

ENDOCRINE AND OXIDATIVE STRESS MECHANISMS OF YOGA DISCIPLINE IN THE CONTROL OF NON- INSULIN DEPENDENT DIABETES MELLITUS

A Thesis

Submitted in Fulfillment of the Requirement for the Degree of Doctor of
Philosophy in Biochemistry (Diabetology)

The University of the West Indies

by

Lorenzo Augustus Gordon

2006

**Department of Basic Medical Sciences
Biochemistry Section
Faculty of Medical Sciences
University of the West Indies, Mona Campus.**

ABSTRACT

Endocrine and Oxidative Stress Mechanisms of Yoga Discipline in the Control of Non-Insulin Dependent Diabetes Mellitus

Lorenzo Augustus Gordon

This thesis sets out to compare selected metabolic, biochemical and oxidative stress variables in a population of Non-insulin Dependent Diabetics (NIDDM) divided into three matched groups. One group was subject to a weekly traditional exercise regimen, along with diet, instruction and medication as prescribed by the International Diabetes Federation protocols (Traditional Group). One was subject to the same protocols but with Yoga Discipline substituted for the standard exercise regimen (Yoga Group). The third was subject only to treatment as directed by their clinics or general physicians, not enjoying any form of supervised exercise intervention (Habitual Group). Starting with the hospital population of 2652 NIDDM patients, the exclusion criteria plus drop outs, reduced the numbers to 231 in all: 77 matched patients per group. The groups were followed over six months, with the first three months being taken as required for training and adaptation. The Traditional and Yoga groups were sampled weekly whilst the Habitual group was sampled only at three month intervals.

The aim of the study was to determine how the matched members of these groups differed biochemically from each other at the start and over the six month period in order to discover any underlying endocrine and oxidative stress mechanisms which might form the basis of differences found. Metabolic, hormonal, biochemical and oxidative stress parameters were measured at the beginning, three and six months during treatments. In 24 weeks of an exercise programme (only for the Traditional and Yoga groups), the frequency of symptoms and signs of hypo or hyperglycaemia were significantly lower in the Yoga group (16/77, 20.8%) than the Traditional (32/77, 40.3%) ($P=0.004$). Using Two way ANOVA, and the Within – Subjects factors analysis, supported by Tukey HSD test, there were significant differences in the change of Fasting Blood Glucose (FBG) between the managed groups and the Habitual group in the third and sixth month ($P < 0.01$). Similar results were observed in Glycosylated haemoglobin [%], Cholesterol [mmol/L] and in the ratio Cholesterol/HDL. According to the principal component (PC) analysis test (SPSS Version 10.0 for Windows), all groups were characterized by similar attributes up to the third month but at six months each group showed different outcomes (evidence of the influence of each treatment). The changes in the Yoga group at the sixth month demonstrated significant correlations of internalization of the insulin-receptor complex with insulin receptors binding ($P < 0.01$), high density lipoprotein ($P < 0.01$) and Superoxide dismutase (SOD), ($P < 0.01$). These results indicate that Yoga Discipline provides a favourable linkage between metabolic functions and the antioxidant cell defenses in NIDDM.

Keywords: Lorenzo Augustus Gordon, Non-Insulin Dependent Diabetes Mellitus, Yoga, endocrine, oxidative stress, principal component analysis test.