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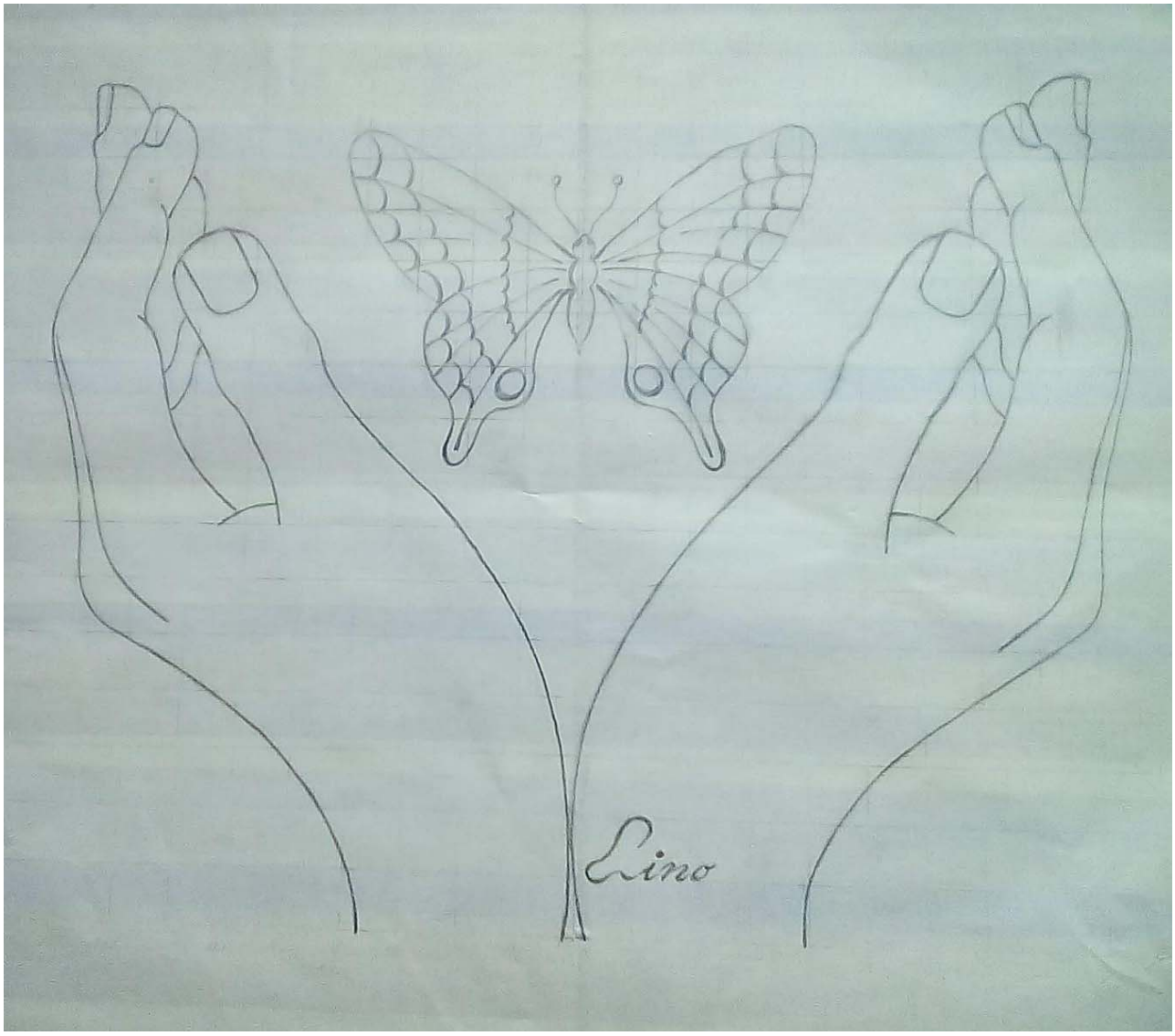


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# The evaluation behind Bioelectrical impedance of the treatment of type II diabetes.

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**KEY-WORDS: BIA, insulin, diabetes**

## ABSTRACT

**Background:** Insulin treatment is a very common clinical condition in the young, adult or elderly population with type I diabetes mellitus or advanced type II diabetes mellitus. These clinical conditions linked to mild or severe glycemic changes can be a transient or chronic (often underestimated) condition that affects the patient's quality of life. **Aim:** The purpose of this study is to evaluate the efficacy of drug treatment with rapid insulin (Novorapid) and changes in cutaneous electrical conductivity after the administration of insulin therapy through the use of cutaneous bioimpedance analysis. **Materials and Methods:** In order to evaluate the efficacy of the insulin treatment and any changes in skin electrical conductivity after therapeutic treatment with rapid insulin (Novorapid), we enrolled 12 patients in our study (8 men and 4 women with an average age of 70 years old and standard deviation of 11 years). All enrolled patients accepted the enrolment criteria and provided informed consent for the treatment of health data. After the initial clinical evaluation, the enrolled subjects were subjected to blood glucose measurement by skin puncture and skin bioimpedance examination with positioning of the electrodes on the deltoid and on the elbow of the arm subjected to subcutaneous insulin therapy (as shown in the photo). A similar protocol was implemented 30 minutes after the administration of subcutaneous insulin therapy. **Results:** the results of the treatment, assessed by bioelectrical analysis, appear statistically significant ($P < 0.001$) in all the items envisaged by the study protocol (Table 1). **Discussion:** On the basis of the data relating to changes in electrical resistance and electrical reactance measured by skin bioimpedance analysis in the group of diabetic subjects enrolled in the study, subcutaneous insulin treatment determines a significant change in skin conductivity in the limb subjected to subcutaneous administration in relation to the effect on glucose metabolism and electrolyte balance. **Conclusions:** Our experience has allowed us to highlight the statistical significance of the metabolic and electrolyte changes that take place physiologically following the subcutaneous insulin treatment using a non-invasive analysis method such as skin bioimpedance.

**Background:** Insulin treatment is a very common clinical condition in the young, adult or elderly population with type I diabetes mellitus or advanced type II diabetes mellitus. These clinical conditions linked to mild or severe glycemic changes can be a transient or chronic (often underestimated) condition that affects the patient's quality of life.

**Aim:** The purpose of this study is to evaluate the efficacy of drug treatment with rapid insulin (Novorapid) and changes in cutaneous electrical conductivity after the administration of insulin therapy through the use of cutaneous bioimpedance analysis.

**Materials and Methods:** In order to evaluate the efficacy of the insulin treatment and any changes in skin electrical conductivity after therapeutic treatment with rapid insulin (Novorapid), we enrolled 12 patients in our study (8 men and 4 women with an average age of 70 years and standard deviation of 11 years).

The inclusion criterion required for enrolment is represented by an history of diabetes treated with insulin and HbA1c > 7 %. Enrolment was carried out after requesting informed consent from enrolled patients.

The exclusion criteria are attributable to the treatments with oral antidiabetic agents.
Enrolment for the study was done on a voluntary basis. Patients were given informed consent explaining in detail the rationale for the study, how it was conducted and the possibility of withdrawing from the study at any time. Sensitive data have been processed in accordance with the privacy law. The statistical analysis software carried out with SIGMASTAT version 3.5 for Windows XP. The data collection was carried out simultaneously with the request for informed consent processed by us. As regards the use of scale, it has been standardized to the international reference system for laboratory tests and instrumental tests.

**Results:** After the initial clinical evaluation, the enrolled subjects were subjected to blood glucose measurement by skin puncture and skin bioimpedance examination with positioning of the electrodes on the deltoid and on the elbow of the arm subjected to subcutaneous insulin therapy (as shown in the photo in detail). A similar protocol was implemented 30 minutes after the administration of subcutaneous insulin therapy. The results of the treatment, assessed by bioelectrical analysis, appear statistically significant ($P < 0.001$) in all the items envisaged by the study protocol (Table 1).

**Discussion:** On the basis of the data relating to changes in electrical resistance and electrical reactance measured by skin bioimpedance analysis in the group of diabetic subjects enrolled in the study, subcutaneous insulin treatment determines a significant change in skin conductivity in the limb subjected to subcutaneous administration in relation to the effect on glucose metabolism and electrolyte balance.

**Conclusions:** Our experience has allowed us to highlight the statistical significance of the metabolic and electrolyte changes that take place

physiologically following the subcutaneous insulin treatment using a non-invasive analysis method such as skin bioimpedance.

**Conflict of Interest: none declared.**

## TABLES

| | CONTROL ± DS | EFFECT ± DS | Probability (P) |
|---|---|---|---|
| **Glucose (md/dl)** | 206,083 ± 99,478 | 167,833 ± 88,665 | < 0,001* |
| **Resistance (Ohm)** | 90,250 ± 34,965 | 85,333 ± 35,300 | < 0,005* |
| **Reactance (Ohm)** | 10,667 ± 6,329 | 8,417 ± 6,201 | < 0,001* |

**Tab. 1 Descriptive statistics about the glucose level and bioelectrical measurement during insulin treatments in patients with diabetes. Data are expressed as mean ± Standard Deviation.**

## FIGURES

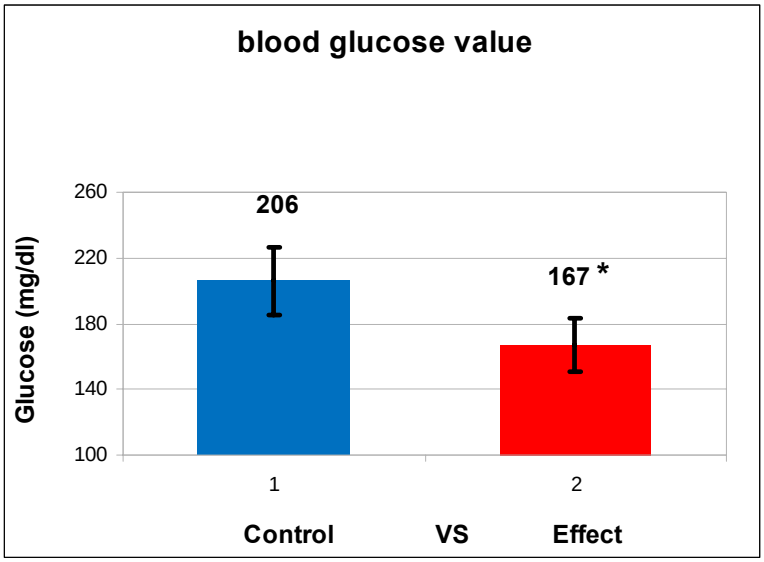


Fig. 1 Graphical representation of the main blood glucose value. Data are expressed as mean ± Standard Deviation.

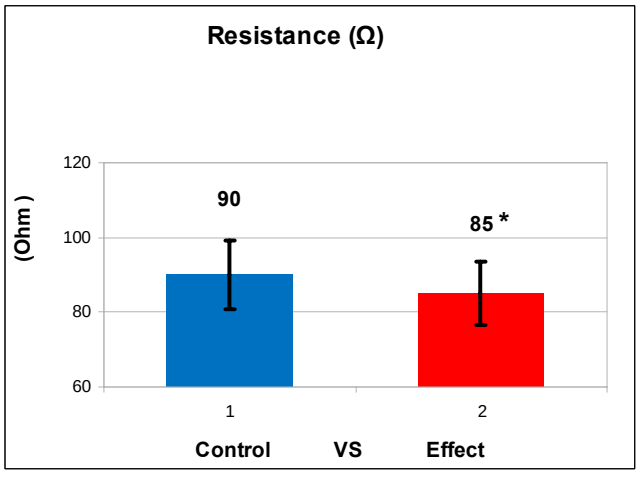


**Fig 2a.** Graphical representation of the main value of the Resistance. Data are expressed as mean ± Standard Deviation.

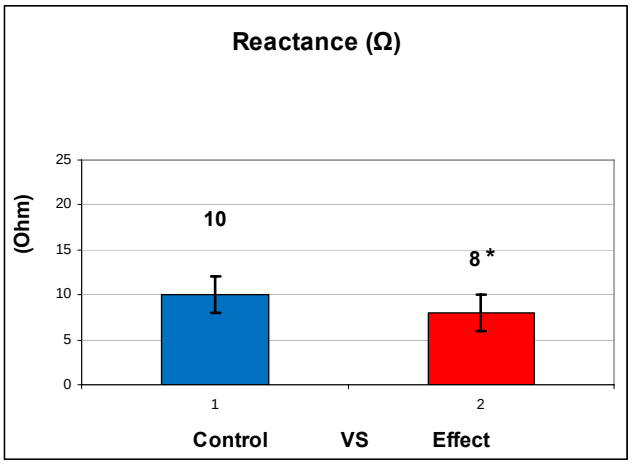


**Fig. 2b** Graphical representation of the main value of the Reactance. Data are expressed as mean ± Standard Deviation.

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