

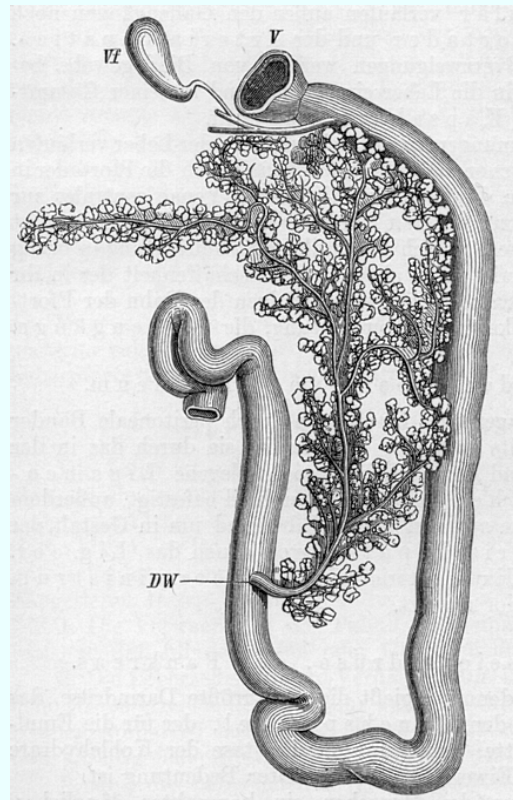
Diabetes in rabbits

Esther van Praag, Ph.D.

Diabetes relates to the pancreas, an organ that possesses endocrine cells called islets of Langerhans. Those islets secrete insulin in the blood circulatory system. The level of glucose in the blood is controlled by insulin excretion in the circulation. When the pancreas of rabbits was ligated, a strong decrease of insulin secretion (hypoinsulinemia) was observed, accompanied by an increase of glucagon (hyperglucagonemia). As a consequence the glucose level in the blood increased dramatically.

In human medicine, types of diabetes are differentiated:

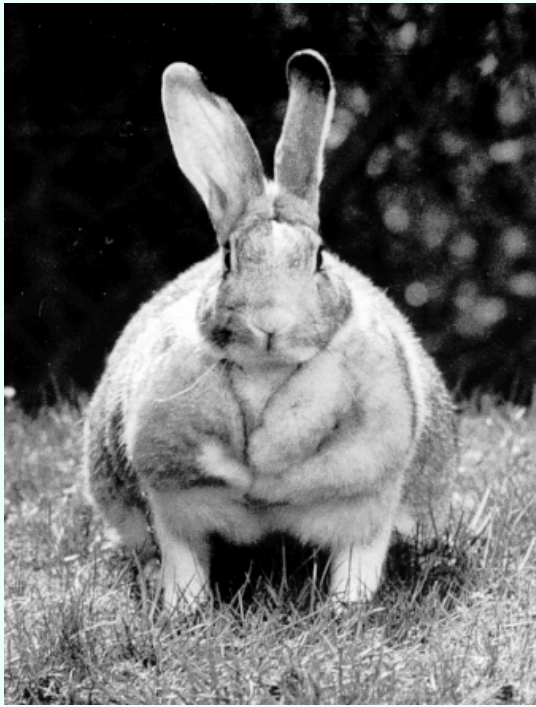
- Type 1 (or I, or juvenile) and is characterized by a destruction of the islets of Langerhans. There is still speculation about the cause: autoimmune, or viral, or viral that triggers an autoimmune reaction against the virus and the cells of the islets due to mimicry of surface proteins. A subject suffering from diabetes 1 needs regular intake of insulin.
- Type 2 diabetes happens mainly in older obese persons; insulin production is normal, at least in the beginning, but cells fail to respond to insulin as they have developed a mechanism of resistance. Consequently the level of sugar remains high in the blood. Subject or diabetes 2 will take oral medication to reduce the sugar level (e.g. glucophage).



Pancreas of the rabbit

(DW ductus, V pylorus, Vf, gall bladder with ductus) from: "Das Kaninchen", by Dr. U. Gerhardt, 1909.





E. van Praag

Obese rabbits are more prone to develop diabetes-like symptoms.

True diabetes is a rare condition in rabbits, and barely described in the literature, with the exception of drug-induced diabetes (alloxan or streptozotin induced diabetes for instance). Both type 1, and type 2 have been observed; the symptoms of the latter being more common in obese rabbits.

During the onset phase of the disease, rabbits are able to compensate for the lack of insulin production in the pancreas. It seems indeed that insulin plays a less important role in rabbits and herbivores, than in carnivores. Many plants have furthermore hypoglycemic properties and, when ingested, may help the rabbit adjust its glucose level to normal. A corrected diet, with a

great variety of fresh vegetables would help correct true diabetes or diabetes-like symptoms in a rabbit, without a need to inject insulin on a daily basis.

Symptoms

In cases of induced diabetes in lab rabbits, hyperglycemia is accompanied by polydipsia (excessive thirst), polyuria (excessive urination) and polyphagia (strong desire to eat).

Pathology

In type 1 diabetes New-Zealand rabbits, endocrine cells of the Langerhans islets were affected and showed hypergranulation, as compared with the healthy non-diabetic rabbits. In other animals, degranulation of these cells is usually observed. The lack of insulin production was accompanied by glycosilation of the hemoglobin (attachment of glucose molecules to hemoglobin, the protein that is involved in oxygen transport in the red blood cells). With time, non-insulin treated diabetic rabbits will suffer the same side effects with time than humans (mineralization of the kidneys, eye trouble and blood vessel problems), independently from a corrected diet.



Diagnosis

Manipulation of a rabbit can lead to an increase of the glucose level in the blood, to the order of 8.6 mmol/l and higher, and will falsify the result. This phenomenon relates to the release of adrenaline (epinephrine in the US), a molecule that counters the effect of insulin, enabling a raise in the blood glucose. Knudtson J. reports about this phenomenon in his papers about diabetes in rabbits.

Consequently, diabetes cannot be diagnosed by one simple blood test; a series of blood and urine tests must be done over a period of time to confirm the disease.

Blood chemistry tests should include:

- blood glucose,
- serum osmolarity,
- elevated BUN,
- electrolytes disbalance (sodium and potassium),
- glucose in urine
- glycosylation of protein (fructosamine test),
- glycosylated hemoglobin (Hb_{A1c}).

Hyperglycemia (overload of glucose in the blood) has been linked to stasis, with poor prognosis for rabbit; seems to relate to fatty degeneration of the liver. If the rabbit survives, the glucose level that has been as high as 25 mmol/l, will come back to normal.

Differential

Diabetes must be differentiated from:

- endocrine disorders, e.g. overproduction of cortisol or glucagon, Cushing disease
- disorders of the target organs (liver, fat tissue, muscle)
- pancreatitis (inflammation of the pancreas)
- renal glycosuria

Treatment

The treatment recommended is a healthy diet:

- hay,
- fresh vegetables,
- good quality pellets,
- no "junk" food, rich in carbohydrates.

If the rabbit is overweight, a weight-reduction plan must be organized. This should be done slowly, over weeks, rather than days. Insulin injections are



not needed in a rabbit with diabetes. They live well with a healthy diet and no insulin injections, on the contrary to dogs and cats.

Further Information

1. Catala J, Daumas M, Chanh AP, Lasserre B, Hollande E. Insulin and glucagon impairments in relation with islet cells morphological modifications following long term pancreatic duct ligation in the rabbit--a model of non-insulin-dependent diabetes. *Int J Exp Diabetes Res.* 2001; 2(2):101-12.
2. Conaway HH, Faas FH, Smith SD, Sanders LL. Spontaneous diabetes mellitus in the New Zealand white rabbit: physiologic characteristics. *Metabolism.* 1981; 30(1):50-6.
3. Roman-Ramos R, Flores-Saenz JL, Alarcon-Aguilar FJ. Anti-hyperglycemic effect of some edible plants. *J Ethnopharmacol* 1995; 48(1):25-32
4. Roth SI, Conaway HH, Sanders LL, Casali RE, Boyd AE 3rd. Spontaneous diabetes mellitus in the New Zealand white rabbit: preliminary morphologic characterization. *Lab Invest.* 1980; 42(5):571-9.

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