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A COMPARATIVE STUDY OF GLUCOSE INTOLERANCE AND INSULIN RESISTANCE IN INDIVIDUALS USING INSULIN VS. ORAL HYPOGLYCEMIC DRUGS

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Abstract

Introduction: Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. Two primary forms of diabetes treatment include insulin therapy and oral hypoglycaemic drugs.

Methodology: This cross-sectional observational study, which took place at Capital Hospital Islamabad between September 2023 and March 2024, involved patients with diabetes mellitus aged 18 to 75 who had been diagnosed with the disease; patients without diseases influencing glucose metabolism were excluded.

Results: Medical history, fasting blood glucose levels, OGTT findings, HOMA-IR values, physical activity, and food habits were the main findings. According to the type of treatment, there are notable variations in glucose intolerance and insulin resistance; insulin therapy generally produces better results in terms of glucose control.

Conclusion: By highlighting the intricacy of diabetes pathophysiology and the necessity of individualized treatment plans to enhance patient outcomes, this study offers important new understandings into the various ways that diabetes management techniques affect metabolic health.

Keywords: Insulin Resistance, Glucose Intolerance, Insulin Therapy, Oral Hypoglycemic Medication, HOMA-IR, OGTT.

Introduction

Diabetes mellitus, a chronic metabolic disorder characterized by hyperglycemia, is primarily managed through insulin therapy and oral hypoglycemic drugs. However, the impact of these

treatments on glucose intolerance and insulin resistance remains inadequately explored. Given the critical role of these conditions in diabetes progression and complication development, understanding their relationship with treatment modalities is essential for improving patient outcomes. Insulin resistance, impaired glucose tolerance (IGT), and type 2 diabetes are disorders with poorly understood underlying biological processes. There is evidence suggesting that altered endogenous glucocorticoid metabolism is responsible, including the activity of 11β-hydroxysteroid dehydrogenase type 1 (11β-HSD1), which converts cortisone into active cortisol, and 5α-reductase (5αR), which renders cortisol inactive (1).

Type 2 diabetes is predictingly associated with insulin resistance (IR), which is also linked to a range of metabolic abnormalities during fasting. Although there is a dearth of information on the effects of IR on metabolic responses in a non-fasting context, persons in contemporary culture are mostly exposed to this state while they are awake. Our goals are to evaluate the relationships between these changes and insulin resistance (IR) by thoroughly characterizing the metabolic alterations brought on by an oral glucose tolerance test (OGTT) (2). Two primary forms of diabetes treatment include insulin therapy and oral hypoglycaemic drugs. While insulin therapy is a cornerstone of diabetes management, oral hypoglycaemic drugs are often prescribed to individuals with type 2 diabetes (3).

The choice of treatment, whether it be insulin therapy or oral hypoglycemic drugs, can influence the development and progression of these metabolic disturbances (4,5). Glucose intolerance and insulin resistance are interconnected phenomena that contribute to poor glycemic control and complications in diabetes. However, the comparative impact of insulin therapy and oral hypoglycemic drugs on these aspects of glucose metabolism is not well understood (6).

Understanding the differences in glucose intolerance and insulin resistance between these two treatment modalities could guide healthcare providers in selecting the most appropriate treatment regimen for individual patients. Understanding the impact of insulin therapy and oral hypoglycemic drugs on glucose intolerance and insulin resistance is crucial for optimizing diabetes care. This comprehensive study aimed at comparing glucose intolerance and insulin resistance in individuals using insulin therapy and those using oral hypoglycemic drugs, with the goal of enhancing diabetes management strategies.

Methodology

We did a cross-sectional observational study at Capital Hospital Islamabad between September 2023 and March 2024, with people who had been identified with diabetes mellitus and were either taking insulin or oral hypoglycemic drugs at the time of the study. Diabetes center patients between the ages of 18 and 75 who had been diagnosed with diabetes mellitus were asked to take part. Patients with secondary diabetes, pregnancy, or diseases that affect glucose metabolism were not allowed to participate.

Medical history, demographic data, fasting blood glucose levels, OGTT results, HOMA-IR values, physical activity, and dietary practices were among the information gathered. Using summary statistics, t-tests, chi-squared tests, and multivariate regression analysis, we looked for links between the condition's glucose intolerance and insulin resistance. A significant threshold of $p < 0.05$ was established.

Results

There are 157 participants in the sample, ranging in age from 30 to 75. The following are the main numerical findings:

Table 1: Descriptive Statistics

Variable		Frequency (Percentage)
Gender	Male	71 (45.2)
	Female	86 (54.8)
Diabetes Type	Type 1	71 (45.2)
	Type 2	86 (54.8)
Treatment Modality	Insulin	78 (49.7)
	Oral drug	79 (50.3)
Physical Activity Level	Low	61 (38.9)
	Moderate	44 (28.0)
	High	52 (33.1)
Dietary Habits	Low carb	59 (37.6)
	Balanced carb	56 (35.7)
	High carb	42 (26.8)
Continuous Variables		Mean ± Standard Deviation
Age		52.87 ± 13.443
Fasting Blood Glucose Level		9.0408 ± 2.01068
OGTT Results		179.14 ± 41.861
HOMA IR Values		2.9796 ± 0.86940
Duration of Treatment		10.64 ± 5.402

People who were taking insulin had different patterns of glucose intolerance than people who were taking oral hypoglycemic drugs. In general, insulin users had better OGTT readings.
Fasting Blood Glucose Level: The range of results for the fasting blood glucose level is 5.5 to 12.4 mmol/L, with an average of 9.04 mmol/L. The comparatively large distribution suggests that participants' glucose control varies.

Table 2: Association of HOMA-IR Values (Insulin Intolerance) and OGTT Results (Glucose Intolerance)

Variables	HOMA IR Values (Insulin Intolerance)		OGTT Results (Glucose Intolerance)	
	Statistics	p-value	Statistics	p-value
Gender	0.358	0.550	2.226	0.138
Diabetes Type	2.337	0.128	1.377	0.242
Treatment Modality	0.805	0.371	9.165	0.003
Physical Activity Level	0.382	0.683	0.868	0.422
Dietary Habits	1.548	0.216	0.276	0.759
Age	46.27	0.000	-36.96	0.000
Duration of Treatment	17.53	0.000	-49.905	0.000
Fasting Blood Glucose Level	34.663	0.000	-50.691	0.000

OGTT Findings: The range of scores on the Oral Glucose Tolerance Test, from 103 to 248, shows that people's glucose tolerance is very different.
Using HOMA-IR measurements, insulin resistance levels were compared among treatment groups. This suggests that different treatment approaches are more or less effective at controlling insulin sensitivity.
Values for HOMA-IR: The group exhibits various degrees of insulin resistance, as indicated by the mean HOMA-IR value of approximately 2.98. The range of values is 1.5 to 4.5.
Treatment Duration: Participants have been getting care for diabetes for an average of 10.64 years, ranging from 1 to 20 years.

Diagnosis Type Distribution and Available Treatments

Type of Diabetes: Type 2 diabetes is more common in this group than Type 1 diabetes, as shown by the fact that 86 of the subjects have it and 71 have Type 1.

Methods of Treatment: Insulin (78 participants) and oral hypoglycemics (79 participants) make up about equal shares of the treatment modalities.

The results indicate that the mechanisms impacting blood glucose levels are complex and diverse, as there is minimal association seen between fasting blood glucose levels and other variables such age, HOMA-IR values, and length of therapy.

The absence of significant connections within the dataset emphasizes how diabetes therapy is customized and how several factors such as exercise, food, and drug adherence play a role.

Distribution of Fasting Blood Glucose Levels

The observed distribution of fasting blood glucose levels exhibits a slight skewness in favor of higher values, suggesting that a subset of the participants may have impaired glycemic control. This skewness highlights the difficulties diabetics face in keeping their fasting blood sugar levels within the desired range.

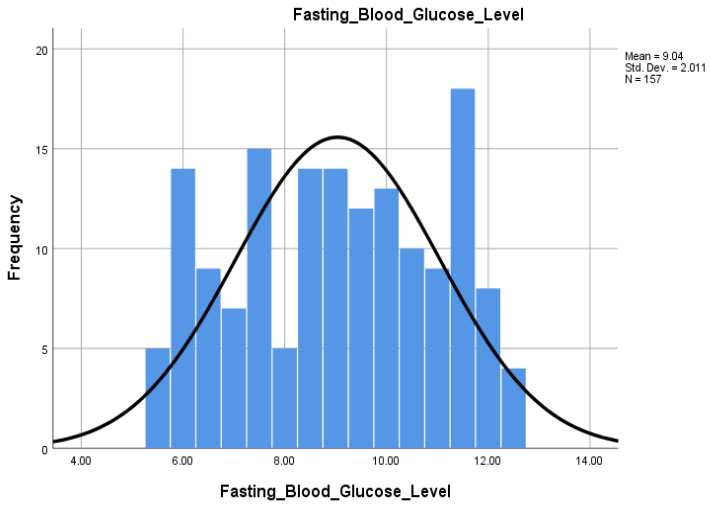

Figure 1: Fasting Blood Glucose Level

Factors linked with variations in glucose intolerance and insulin resistance among treatment modalities included age, length of treatment, and dietary practices.

Effects of Dosage and Length of Treatment: A longer treatment period was linked to small gains in glucose control and insulin sensitivity. This shows how important it is to stick to treatment and make it work best for you.

Discussion

Since people with glucose intolerance typically have elevated glucose levels and no other symptoms, a significant number of these patients go undetected. In 2010, the global prevalence of glucose intolerance was approximately 8%. In a study examining the transition from normal glucose tolerance (NGT) to insulin-glucose tolerance (IGT), after ten years, 14% of NGT individuals had advanced to IFG and 48% to IGT. Approximately 57 million Americans had IFG and 30 million had IGT in 2010. The difference in advancement between NGT and IGT and NGT and IFG is approximately four times larger. Individuals over 65 have greater likelihood of progressing to an aberrant 2-hour value during a GTT in comparison to younger individuals (7).

Resistance to early insulin use after type 2 diabetes diagnosis is due to weight increase, hypoglycemia, and concerns about compliance and quality of life. In a comparison study, glycated hemoglobin A1C levels were 6.1 ± 0.6% (insulin group) and 6.0 ± 0.8% (oral group) at study conclusion. Both groups gained 4.47 kg (insulin group) and 7.15 kg (orals group) weight which is significantly different (P =

0.09) (8). Insulin shortage, insulin resistance, and increased hepatic glucose output describe type 2 diabetes. Treatments for type 2 diabetes aim to repair metabolic imbalances. Five classes of hypoglycemic drugs exist, each with specific pharmacologic features. These include sulfonylureas, meglitinides, thiazolidinediones, biguanides, and alpha-glucosidase inhibitors. When diet and exercise fail to manage glucose, a single oral medication can be used. Patient- and drug-specific features should be considered while choosing an agent. Combined oral medications with diverse modes of action may improve glycemic control if one agent fails to control blood glucose (9).

Numerous short-term trials have demonstrated the efficacy of combined therapy, which combines insulin with oral medications, in enhancing glycemic control. Combining regimens makes sense since it reduces the dosage of antihyperglycemic medications and, consequently, their side effects (in the case of insulin, hypoglycemia). When oral medication is continued throughout insulin therapy, either by increasing the availability or efficiency of endogenous insulin, glycemic stability may increase, resulting in improved glycemic control with a lower risk of hypoglycemia, or equivalent glycemic control with fewer hypoglycemia. Additionally, the risk of weight gain is reduced when metformin is combined with insulin (10).

When determining what level of A1C, a person with newly diagnosed diabetes should take before starting insulin, there are conflicting suggestions and widely differing practices. The adjusted average A1C drop from baseline was larger in the OA group (insulin: −1.97% vs. OA: −2.52%; $p<0.001$) in a study of 489 patients. In a subset analysis of individuals with A1C >11%, considerably more patients were started on OAs (insulin: n=51, OA: n=93; $p<0.001$). A1C improvements were similar at 12 months (insulin: −5.06%, OA: −4.62%, $p=0.846$). Baseline A1C was significantly associated with insulin beginning ($p<0.001$): Every one unit increase in baseline A1C increased the probability of insulin initiation by 47.5%. Those in the insulin group visited the ED more frequently annually (0.169 vs. 0.0025; $p<0.005$). Because OAs have good clinical outcomes even with very high A1C levels, and they also help the healthcare system, they are a promising first treatment for people with low incomes who have just been diagnosed with type 2 diabetes (11).

Conclusion

This study contributes to the understanding of how insulin therapy and oral hypoglycemic drugs differentially impact glucose intolerance and insulin resistance. Tailoring treatment to individual patient profiles based on these insights could improve outcomes for those with diabetes mellitus.

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