

Rat Insulin ELISA Kit (U-E type)

Ref.#AKRIN-130

1. Intended use

Rat Insulin ELISA Kit (U-E type) is a highly sensitive sandwich ELISA system for quantitative measurement of rat insulin.

Features

- (1) This is intended for research use only.
- (2) Rapid assay (total reaction time: 3 hours).
- (3) This kit is for insulin in rat serum, plasma, culture medium and tissue extract.
- (4) A small sample volume of serum or plasma is needed.
- (5) Assay format is 96 wells.
- (6) Standard insulin is derived from rat pancreas extract.
- (7) All reagents are provided in liquid form and ready to use.

2. Storage and expiration

When the complete kit is stored at 2-8°C, the kit is stable until the expiration date shown on the label on the box. Opened reagents should be used as soon as possible to avoid less than optimal assay performance caused by storage environment.

3. Introduction

Insulin is a peptide hormone secreted from B cells of islet of Langerhans in the pancreas with a molecular weight of about 5,800 and pI 5.4. It is consisted of 2 chains, A and B. It has 3 disulfide bonds formed between A6 and A11, A7 and B7, and A20 and B19. Insulin exists as a dimer molecule in acidic to neutral solution without Zn ion, and as a hexamer including two Zn ions in neutral solution if Zn ions are present.

Main targets of insulin are liver, muscle, and adipose tissue. Insulin actions in these targets are as follows. In the liver, it promotes glycogenesis, protein synthesis, fatty acid synthesis, carbohydrate utilization, and inhibition of gluconeogenesis. In the muscle, it promotes membrane permeability for carbohydrates, amino acids and K ion, glycogenesis, protein synthesis, while inhibits protein degradation. In the adipose tissue, it promotes membrane permeability for glucose and fatty acid synthesis.

A precursor of insulin, called proinsulin with a single polypeptide chain, is first synthesized in the cell, then sulfide bonds are formed, and finally by enzymatic cutting at two sites, active insulin and c-peptide (connecting peptide) are formed.

Potency of an insulin preparation was originally determined by bioassay. However, whole body bioassay inevitably shows poor precision owing to individual variation. To avoid any variation, international standard preparation has been used. The 4th international standard preparation is a mixture of purified preparations of bovine (52%) and porcine (48%) insulin, and 1mg of the standard is defined as 24 IU (=0.04167 mg/IU).

Following further purification of insulin, WHO issued 1st International Standard for human insulin in 1986 which has the potency of 26 IU/mg (0.038 mg/IU). In the same year, 1st International Standard of bovine insulin, the potency of which is 25.7 IU/mg, and Porcine insulin 1st International Standard, 26 IU/mg, were provided. Before these standards, in 1974, 1st International Reference Preparation of human insulin for immunoassay was provided as 3 IU/ampoule.

Based on the above data, if the biological activity of insulin per molecule is the same among various animal species, potencies of animal insulin might be calculated from their molecular weights. But, so far, we do not have experimental proof about this. As the molecular weights of insulin of various animals are nearly the same, and the differences are within 1%, there may be no critical fault if we think that the general potency of insulin is 26 IU/mg.

Rat and mouse have two molecular species of insulin, type 1 and type 2. Amino acid sequences of these molecular species are same between rat and mouse. But as their ratios are different between these two animal species, it is recommended to use standard preparation derived from each animals.

4. Assay principle

In Shibayagi's Rat Insulin ELISA Kit (U-E type), biotin conjugated anti insulin, and standard or sample are incubated in monoclonal anti-insulin-coated wells to capture insulin bound with biotin conjugated anti insulin. After 2 hours' incubation and washing, HRP (horse radish peroxidase) conjugated streptavidin is added, and incubated for 30 minutes. After washing, HRP conjugated streptavidin remaining in wells are reacted with a substrate chromogen reagent (TMB) for 20 minutes, and reaction is stopped by addition of acidic solution, and absorbance of yellow product is measured spectrophotometrically at 450 nm. The absorbance is proportional to insulin concentration. The standard curve is prepared by plotting absorbance against standard insulin concentrations. Insulin concentrations in unknown samples are determined using this standard curve.

5. Precautions

- For professional use only, beginners are advised to use this kit under the guidance of experienced person.
- Do not drink, eat or smoke in the areas where assays are carried out.
- In treating assay samples of animal origin, be careful for possible biohazards.
- This kit contains components of animal origin. These materials should be handled as potentially infectious.
- Be careful not to allow the reagent solutions of the kit to touch the skin, eyes and mucus membranes.
Especially be careful for the reaction stopper because it is 1 M sulfuric acid. The reaction stopper and the substrate solution may cause skin/eyes irritation. In case of contact with these wash skin/eyes thoroughly with water and seek medical attention, when necessary.
- Avoid contact with the acidic Reaction stopper solution and chromogenic substrate solution, which contains hydrogen peroxide and tetramethylbenzidine (TMB). Wear gloves and eye and clothing protection when handling these reagents.
- The materials must not be pipetted by mouth.
- Unused samples and used tips should be rinsed in 1% formalin, 2% glutaldehyde, or more than 0.1% sodium hypochlorite solution for more than 1 hour, or be treated by an autoclave before disposal.
- Dispose consumable materials and unused contents in accordance with applicable regional/national regulatory requirements.
- Use clean laboratory glassware.
- In order to avoid dryness of wells, contamination of foreign substances and evaporation of dispensed reagents, never forget to cover the well plate with a plate cover supplied, during incubation.
- ELISA can be easily affected by your laboratory environment. Room temperature should be at 20-25°C strictly. Avoid airstream velocity over 0.4 m/sec. (including wind from air conditioner), and humidity less than 30%.

6. Technical tips

- In manual operation, proficiency in pipetting technique is recommended.
- The reagents are prepared to give accurate results only when used in combination within the same box.
Therefore, do not combine the reagents from kit of different lot numbers. Even if the lot number is the same, it is best not to mix the reagents with those that have been preserved for some period.
- Be careful to avoid any contamination of assay samples and reagents. We recommend the use of disposal pipette tips, and 1 tip for 1 well.
- Optimally the reagent solutions of the kit should be used immediately after reconstitution. Otherwise, store them in a dark place at 2-8 °C.
- Time the reaction from the pipetting of the reagent to the first well.
- Prepare a standard curve for each assay.
- Dilution of the assay sample must be carried out using the buffer solution provided in the kit.

- The substrate chromogen reagent (TMB) solution should be almost colorless before use. It turns blue during reaction, and gives yellowish color after addition of reaction stopper. Greenish color means incomplete mixing.
- To avoid denaturation of the coated antibody, do not let the plate go dry.
- As the anti-insulin-coated plate is module type of 8wells x 12 strips, each strip can be separated by cutting the cover sheet with a knife and used independently.
- When ELISA has to be done under the airstream velocity of over 0.4 m/sec. and the humidity of less than 30%, completely close each well in addition to cover the well plate with a plate cover in each step of incubation.Ex.) Cover the well plate with parafilm, and put the plate cover on it. Or place the well plate with the plate cover in an incubator, or in a styrofoam box. Take the best way depending on situation of each laboratory.

7. Reagents supplied

Components	State	Amount
(A)Anti-Insulin-coated plate	Use after washing	96 wells/1 plate
(B)Standard Rat Insulin solution (5 ng/ml)	Concentrated. Use after dilution	500µl/1 vial
(C) Buffer solution	Ready for use.	60 ml/1 bottle
(D)Biotin conjugated anti insulin	Concentrated. Use after dilution.	200µl/1 vial
(E)HRP conjugated streptavidin	Concentrated. Use after dilution.	200µl/1 vial
(F)Substrate chromogen reagent (TMB)	Ready for use.	12 ml/1 bottle
(H) Reaction stopper(1M H ₂ SO ₄)	Ready for use.	12 ml/1 bottle
(I) Washing buffer concentrate (10x)	Concentrated. Use after dilution.	100 ml/1 bottle
Plate cover	-	1 plate
Instruction Manual	-	1 copy

Biotin conjugated anti insulin (D), and HRP conjugated streptavidin (E) : Vials contain more than volumes shown in the list. You can take out 200 µl from vials.

8. Equipments or supplies required but not supplied

- Purified water (distilled water)
- Test tubes for preparation of standard solution series.
- Glassware for dilution of washing buffer (a graduated cylinder, a bottle)
- Pipettes (disposable tip type). One should be able to deliver 10 µl precisely, and another for 100-200µl.
- Syringe-type repeating dispenser like Eppendorf multipette plus which can dispense 50-100 µl.
- Paper towel to remove washing buffer remaining in wells.
- A vortex-type mixer.
- A shaker for 96 well-plate (~800rpm)
- An automatic washer for 96 well-plate (if available), or a wash bottle with a jet nozzle.

- A 96 well-plate reader (450nm ±10nm, 620nm: 600-650nm)
- Software for data analysis, if available. Shibayagi is proposing the use of assay results calculation template for EXCEL. Please check our website (http://www.shibayagi.co.jp/en/tech_003.html).

9. Preparation of reagents

- ◆ Bring all reagents of the kit to room temperature before use.
- ◆ Prepare reagent solutions in appropriate volume for your assay. Do not store the diluted reagents.
- ◆ Do not use the reagent after expiration date.

• Reagents ready for use after return to room temperature

[Anti-Insulin-coated plate]

Storage and stability

If seal is not removed, put the strip back in a plastic bag with zip-seal originally used for well-plate container and store at 2-8 °C. The strip will be stable until expiration date.

[Buffer solution]

[Substrate chromogen reagent]

Storage and stability

If not opened, store at 2-8 °C. It maintains stability until expiration date. Once opened, we recommend using them as soon as possible to avoid influence by environmental condition.

[Reaction stopper (1 M H₂SO₄)]

Storage and stability

Close the stopper tightly and store at 2-8 °C. It maintains stability until expiration date.

• Concentrated reagents

[Washing buffer concentrate (10x)]

DDilute 1 volume of the washing buffer concentrate (10x) to 10 volume with deionized water to prepare working solution. Example: 100 ml of washing buffer concentrate (10x) and 900ml of deionized water.

Storage and stability

The rest of undiluted buffer: if stored tightly closed at 2-8 °C, it is stable until expiration date.

Dispose any unused diluted buffer.

[Standard Rat Insulin solution (5 ng/ml)]

Make a serial dilution of master standard (5 ng/ml) solution to prepare each standard solution (0-2500pg/ml).

Volume of standard solution	Buffer solution	Concentration (pg/ml)	Concentration (μIU/ml)
Original solution: 100μl	100μl	2500	65
2500 pg/ml solution: 100μl	100μl	1250	32.5
1250 pg/ml solution: 100μl	100μl	625	16.3
625 pg/ml solution: 100μl	100μl	313	8.15
313 pg/ml solution : 100μl	100μl	156	4.08
156 pg/ml solution : 100μl	100μl	78	2.04

78 pg/ml solution: 100µl	100µl	39	1.02
0 (Blank)	100µl	0	0

Storage and stability

Standard solutions prepared above should be used as soon as possible, and should not be stored.

*Unit reduction for µIU/ml is 26µIU/ml. (Refer to **3. Introduction.**)

[Biotin conjugated anti insulin]

Prepare working solution by dilution of (D) with the buffer solution (C) to 1:100.

Storage and stability

Unused working solution (already diluted) should be disposed.

[HRP conjugated streptavidin]

Prepare working solution by dilution of (E) with the buffer solution (C) to 1:100.

Storage and stability

Unused working solution (already diluted) should be disposed.

10. Preparation of samples

This kit is intended to measure rat serum, plasma, culture medium and tissue/cell extracts.

Samples should be immediately assayed or stored below -35°C for several days. Defrosted samples should be mixed thoroughly for best results. Hemolytic and hyperlipemic serum samples are not suitable. If presence of interfering substance is suspected, examine by dilution test at more than 2 points. Dilution of a sample should be made in a test tube using buffer solution prior to adding them to wells. Turbid samples or those containing insoluble materials should be centrifuged before testing to remove any particulate matter.

Storage and stability

Insulin in samples will be inactivated if stored at $2-8^{\circ}\text{C}$. If it is necessary to store sample in refrigerator ($2-8^{\circ}\text{C}$), add aprotinin at final concentration of 100-500KIU/ml. (KIU: kallikrein inhibitor unit).

If you have to store assay samples for a longer period, snap-freeze samples and keep them below -35°C . Avoid repeated freeze-thaw cycles.

• Testing for compatibility of your samples with Shibayagi's kit using a positive sample.

Due to various factors of your sampling conditions (anesthesia, preservatives, anticoagulants, raised sample pH caused by loss of CO_2 during storage, preservative used, evaporation and condensation during storage in a freezer, etc), sometimes the kit does not work well with your samples. If the standard curve is in a good shape, while your samples give low absorbance, please check the compatibility of your samples (serum, plasma, or culture medium) by a simple recovery test as follows.

Place 90 µl of your sample (e.g. a sample from control group in your experiment) in a small test tube, then add 10µl of the highest standard solution (10ng/ml). Assay this mixture together with the original sample, and compare the assay values. The assay value of the mixture will be around $[0.9 \times \text{original sample} + 0.1 \times \text{highest standard concentration}]$. If the assay value is increased as expected, the assay system is working well with your sample.

Especially when you use Shibayagi's kit for the first time, we recommend you to run this simple recovery test.

• Quality control samples

We recommend preparing quality control samples of your own laboratory by storing many aliquots of serum, plasma or culture medium with known amount of the analyte to be measured after initial testing. Keep them in small and tightly capped sample tubes below -35°C . If the sample tube is too big, water will be lost during storage. If possible, prepare high and low controls.

Measure these control samples along with your samples in every run to confirm the reproducibility and successful performance of the assay system.

11. Assay procedure

Remove the cover sheet of the anti-Insulin-coated plate after bringing up to room temperature.

- (1) Wash the anti-Insulin-coated plate (A) by filling the wells with 300µl of washing buffer and discard 4 times, then strike the plate upside-down onto several layers of paper towels to remove residual buffer in the wells.
- (2) Pipette 100µl of biotin conjugated anti insulin to all wells. Shake the plate gently on a plate shaker.
- (3) Pipette 10µl of sample to the designated sample wells.
- (4) Pipette 10µl of standard solution to the wells designated for standards.
- (5) Shake the plate gently on a plate shaker (800rpm for 10 seconds x 3 times).
- (6) Put a plate cover on the plate and incubate for 2 hours at room temperature (20-25°C).
- (7) Discard the reaction mixture. Rinse wells by filling the wells with 300µl of washing buffer and discard 4 times, then strike the plate upside-down onto several layers of paper towels to remove residual buffer in the wells.
- (8) Pipette 100µl of HRP conjugated streptavidin to all wells, and shake as step (5).
- (9) Put a plate cover on the plate and incubate the plate for 30 minutes at room temperature.
- (10) Discard the reaction mixture, and then wash the plate as step (1).
- (11) Pipette 100µl of substrate chromogen reagent to wells, and shake as step (5).
- (12) Put a plate cover on the plate and incubate the plate for 30 minutes at room temperature.
- (13) Add 100 µl of the reaction stopper to all wells and shake as step (5).
- (14) Measure the absorbance of each well at 450 nm (reference wavelength, 620*nm) using a plate reader within 30 minutes.

Note: For manual washing procedure see “[Kit operation \(Power point\)](#)” or “[Shibayagi’s Manual Operation](#)”

* 600-650 nm can be used as reference wavelength.

In case of washing by using 8 channel pipette, sometimes the back ground tends to be high. If so, change washing frequency from 4 times to 5-8 times at the constant stroke after the reaction with HRP conjugated streptavidin.
Standard of plate-washing pressure: 5-25ml/min. (Adjust it depending on the nozzle’s diameter.)

Worksheet example

	Strip 1&2	Strip 3&4	Strip 5&6	Strip 7&8	Strip 9&10	Strip 11&12
A	2500 pg/ml	Pos.Control.	Sample 8	Sample 16	Sample 24	Sample 32
B	1250 pg/ml	Sample 1	Sample 9	Sample 17	Sample 25	Sample 33
C	625 pg/ml	Sample 2	Sample 10	Sample 18	Sample 26	Sample 34
D	313 pg/ml	Sample 3	Sample 11	Sample 19	Sample 27	Sample 35
E	156 pg/ml	Sample 4	Sample 12	Sample 20	Sample 28	Sample 36
F	78 pg/ml	Sample 5	Sample 13	Sample 21	Sample 29	Sample 37
G	39 pg/ml	Sample 6	Sample 14	Sample 22	Sample 30	Sample 38
H	0	Sample 7	Sample 15	Sample 23	Sample 31	Sample 39

12. Calculations

- (1) Prepare a standard curve using semi-logarithmic or two-way logarithmic section paper by plotting absorbance* (Y-axis) against insulin concentration(pg/ml) on X-axis.

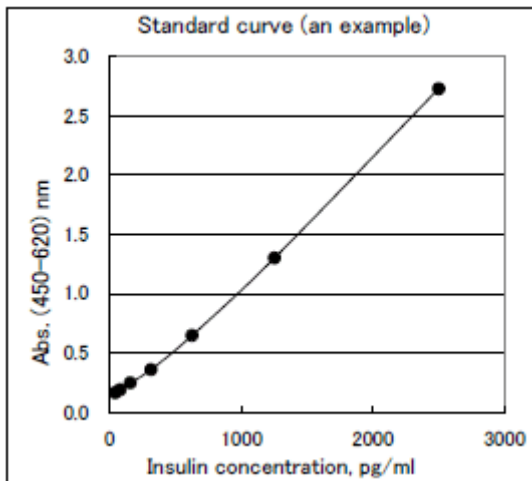
*Absorbance at 450nm minus absorbance at 620nm.

- (2) Using the standard curve, read the insulin concentration of a sample at its absorbance*, and multiply the assay value by dilution factor if the sample has been diluted. Though the assay range is wide enough, in case the absorbance of some samples is higher than that of the highest standard, please repeat the assay after proper dilution of samples with the buffer solution.

* We recommend the use of 3rd order regression curve for log-log plot, or 4 parameters method for log-normal plot in computer calculation. Physiological or pathological situation of animals should be judged comprehensively taking other examination results into consideration.

Rat insulin assay standard curve (an example)

Absorbance may change due to assay environment.



13. Performance characteristics

• Assay range

The assay range of the kit is 39 pg/ml ~ 2500 pg/ml.

If some samples show absorbance more than that of 2500 pg/ml standard, please repeat the assay after proper dilution of samples.

• Specificity

The antibodies used in this kit are specific to insulin. Cross-reactivity of the kit is shown below.

Substances	Cross-reactivity
Rat C-peptide	-
Rat proinsulin	+
Mouse insulin	+
Mouse C-peptide	-
Human proinsulin	+

*Cross-reactivity at Conc. 2.5 ng/ml.

- Precision of assay
Within assay variation (3 samples, 8 replicates assay.)
Mean CV is less than 4 %.
- Reproducibility
Between assay variation (3 samples, 4 days, assayed in triplicates)
Mean CV is 3 %
- Recovery test
Standard insulin was added in 3 concentrations to 2 serum samples and were assayed.
The recoveries were 94.1 ~101%
- Dilution test
Three serum samples were serially diluted and assayed in triplicates.
The dilution curves showed excellent linearity with $R^2 > 0.992$.

14. Reference assay data

Insulin assay data in fasted rats, assayed in duplicates.

Mean assay value: 245 pg/ml Standard deviation: 72 pg/ml

Rat strain: SD

Number of animals: 8 males, 6 weeks of age.

After fasting for 24 hours.

These data should be considered as guidance only. Each laboratory should establish its own normal and pathological reference ranges for insulin levels independently.

15. Trouble shooting

- Low absorbance in all wells
Possible explanations:

- 1) The standard or samples might not be added.
- 2) Reagents necessary for coloration such as Biotin conjugated anti insulin, HRP conjugated streptavidin, or Substrate chromogen reagent might not be added.
- 3) Wrong reagents related to coloration might have been added. Wrong dilution of biotin conjugated anti insulin or HRP conjugated streptavidin.
- 4) Contamination of enzyme inhibitor(s).
- 5) Influence of the temperature under which the kits had been stored.
- 6) Excessive hard washing of the well plate.
- 7) Addition of substrate chromogen reagent soon after taking out from a refrigerator might cause poor coloration owing to low temperature.

- Intense coloration in all wells including blank
Possible explanations:

- 1) Improper or inadequate washing. Change washing frequency from 4 times to 5-8 times at the constant stroke after the reaction with HRP conjugated streptavidin.)
- 2) Overdeveloping. Incubation time with substrate chromogen reagent should be decreased before addition of reaction stopper.
- 3) Too high incubation temperature. Adjust the temperature to 20-25°C.

- High coefficient of variation (CV)
Possible explanation:

- 1) Improper or inadequate washing.
- 2) Improper mixing of standard or samples.
- 3) Pipetting at irregular intervals.

- Q-1: Can I divide the plate to use it for the other testing?

A-1: Yes, cut off the clear seal on the plate with cutter along strip. Put the residual plate, which is still the seal on, in a refrigerator soon

- Q-2: I found there contains liquid in 96 well-plate when I opened the box. What is it?
A-2: When we manufacture 96 well-plate, we insert preservation stabilizer in wells.

For detailed FAQs and explanations, refer to “Trouble shooting and Important Points in Shibayagi’s ELISA kits” on our website (http://www.shibayagi.co.jp/en/tech_004.html).

16. References

Please, refer to “[User’s Publication](#)” on our website.

Summary of assay procedure

***First, read this instruction manual carefully and start your assay after confirmation of details.**

- Bring the well-plate and all reagents to room temperature.
- Washing buffer concentrate must be diluted to 10 times by purified water that returned to room temperature.
- Standard Mouse Insulin solution dilution example:

In the case of sample volume 10 µl: Assay range : 2500~39 pg/ml

concentration (pg/ml)	2500	1250	625	313	156	78	39	0
Std. Insulin solution (µl)	+100	*100	*100	*100	*100	*100	*100	0
Buffer solution (µl)	100	100	100	100	100	100	100	100

+ Original standard solution(B)

* Higher standard solution

- Prepare the positive sample.
- Biotin conjugated anti insulin(D) : Dilute to 4,000 times by using buffer solution(C) and use.
- HRP conjugated streptavidin(E) : Dilute to 2,000 times by using buffer solution(C) and use.
*Dilute HRP conjugated streptavidin during the incubation of 2 hours (refer to 11. Assay procedure-(6).

- Anti-Insulin-coated plate

- ↓Washing 4 times*

- Biotin conjugated anti insulin 100 µl

- ↓Shaking**

- Samples/Standards 10 µl

- ↓Shaking**, Incubation for 2 hours at room temp.(Standing***)

- ↓Washing 4 times*

- HRP conjugated streptavidin 100 µl

- ↓Shaking**, Incubation for 30 minutes at room temp.(Standing***)

- ↓Washing 4 times*
- Substrate chromogen reagent (TMB) 100 µl
- ↓Shaking**, Incubation for 30 minutes at room temp.(Standing***)
- Reaction stopper (1M H₂SO₄) 100µl
- ↓Shaking**
- Measurement of absorbance (450nm,Ref 620nm)
Use the value (abs.450nm-abs.620nm)
- Use as a check box Room temp: 20~25°C

:Use as a check box

* Guideline of washing volume: 300µl/well for an automatic washer and for a pipette if the washing buffer is added by pipette. If the back ground is high, change washing frequency from 4 times to 5-8 times at the constant stroke after the reaction with HRP conjugated streptavidin.

** Guideline of shaking: 800rpm for 10 seconds x 3 times.600-650 nm can be used as reference wavelength.

***Put a plate cover on the plate while the reaction after shaking.

Assay worksheet

	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												
H												

[Storage condition] Store the kit at 2-8°C (Do not freeze).

[Term of validity] 6 months from production (Expiration date is indicated on the container.)

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