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

Thesis

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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.

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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.