Lecturer of chemical and Clinical pathology, Faculty of Medicine, Cairo University for her devoted work, help, effort, advice and time which my words can't appreciate it enough.*

Special appreciation and gratitude goes to my home team, my husband and Kids who gave me from their time to fulfill this work and mostly to my beloved parents for their constant support, patience encouragement and sincere help.

Lastly, I am deeply grateful to everyone who has participated in this work,

Rasha El-Deeb
2009

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List of abbreviations

- **A = Agouti.**
- **AHA=American Heart Association.**
- **ATP=Adenosine triphosphate.**
- **BMI = Body Mass Index**
- **BP = Blood Pressure.**
- **BPAI-1= plasminogen activator inhibitor-1.**
- **BW = Body Weight.**
- **CLA = Conjugated linoleic acids**
- **CPE = Carboxy peptide E.**
- **DG = Diglyceride.**
- **E2 = Estradiol.**
- **EWAT = Epididymal white adipose tissue.**
- **FCR = Fractional catabolic rate.**
- **FFA = Free fatty acid.**
- **GERD= Gastroesophageal reflex disease.**
- **GOD= Glucose oxidase**
- **HCT = Hematopoietic Cell Transplantation.**
- **HDL= High density lipoprotein.**
- **HMG-CoA= 3-hydroxy3-methylglutaryl coenzyme A.**
- **HSL= Hormone sensitive Lipase.**
- **IBWT = Ideal Body Weight for height and Age.**
- **IDDM = Insulin Dependent Diabetes Mellitus.**
- **IFG= Impaired fasting glucose.**
- **IGT = Impaired glucose tolerance.**
- **IL-6 = Interleukin.**
- **LCAT = Lecithin Cholesterol acetyltransferase.**
- **LDL(s) = Low Density Lipoprotein.**
- **LPL = Lipoprotein lipase.**
- **LxRs = Liver x receptors.**
- **MG = Monoglyceride.**
- **NIDDM =Non insulin dependent diabetes mellitus.**
- **OBR=leptin receptor.**
- **OHS= Obesity Hypoventilation Syndrome.**
- **PCOS= Polycystic ovarian syndrome.**
- **PUF=Polyunsaturated fat.**
- **PUFA = Polyunsaturated fatty acids.**
- **RNY = Roux-en-Y gastric bypass surgery.**

- **SC = Subcutaneous adipose tissue.**
- **TBI= Total body irradiation.**
- **TG= Triglyceride.**
- **TNF α = Tumor Necrosis Factor alpha.**
- **TUB = Tubby.**
- **VBG = Vertical banded gastroplasty.**
- **VLDL = Very Low Density Lipoprotein.**
- **WAT = White Adipose Tissue.**

Introduction:

Adipose tissue serves as the main fuel and energy supply for the whole body and its metabolic activity is the main contributor to the development of obesity, followed by or concomitant with insulin resistance and cardiovascular diseases. (*Fickova et al., 1998*)

The fatty acid profile of the adipocytes is determined by the composition of dietary fats. (*Gavino and Gavino, 1991*).

Although dietary recommendations for the prevention of obesity remain controversial, the replacement of saturated fatty acids by the polyunsaturated fatty acids of plant origin (n-6 series) is already a well documented and widely accepted strategy. In addition, the effects of (n-3) polyunsaturated fatty acids (mainly from salt-water fish) have been studied in view of the potency of these compounds in reducing plasma triglycerides (*Fickova et al., 1998*).

Obesity is often associated with metabolic syndrome which includes insulin resistance, dyslipidemia and hypertension. (*Spiegelman and Flier, 2001*) Weight reduction lowers arterial blood pressure in obese hypertensive patients, suggesting a close association between energy homeostasis and hypertension. (*Busetto, 2001*).

Regional variations in adipose tissue function seem to have an additional bearing on insulin resistance. Visceral fat accumulation has a stronger association with insulin resistance than subcutaneous fat accumulation. This has in part been attributed to higher lipolytic activity in visceral than subcutaneous adipose tissue. (*Wajchenberg, 2000*) There is much evidence showing that the function of adipose tissue is disturbed in insulin-resistant states. The ability of insulin to suppress fatty acid

release from adipose tissue is impaired in obesity and insulin resistant states. (*Lofgren et al., 2002.*)

Intra-abdominal fat depots, although relatively small in comparison with subcutaneous fat depots, play an important role in fat buffering. Rate of lipolysis from intra-abdominal adipocytes, when measured in vitro, tends to be high. (*Campbell et al., 1994.*)

However, enlarged intra-abdominal fat store is associated in many studies with features of insulin resistance. (*Wajchenberg, 2000.*)

Aim of work:

The aim of the present work is to study the effects of polyunsaturated fats on adipose tissue function, lipid profile, body weight, and blood pressure in obese and insulin resistant male rats.