

Glucose and insulin levels in healthy males after consuming breakfast containing different composition of macronutrient with equal energy

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Background: The main objective of this research is to determine the patterns of glucose levels and insulin levels after consuming diets containing 500kcal of energy with the different macronutrient compositions. The diet containing 55% of Carbohydrate, 15% of Protein and 30% of Fat (Diet Type-2) was considered as the control diet and the other diets with varying amounts of carbohydrate, protein and fat will be considered as the test diets.

Methodology: This was a laboratory based experimental study design where complete randomized design (CRD) was used. In this study, 6 healthy normal males (no.6) and 4 different compositions of breakfast were used. Blood samples were collected after 12 hours of fasting. The subjects consumed the breakfast of different composition with 500 kcal. Blood samples were collected at fasting as well as with half an hour interval for 2 hours after the consumption of breakfast. Blood samples were analysed for plasma glucose and insulin levels by standard methods. Approval of Ethical Review Committee, Faculty of Medicine, University of Jaffna was obtained. The collected data were analysed using SPSS software.

Results: This study was carried out to compare the changes in plasma glucose and serum insulin levels in normal healthy individuals after consuming the different diets [Diet Type- 1 (509kcal), Diet Type-3 (502kcal) and Diet Type- 4 (526kcal)]. Diet Type – 2 (507kcal) was considered as control because it contained the macronutrients of a balanced diet. Diets Type 1, 2, 3, and 4 contained the carbohydrates: Proteins: Fats in the ratios of 40: 35: 25; 55: 15: 30; 70: 20: 10 and 55: 30: 15. All the subjects were males and the mean BMI and fasting plasma glucose levels were $21.51(\pm 2.5) \text{ kg/m}^2$ and $80.9 (\pm 7.4) \text{ mg/dl}$. With all the four different types of diets, highest plasma glucose levels were obtained at 0.5h [Diet Type -1 $109.7 (\pm 22.7)$; Diet Type -2 $124.8 (\pm 13.8)$; Diet Type -3 $116.7 (\pm 8.08)$ and Diet Type -4 $79.3, \text{ mg/dl}$]. The second highest area under the curve for insulin was obtained with Diet Type-2 (143.5), which contained second highest amount of carbohydrates (55%). Among the different types of diets, the Diet Type-3 (70%) contained the highest amount of carbohydrate followed with Diets Type-2 and -4 (55%). The area under the curve for glucose and plasma glucose level at 0.5h were highest for Diet Type-2 (219.4 and $124.8 \pm 13.8 \text{ mg/dl}$) followed with Diet Type-4 (205.2 and $121.3 \pm 7.8 \text{ mg/dl}$). But the area under the curve for insulin and insulin level were highest (210.4 and $141.6 \pm 44.9 \mu\text{IU/ml}$) for the diet with highest amount of carbohydrate (Diet Type-3, 70% carbohydrate). The area under curve for glucose of diet types 1 and 2 were significant ($p \leq 0.01$). The area under curve for insulin of diet types 3 and 4 were significant ($p \leq 0.023$). The results indicated that the amount of carbohydrate in a diet alone does not determine the area under the curves for glucose and insulin, and plasma glucose level.

Diet Type-1 contained highest amount of protein (35%) followed with Diet Type-4 (30%). Area under the curve for insulin for the Diet Type-1 was second highest (137.3) with the area under the curve for glucose (198.3) and the least plasma glucose level at 0.5h [109.0 (\pm 22.7) mg/dl]. Among the Diets Type-2 and-4, which contained equal amounts of carbohydrates (55%), Diet Type-2 contained half the amount of proteins as of Diet Type -4. The results indicated that carbohydrates have more influence area under the curve glucose and plasma glucose levels than proteins. Further the results indicated that not only the carbohydrates but also proteins increase the insulin secretion.

Diet Type-2 contained the highest amount of fat (30%) followed with Diet Type 1 and the least amount of fat was in Diet Type-3. With the Diet Type-2, the area under the curve for glucose (219.4) and 0.5h plasma glucose level (124.8 \pm 13.8mg/dl) values are the highest. Diet Type-4 contained half the amount of fat (15%) than Diet Type-2. But the plasma glucose level or area under the curve for glucose and area under the curve for insulin did not show any correlation with dietary fat contents.

Least area under the curve for glucose (198.3) and plasma glucose level (109.7 \pm 22.7 mg/dl)at 0.5h was observed for the Diet Type - 1 which contained 40% of carbohydrates, 35% of protein and 25% of fats but with a second highest (137.6) area under the curve for insulin.

Conclusion: Even though the calculated amounts of carbohydrates, proteins and fats show a wide variation in macronutrient contents, no direct correlation with the three major nutrients and the area under the curves for insulin and glucose were observed, but there is indication of increased insulin secretion and delayed returning to blood glucose level with increased carbohydrate content in the diets..

Key words: Glucose, Insulin, Composition, Carbohydrate, Protein, Fat, area under the curve