



Glucagon ELISA Kit

Catalog Number

EK0486

For the quantitative determination of Glucagon concentrations in cell culture supernates, serum, and plasma.

**This instruction must be read in its entirety before using this product.
For research use only. Not for use in diagnostic procedures.**

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PRINCIPLE OF THE ASSAY

This assay employs the quantitative sandwich enzyme immunoassay technique. A monoclonal antibody specific for Glucagon has been pre-coated onto a microplate. Standards and samples are pipetted into the wells and any Glucagon present is bound by the immobilized antibody. Following incubation unbound samples are removed during a wash step, and then a detection antibody specific for Glucagon is added to the wells and binds to the combination of capture antibody- Glucagon in sample. Following a wash to remove any unbound combination, and enzyme conjugate is added to the wells. Following incubation and wash steps a substrate is added. A coloured product is formed in proportion to the amount of Glucagon present in the sample. The reaction is terminated by addition of acid and absorbance is measured at 450nm. A standard curve is prepared from seven Glucagon standard dilutions and Glucagon sample concentration determined.

DETECTION RANGE

31.25 pg/ml - 2000 pg/ml

SENSITIVITY

The minimum detectable dose was 7pg/mL.

SPECIFICITY

This assay recognizes natural Glucagon. The factors listed below were prepared at 50ng/ml in Standard /sample Diluent and assayed for cross-reactivity and no significant cross-reactivity or interference was observed.

Table 1: Factors assayed for cross-reactivity

Natural proteins
Gastric Inhibitory Polypeptide
Glucagon-like Peptide 1
Glucagon-like Peptide 2
Glicentin-related Polypeptide

PRECISION

The coefficient of variation of both intra-assay and inter-assay were less than 10%.

Oxyntomodulin cross-reacts < 12% in this assay.

MATERIALS PROVIDED

1. Aluminium pouches with a Microwell Plate coated with antibody to Glucagon (8x12)
2. 2 vials Glucagon Standard lyophilized, 2000 pg/vial upon reconstitution
3. 2 vials concentrated Biotin-Conjugate anti- Glucagon antibody
4. 2 vials Streptavidin-HRP solution
5. 4 bottle Standard /sample Diluent
6. 1 bottle Biotin-Conjugate antibody Diluent
7. 1 bottle Streptavidin-HRP Diluent
8. 1 bottle Wash Buffer Concentrate 20x (PBS with 1% Tween-20)
9. 1 vial Substrate Solution
10. 1 vial Stop Solution
11. 4 pieces Adhesive Films
12. package insert

STORAGE

Table 2: Storage of the kit

Unopened Kit	Store at 2 – 8°C. Do not use past kit expiration date.	
Opened/ Reconstituted Reagents	Standard /sample Diluent	May be stored for up to 1 month at 2 – 8°C.**
	Concentrated Biotin-Conjugate	
	Streptavidin-HRP solution	
	Biotin-Conjugate antibody Diluent	
	Streptavidin-HRP Diluent	
	Wash Buffer Concentrate 20x	
	Substrate Solution	
	Stop Solution	
	Standard	Aliquot and store for up to 1 month at -20°C. Avoid repeated freeze-thaw cycles. Diluted standard shall not be reused.

	Microplate Wells	Return unused wells to the foil pouch containing the desiccant pack, reseal along entire edge of zip-seal. May be stored for up to 1 month at 2 – 8°C.**
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**Provided this is within the expiration date of the kit

THE REQUIRED ITEMS (not provided, but can help to buy):

1. Microplate reader (450nm).
2. Micro-pipette and tips: 0.5-10, 2-20, 20-200, 200-1000µL.
3. 37 °C incubator, double-distilled water or deionized water, coordinate paper, graduated cylinder.

PRECAUTIONS FOR USE

1. Store kit reagents between 2°C and 8°C. After use all reagents should be immediately returned to cold storage(2°C to 8°C).
2. Please perform simple centrifugation to collect the liquid before use.
3. To avoid cross contamination, please use disposable pipette tips.
4. The Stop Solution suggested for use with this kit is an acid solution. Wear eye, hand, face, and clothing protection when using this material. Avoid contact of skin or mucous membranes with kit reagents or specimens. In the case of contact with skin or eyes wash immediately with water.
5. Use clean, dedicated reagent trays for dispensing the washing liquid, conjugate and substrate reagent. Mix all reagents and samples well before use.
6. After washing microtiter plate should be fully pat dried. Do not use absorbent paper directly into the enzyme reaction wells.
7. Do not mix or substitute reagents with those from other lots or other sources. Do not use kit reagents beyond expiration date on label.
8. Each sample, standard, blank and optional control samples should be assayed in duplicate or triplicate.
9. Adequate mixing is very important for good result. Use a mini-vortexer

at the lowest frequency or Shake by hand at 10min interval when there is no vortexer.

10. Avoid microtiter plates drying during the operation.
11. Dilute samples at the appropriate multiple, and make the sample values fall within the standard curve. If samples generate values higher than the highest standard, dilute the samples and repeat the assay.
12. Any variation in standard diluent, operator, pipetting technique, washing technique, incubation time and temperature, and kit age can cause variation in binding.
13. This method can effectively eliminate the interference of the soluble receptors, binding proteins and other factors in biological samples.

SAMPLE COLLECTION AND STORAGE

1. **Cell Culture Supernates** - Remove particulates by centrifugation.
2. **Serum** - Use a serum separator tube (SST) and allow samples to clot for 30 minutes before centrifugation for 15 minutes at approximately 1000 x g. Remove serum, avoid hemolysis and high blood lipid samples.
3. **Plasma** - Recommended EDTA as an anticoagulant in plasma. Centrifuge for 15 minutes at 1000 x g within 30 minutes of collection.
4. Assay immediately or aliquot and store samples at -20°C. Avoid repeated freeze-thaw cycles.
5. Dilute samples at the appropriate multiple (recommended to do pre-test to determine the dilution factor).

REAGENT PREPARATION

1. Bring all reagents to room temperature before use.
2. **Wash Buffer** - Dilute 10mL of Wash Buffer Concentrate into deionized or distilled water to prepare 200mL of Wash Buffer. If crystals have formed in the concentrate Wash Buffer, warm to room temperature and mix gently until the crystals have completely dissolved.
3. **Standard** - Reconstitute the Standard with 1.0mL of Standard /sample Diluent. This reconstitution produces a stock solution of 2000 pg /mL. Allow the standard to sit for a minimum of 15 minutes with gentle agitation prior to making dilutions.

Pipette 500 μ L of Standard/sample Diluent into the 1000 pg/mL tube and the remaining tubes. Use the stock solution to produce a 2-fold dilution series (below). Mix each tube thoroughly and change pipette tips between each transfer. The 2000 pg/mL standard serves as the high standard. The Standard/ sample Diluent serves as the zero standard (0 pg/mL).

If you do not run out of re-melting standard, store it at -20°C. Diluted standard shall not be reused.

4. Working solution of Biotin-Conjugate anti- Glucagon antibody:
Make a 1:100 dilution of the concentrated Biotin-Conjugate solution with the Biotin-Conjugate antibody Diluent in a clean plastic tube.

The working solution should be used within one day after dilution.

5. Working solution of Streptavidin-HRP: Make a 1:100 dilution of the concentrated Streptavidin-HRP solution with the Streptavidin-HRP Diluent in a clean plastic tube.

The working solution should be used within one day after dilution.

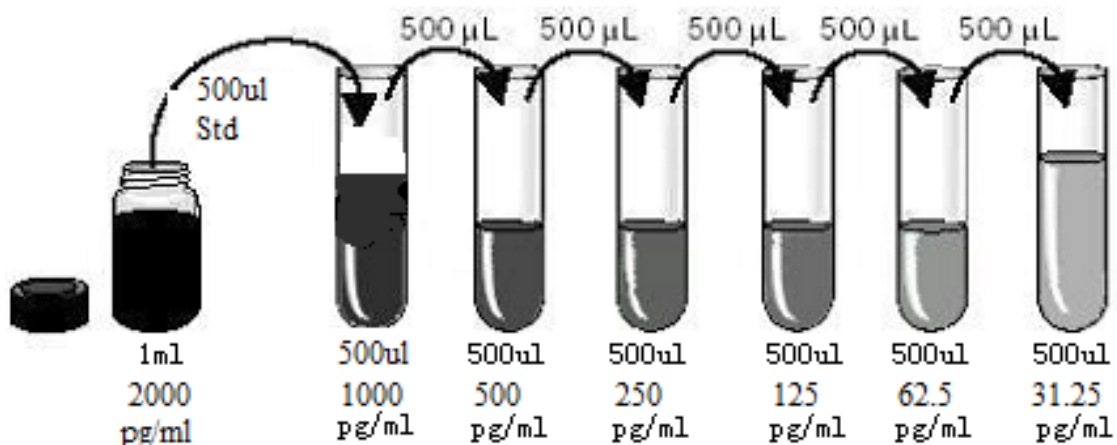


Figure 1: Preparation of Glucagon standard dilutions

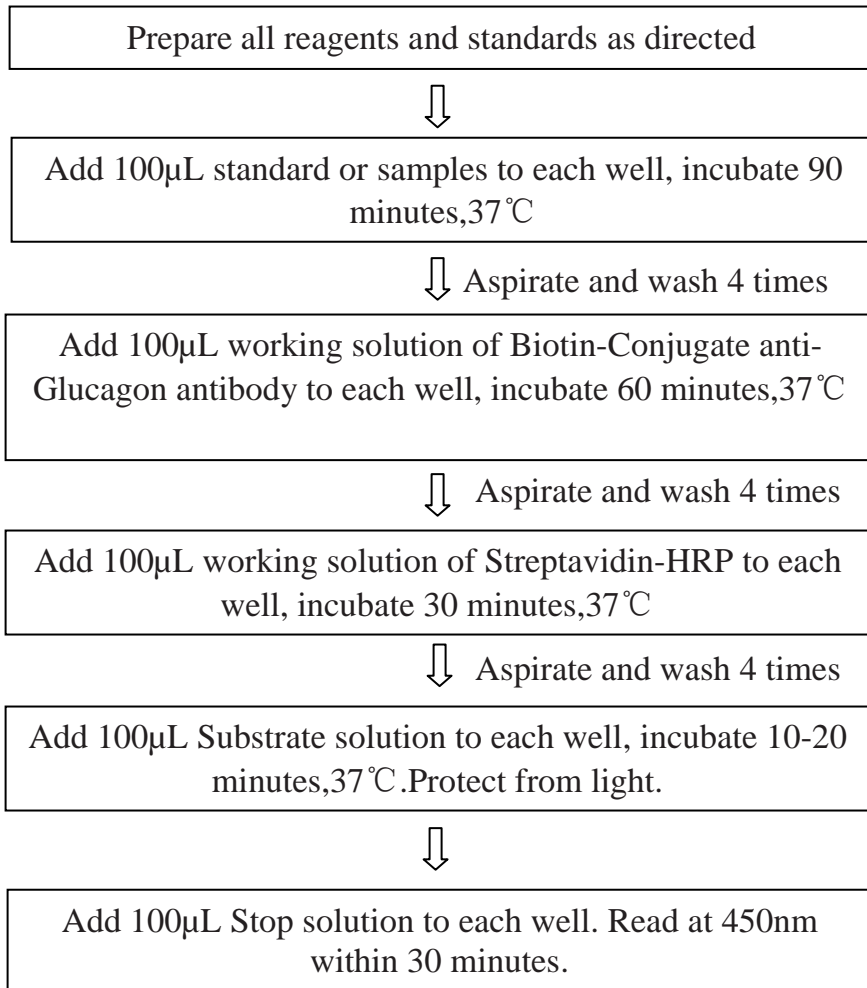
GENERAL ELISA PROTOCOL

1. Prepare all reagents and working standards as directed in the previous sections.
2. Determine the number of microwell strips required to test the desired number of samples plus appropriate number of wells needed for running blanks and standards. Remove extra microwell strips from holder and store in foil bag with the desiccant provided at 2-8°C sealed

tightly.

3. Add 100 μ L of Standard, control, or sample, per well. Cover with the adhesive strip provided. Incubate for 1.5 hours at 37°C.
4. Aspirate each well and wash, repeating the process three times for a total of four washes. Wash by filling each well with Wash Buffer (350 μ L) using a squirt bottle, manifold dispenser or auto-washer. Complete removal of liquid at each step is essential to good performance. After the last wash, remove any remaining Wash Buffer by aspirating or decanting. Invert the plate and blot it against clean paper towels.
5. Add 100 μ L of the working solution of Biotin-Conjugate to each well. Cover with a new adhesive strip and incubate 1 hours at 37°C.
6. Repeat the aspiration/wash as in step 4.
7. Add 100 μ L of the working solution of Streptavidin-HRP to each well. Cover with a new adhesive strip and incubate for 30 minutes at 37°C. Avoid placing the plate in direct light.
8. Repeat the aspiration/wash as in step 4.
9. Add 100 μ L of Substrate Solution to each well. Incubate for 10-20 minutes at 37°C. Avoid placing the plate in direct light.
10. Add 100 μ L of Stop Solution to each well. Gently tap the plate to ensure thorough mixing.
11. Determine the optical density of each well immediately, using a microplate reader set to 450 nm.(optionally 650nm as the reference wave length;610-650nm is acceptable)

ASSAY PROCEDURE SUMMARY



TECHNICAL HINTS

1. When mixing or reconstituting protein solutions, always avoid foaming.
2. To avoid cross-contamination, change pipette tips between additions of each standard level, between sample additions, and between reagent additions. Also, use separate reservoirs for each reagent.
3. To ensure accurate results, proper adhesion of plate sealers during incubation steps is necessary.
4. Substrate Solution should remain colorless until added to the plate. Stop Solution should be added to the plate in the same order as the

Substrate Solution. Keep Substrate Solution protected from light. Substrate Solution should change from colorless to gradations of blue.

5. A standard curve should be generated for each set of samples assayed. According to the content of tested factors in the sample, appropriate diluted or concentrated samples, it is best to do pre-experiment.

CALCULATION OF RESULTS

1. Average the duplicate readings for each standard, control, and sample and subtract the average zero standard optical density.
2. Create a standard curve by reducing the data using computer software capable of generating a four parameter logistic (4-PL) curve-fit. As an alternative, construct a standard curve by plotting the mean absorbance for each standard on the y-axis against the concentration on the x-axis and draw a best fit curve through the points on the graph.
3. The data may be linearized by plotting the log of the Glucagon concentrations versus the log of the O.D. and the best fit line can be determined by regression analysis. This procedure will produce an adequate but less precise fit of the data. If samples have been diluted, the concentration read from the standard curve must be multiplied by the dilution factor.
4. This standard curve is provided for demonstration only. A standard curve should be generated for each set of samples assayed.

Table 3: Typical data using the Glucagon ELISA (Measuring wavelength: 450nm, Reference wavelength: 650nm)

Standard (pg/ml)	OD.	OD.	Average	Corrected
0	0.019	0.020	0.020	---
31.25	0.051	0.052	0.052	0.032
62.5	0.082	0.082	0.082	0.062
125	0.141	0.149	0.145	0.125
250	0.279	0.279	0.279	0.259
500	0.556	0.570	0.563	0.543
1000	1.169	1.193	1.181	1.161
2000	2.588	2.642	2.615	2.595

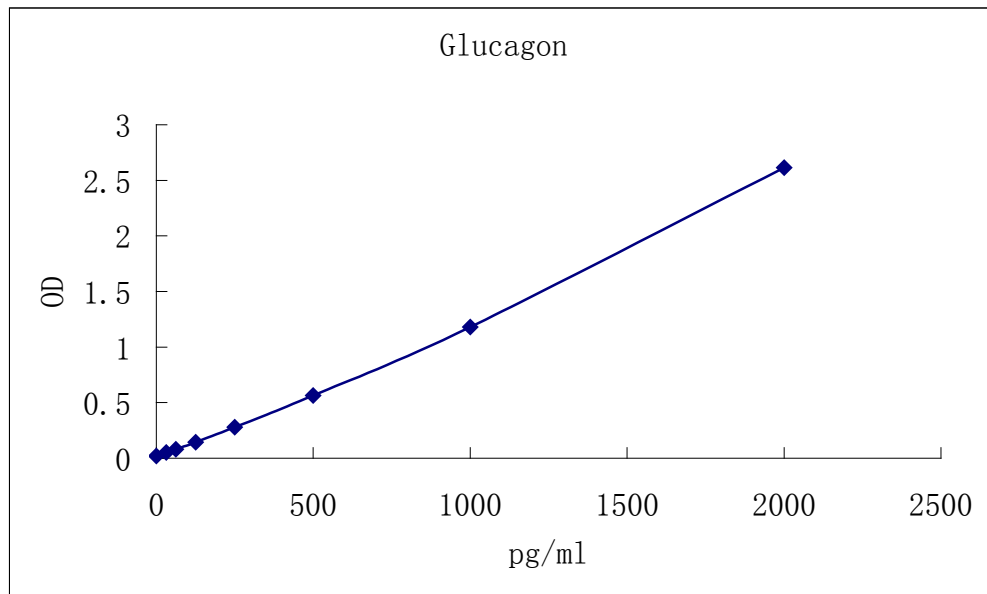


Figure 3: Representative standard curve for Glucagon ELISA. VEGF was diluted in serial two-fold steps in Sample Diluent.

Do not use this standard curve to derive test results. A standard curve must be run for each group of microwell strips assayed.

BACKGROUND

Glucagon is a 29 amino acid (aa) peptide produced by the pancreas that plays a critical role in glucose metabolism and homeostasis (1-4). The Glucagon precursor mRNA is expressed by alpha cells (α-cells) of the pancreas, L cells of the intestine, and in the brain (1, 2). Only the pancreatic α-cells express the prohormone convertase PC2, also called PCSK2, which is required to produce Glucagon (2). Intestinal L cells instead express the prohormone convertase PC1, which processes the precursor to the Glucagon-overlapping peptides glicentin and oxyntomodulin. L cells also produce two Glucagon-like peptides, GLP-1 and GLP-2 that are derived from the same Glucagon precursor and influence glucose metabolism, but do not share any common sequence with Glucagon (1, 2). The aa sequence of the mature Glucagon peptide is identical in human, mouse, rat, pig, dog, horse, cow, sheep, and Xenopus.

In normal metabolism, Glucagon is secreted in response to low blood

glucose (hypoglycemia) and downregulated in response to high blood glucose (hyperglycemia). Although Glucagon binding sites are found in liver, brain, pancreas, kidney, intestine, and adipose tissue, the main activity of Glucagon receptors occurs in the liver, where Glucagon stimulates gluconeogenesis and glycogenolysis, thereby increasing blood glucose (1-4). It is particularly important that the brain receive sufficient glucose, since it is unable to store more than a minute quantity. Therefore the release of Glucagon from α -cells is under control by both hormones and neurotransmitters, and is very responsive to circulating glucose concentration. Insulin, and/or the zinc that islet β cells secrete with it, downregulates Glucagon secretion in intact islets (5, 6). Glucagon secretion is also downregulated by the neurotransmitter γ -aminobutyric acid (GABA), somatostatin produced by islet δ -cells, and GLP-1, but is enhanced by the neurotransmitter L-glutamate, amino acids (especially arginine), and Glucagon itself (2-4, 7). Through receptors on the α -cells, these substances affect potassium, sodium, and calcium channel activity and alter intracellular calcium concentration (2-4). Glucose suppression of Glucagon secretion is probably indirect, acting through paracrine signals from other islet cells (8).

Like insulin, Glucagon is dysregulated in type 2 diabetes (T2D) and contributes to its pathology (2-4). Glucagon secretion is less responsive to insulin-mediated suppression in times of high circulating glucose, causing glucagonemia, and increasing the risk of hyperglycemia. Glucagon is also regulated by some of the same messengers that regulate insulin (10-12). Leptin inhibits α -cell glucagon secretion and stimulates β -cell insulin secretion, but glucagon blunts the leptin-mediated insulin secretion (10). Islet α -cells express ghrelin receptors and respond to ghrelin by increasing Glucagon secretion (11). Glucocorticoids, activated by 11 β -HSD1, depress Glucagon secretion in hypoglycemia and insulin secretion in hyperglycemia (12). Although genetic polymorphisms of the Glucagon receptor are associated with T2D, downregulation of Glucagon secretion or deletion of the Glucagon receptor in mice that are susceptible to T2D actually improves glycemic control (13, 14).

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