



Clinical Significance and Application of HbA1c

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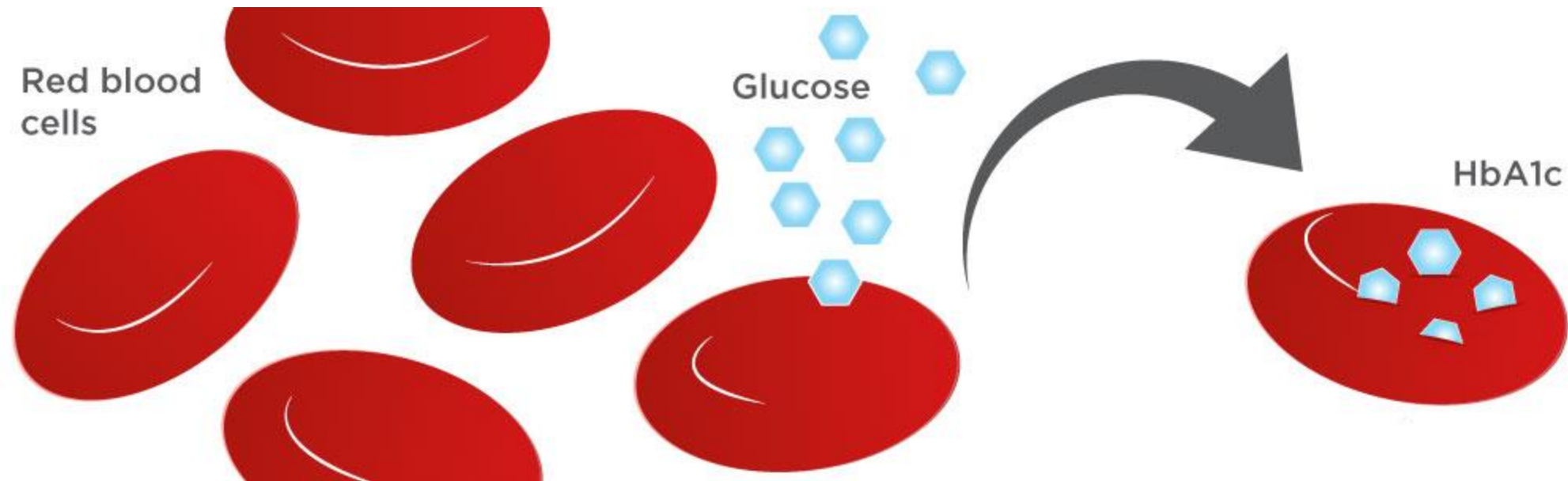
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a. What is HbA1c?

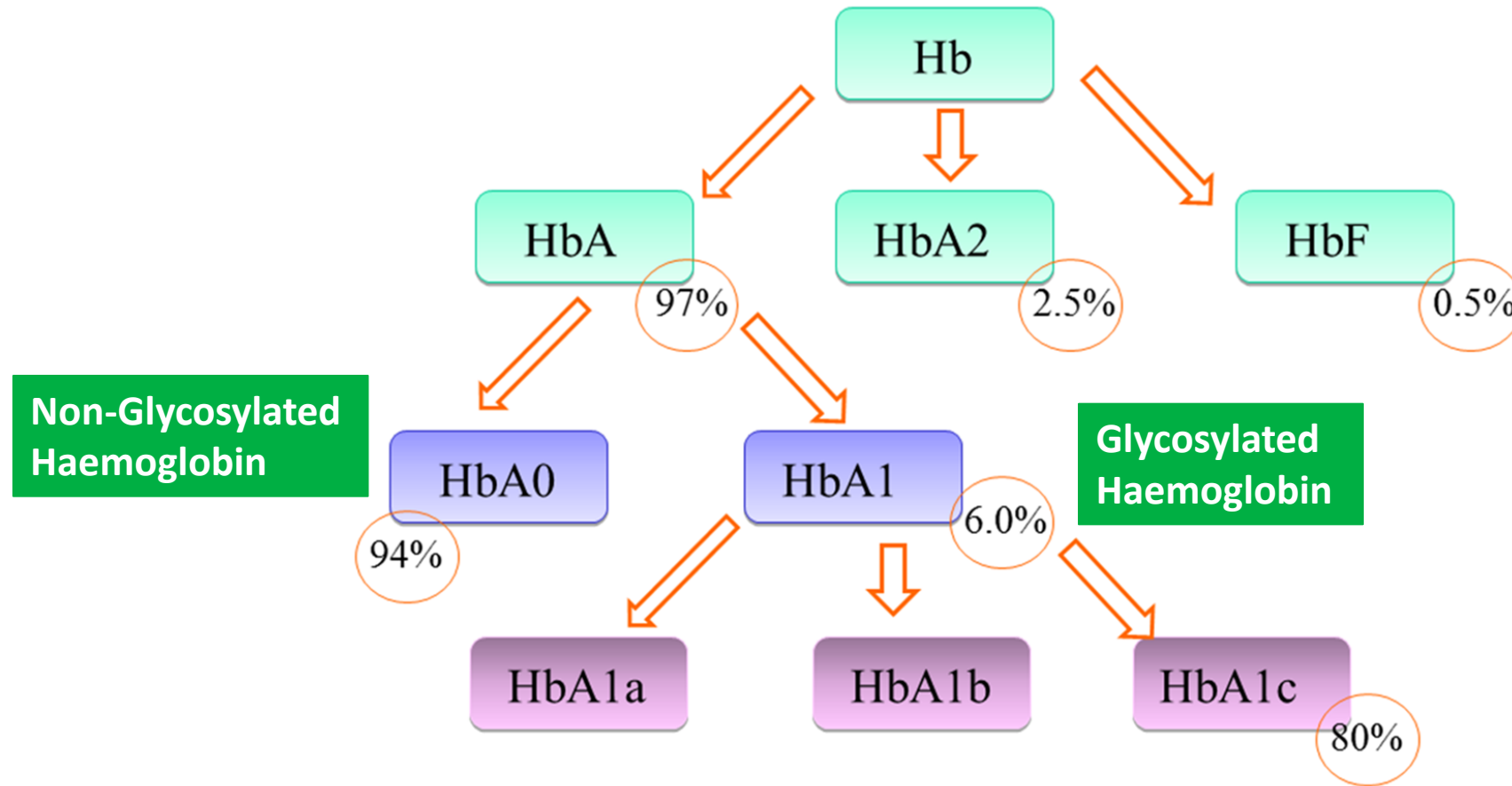
HbA1c is a product of haemoglobin in red blood cells that binds to blood sugar. This reaction is irreversible and proportional to the blood glucose concentration, and remains for about 120 days so the blood glucose concentration before 120 days can be observed.

HbA1c is the gold standard for diabetes treatment and monitoring.

a. What is HbA1c?



a. What is HbA1c?



The Formation of HbA1c

b. Clinical Significance of HbA1c

Difference Between HbA1c and Blood Sugar

Blood Sugar

- Fasting blood glucose and postprandial blood glucose
- They reflect blood sugar levels at a particular time and are susceptible to related factors such as eating and glucose metabolism

HbA1c

- Glycosylated haemoglobin
- It is not affected by the time of blood drawing, whether fasting or not, whether insulin is used and other factors, and can stably and reliably reflect the average blood glucose level in the 120 days before detection

b. Clinical Significance of HbA1c

Correlation Between HbA1c and Blood Glucose Concentration in Dogs

HbA1c	4.0	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9
Glucose	65	69	72	76	79	83	86	90	93	97
HbA1c	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9
Glucose	101	104	108	111	115	118	122	126	129	133
HbA1c	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9
Glucose	136	140	143	147	151	154	158	161	165	168
HbA1c	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9
Glucose	172	175	179	183	186	190	193	197	200	204
HbA1c	8.0	8.1	8.2	8.3	8.4	8.5	8.6	8.7	8.8	8.9
Glucose	207	211	215	218	222	225	229	232	236	240
HbA1c	9.0	9.1	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
Glucose	243	247	250	254	257	261	264	268	272	275
HbA1c	10.0	10.1	10.2	10.3	10.4	10.5	10.6	10.7	10.8	10.9
Glucose	279	282	286	289	293	297	300	304	307	311
HbA1c	11.0	11.1	11.2	11.3	11.4	11.5	11.6	11.7	11.8	11.9
Glucose	314	318	321	325	329	332	336	339	343	346
HbA1c	12.0	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9
Glucose	350	353	357	361	364	368	371	375	378	382
HbA1c	13.0	13.1	13.2	13.3	13.4	13.5	13.6	13.7	13.8	13.9
Glucose	386	389	393	396	400	403	407	410	414	418

Desirable

b. Clinical Significance of HbA1c

- It can be used to evaluate the long-term control level of diabetes and can be used as a disease monitoring index of diabetes to evaluate the development of chronic complications of diabetes
- For animals in coma or receiving glucose infusion of unknown etiology, urgent examination of HbA1c is of value in differential diagnosis
- Acute complications such as ketoacidosis should be observed in animals with particularly high HbA1c

c. How to use HbA1c?

- Diabetes complications and prevention
- Diabetes prediction and screening
- To evaluate long-term glycaemic control and monitoring

c. How to use HbA1c?

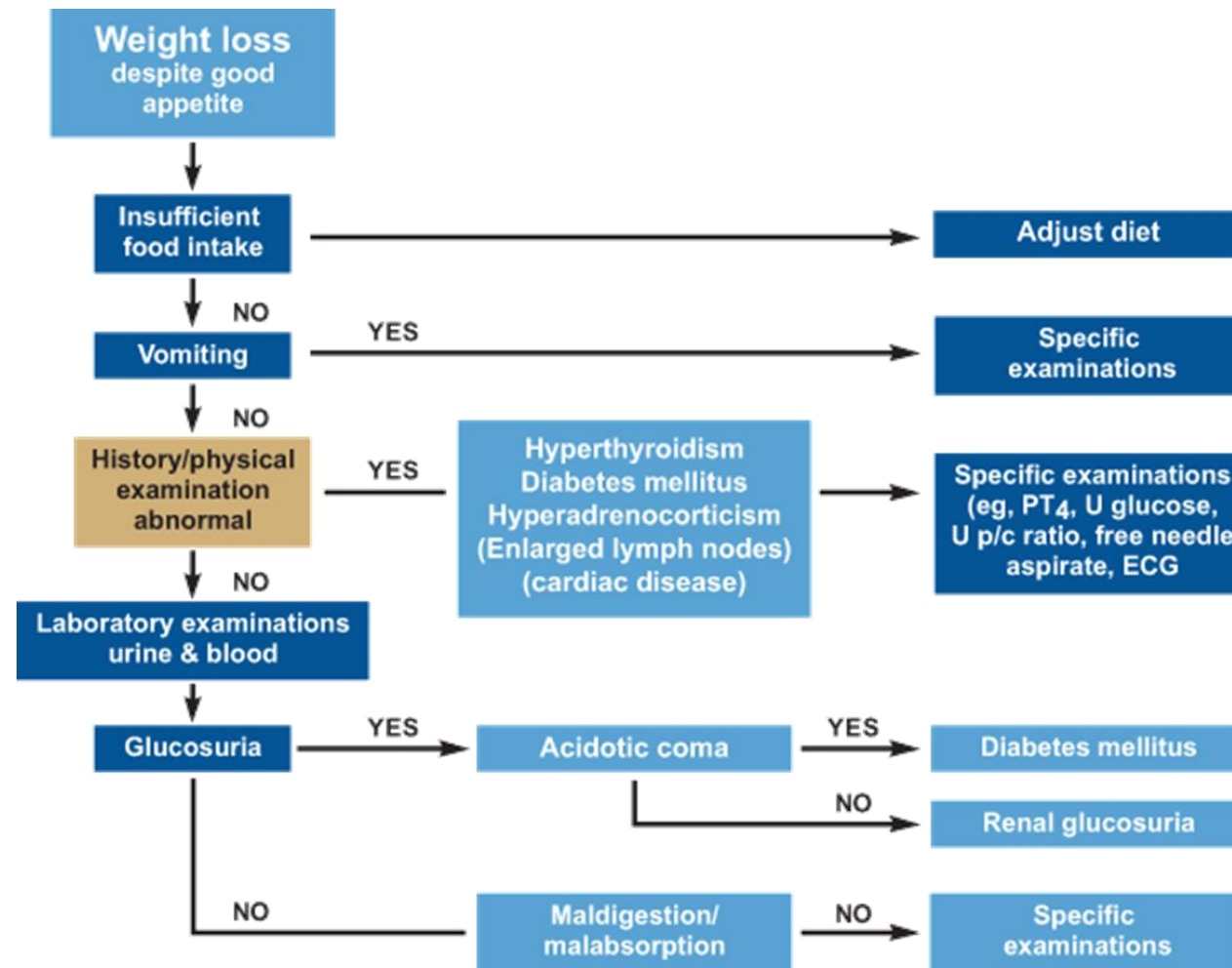
Main Symptoms of Diabetes:

- Excessive hydration
- Urinates more often
- Weight loss
- Loss of appetite
- Fatigue
- Weakness
- Vomiting
- Cataracts (dog)



c. How to use HbA1c?

Diabetes Diagnosis



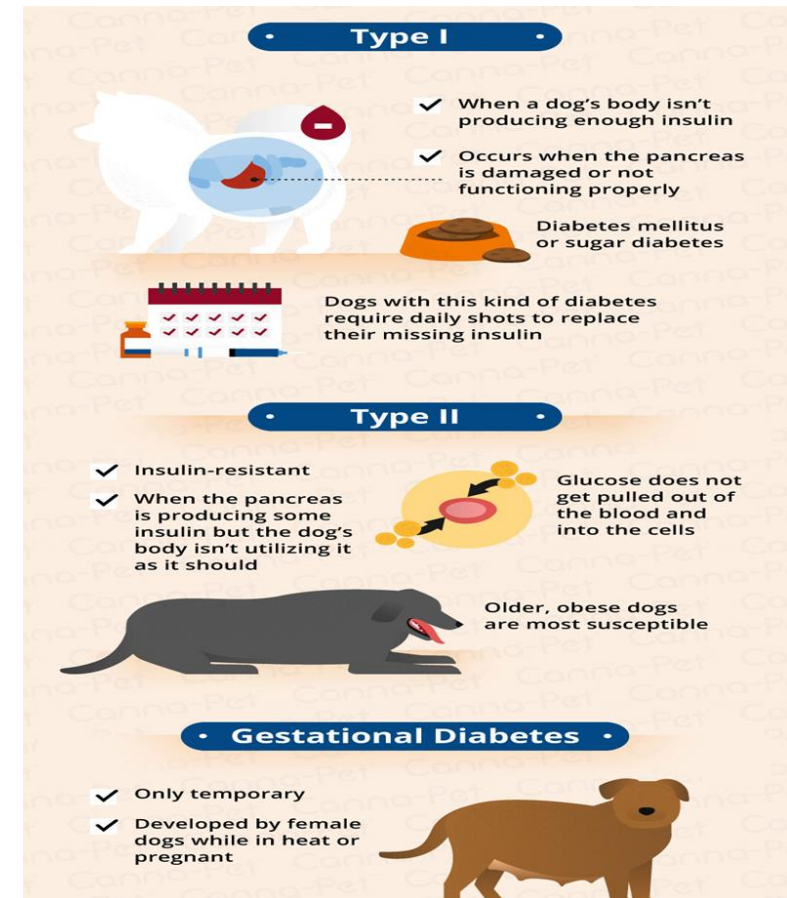
c. How to use HbA1c?

Type 1 Diabetes

Type 1 diabetes is insulin deficiency caused by irreversible reduction or injury of pancreatic beta cells. It is characterised by sudden onset of symptoms, usually with only 20%-25% function of pancreatic beta cells, showing obvious insulin deficiency. The animals are prone to ketosis and must rely on insulin to maintain life. More than 60% of canine diabetes is type 1 (Alejandro R, 2001). It occurs in older animals and most dogs are overweight. Oral hypoglycaemic drugs have no effect on type 1 diabetes. Insulin injection is necessary.

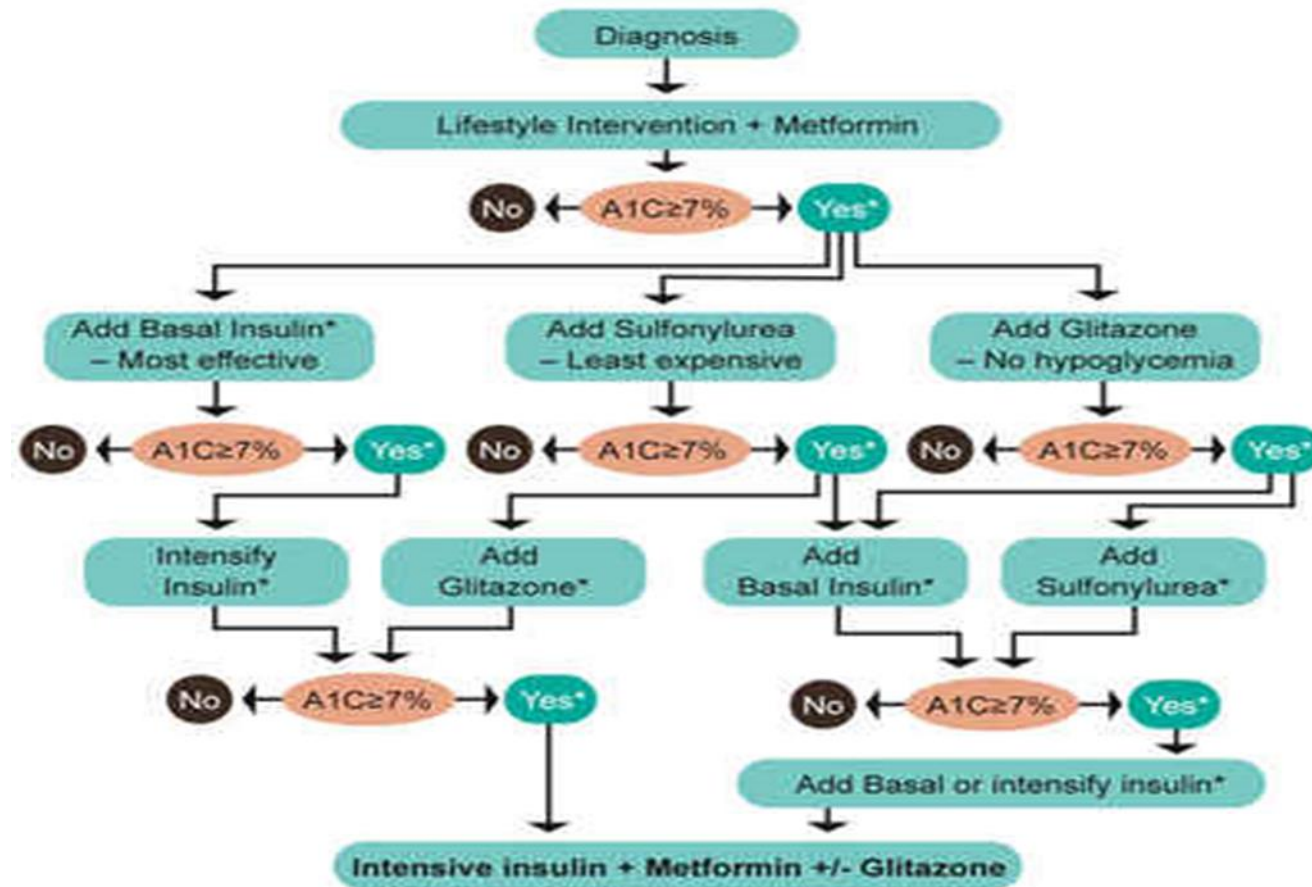
Type 2 Diabetes

Type 2 diabetes is a condition in which the pancreatic beta cells are abundant and insulin production is insufficient or the affinity between insulin and insulin receptors on cell membranes is reduced, leading to a relative insulin deficiency. Most diabetes cases are overweight and glucose intolerance improves with dieting and weight loss. Oral hypoglycaemic drugs are sometimes used instead of insulin. If diabetes is diagnosed at an early stage, oral hypoglycaemic drugs may play a greater role.



c. How to use HbA1c?

Differential Diagnosis of Type 1 and Type 2 Diabetes

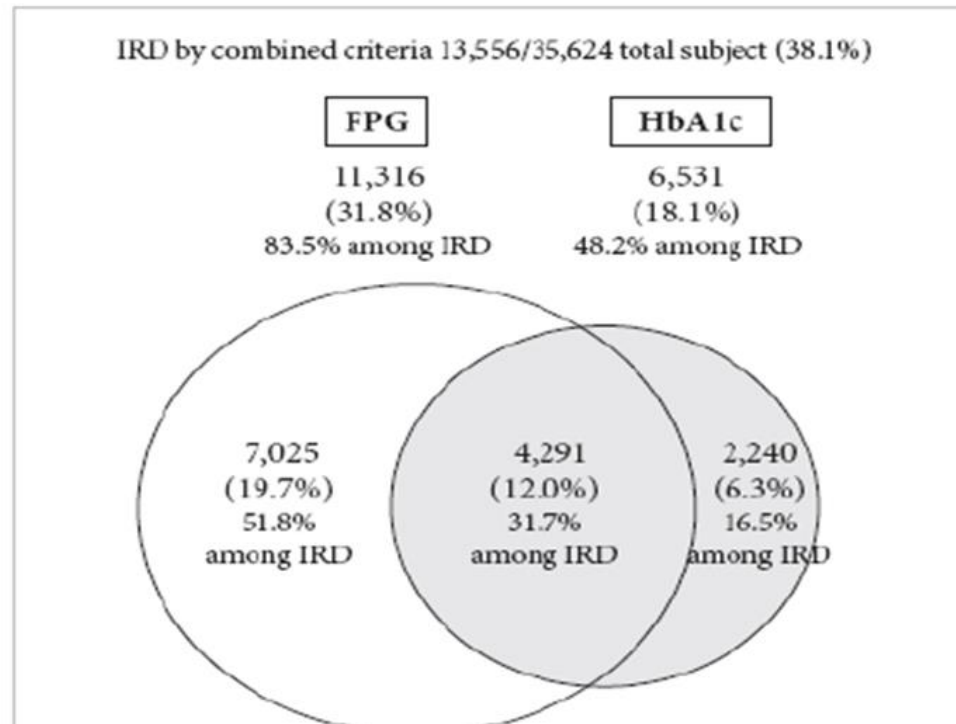


Adapted from Nathan, D. M. *et al.* Management of Hyperglycemia in Type 2 Diabetes. 2006¹

c. How to use HbA1c?

Diabetes Prediction and Screening

A South Korean trial confirmed that combined with HbA1c, an additional 20% of patients with missed FPG could be detected.



Fasting Plasma Glucose: 5.6-6.9 mmol/L
Glycosylated Haemoglobin: 5.7-6.4%

c. How to use HbA1c?

To Evaluate Long-Term Glycaemic Control and Monitoring

A1c tests are not associated with immediate blood sugar. It reflects the average blood glucose level 2-3 months before the measurement.

It is not affected by blood drawing time, fasting, insulin use and other factors.

HbA1c Control Target for Diagnosed Diabetes – <7%

c. How to use HbA1c?

Diabetes Complications and Prevention

- Diabetes complications and prevention
- Hyperglycaemia coma, hyperosmolar brain cells, brain edema
- Fatty liver, ketoemia, ketoacidosis
- Cataracts, retinal vascular abnormalities, cardiovascular injury
- Diabetic nephropathy
- Diabetic peripheral neuritis

Reducing the occurrence of DM complications or controlling the further development of complications can improve the quality of life of patients and greatly reduce the mortality rate of DM.

A1c can best reflect the risk of DM complications.

c. How to use HbA1c?

HbA1c mainly reflects the long-term control level of blood glucose, detects the course of disease and indicates the prognosis.

Reference values are shown in the table below:

Test Results	Significance
4.0%-6.0%	Normal
6.0%-8.0%	Diabetes subclinical stage
>8.0%	Diabetes

InSight V-IA[®]

Canine HbA1c Rapid Quantitative Test

Woodley have developed a rapid, accurate and reliable, highly sensitive detection method for Canine HbA1c.

The InSight V-IA HbA1c Rapid Quantitative Test is a fluorescence immunoassay used with the InSight V-IA Veterinary Immunoassay Analyser for quantitative determination of canine HbA1c concentration in canine whole blood.

The test is used as an aid to diabetes diagnostic testing.

It can be stored at room temperature.



InSight V-IA[®]

References

Hong-Kyu Kim, et al. Diabetes Metab J 2012;36:151-156

Fructosamine and glycated hemoglobin in the assessment of glycaemic control in dogs . Araceli Loste, M. Carmen Marca

Adapted from Nathan.D.M. Ef a/ Management of Hyperglycemia in Type 2 Diabetes 2006

Living With A Diabetic Dog: How To Keep Your Dog Healthy, Prevent Common Problems And Avoid Complications by Amy Newton Thomas.

Diabetes in Dogs by J. K. McEnroe

Sugarbabies: A Holistic Guide to Caring for Your Diabetic Pet by Randi E. Golub CVT



Thank You