

Appendix 2. Guide to insulin initiation and titration

For fasting and preprandial blood glucose targets, please refer to the section '[Glucose monitoring](#)'. Note that adjustments given below are based on average blood glucose levels over at least 2–3 days.

Principles of insulin titration by regimen¹

Basal (intermediate- or long-acting insulin):

- Adjust the dose based on previous average fasting glucose levels

Premixed insulin at breakfast and dinner:

- Adjust the breakfast dose based on average previous dinner readings (as long as a dose increase does not cause hypoglycaemia at lunchtime)
- Adjust the dinner dose based on previous average fasting glucose levels (as long as a dose increase does not cause hypoglycaemia at bedtime)

Basal-bolus:*

- Adjust the dose at mealtime based on the previous day's glucose level measured either two hours after the corresponding mealtime or before the next mealtime (eg adjust the breakfast dose based on the previous 2–3 days' average two-hour post-breakfast value or the pre-lunch value)

*Rapid- or short-acting insulin is used for bolus dose.

Starting and adjusting basal insulin¹⁻³

STEP 1. SELECT basal insulin and injecting device

STEP 2. START basal insulin: 0.1 units/kg or 10 units at bedtime or morning

CONTINUE oral glucose-lowering medication

Evening insulin dosing if fasting blood glucose (FBG) is high (pre-breakfast)

Morning insulin dosing if FBG is on target but pre-dinner blood glucose level (BGL) is high

STEP 3. TITRATION

Adjust basal insulin dose to achieve target using either fasting glucose for bedtime insulin or pre-dinner glucose levels for morning dosages

Practitioner-led titration (below left) can achieve target in a shorter time period than patient-led titration (below right)

Practitioner-led titration OR Patient-led titration

Adjust insulin dose twice weekly as shown, until FBG target is achieved

Mean FBG over previous two days (mmol/L)*	Insulin dose adjustment
≥10.0	↑ by 4 units
8.0–9.9	↑ by 2–4 units
7.0–7.9	No change or ↑ by 2 units
6.0–6.9	No change
4.0–5.9	No change or ↓ by 2 units
<4.0	↓ by 2–4 units

Adjust insulin dose every three days. Increase by 2 units until FBG target is achieved

Mean FBG over previous three days (mmol/L)*	Insulin dose adjustment
≥6.0 mmol/L but ≤8.0 mmol/L	No change
4.0–6.0 mmol/L	↓ insulin dose by 2 units
<4.0 mmol/L	↓ insulin dose by 4 units

*Do not increase insulin dose if FBG <4.0 mmol/L at any time in the preceding week.

Starting and adjusting pre-mixed (biphasic) and co-formulated insulin

STEP 1. SELECT premixed or co-formulated insulin and injecting device

INSULIN-NAÏVE patients

STEP 2. START premixed or co-formulated insulin **10 units** immediately before or soon after the largest meal (usually evening meal)

CONTINUE metformin if indicated; consider tapering sulfonylureas as glycaemic control improves

STEP 3. TITRATION

Adjust the evening pre-mixed insulin dose once or twice a week according to the schedule below to FBG^{2,3}

Co-formulated insulin should be titrated once a week

Lowest BGL reading (mmol/L) of the previous three days – fasting or preprandial	Insulin dosage adjustment
≥10	↑ by 6 units
8.0–9.9	↑ by 4 units
6.0–7.9	↑ by 2 units
4.0–5.9	No change
<4.0	↓ by 2 units

If a morning insulin dose is given, adjust the insulin dose according to evening preprandial BGL according to the same titration recommendations

Hypoglycaemia should prompt a review of other oral therapy. Which insulin is adjusted depends on regimen and target glucose

STEP 4. INTENSIFICATION: Once-daily insulin to twice-daily premixed insulin

When?

- With FBG at target, if evening preprandial BGL > FBG, or if evening preprandial BGL is high, or
- After three months if glycated haemoglobin (HbA1c) > target, despite FBG and evening preprandial BGL at target

How?

- Calculate any increased total daily insulin dose and divide this into two doses, considering the continued need to maintain FBG and postprandial targets
- Give the increased dose adjustment as twice-daily injections (pre-breakfast and pre-dinner). This may not be a 50/50 split, as prandial targets may require a higher proportion to be given at the largest meal of the day (eg 60/40)
- Monitor pre-dinner BGL and FBG against targets
- Once a week, adjust both insulin doses independently (according to protocol above in step 3); pre-breakfast insulin is adjusted according to pre-dinner BGL, and pre-dinner insulin is adjusted according to FBG

Guide to basal plus insulin intensification schedules

STEP 1. SELECT rapid-acting (prandial) insulin and injecting device to be added in addition to basal insulin

STEP 2. START rapid-acting insulin (4 units) to be given before the meal with the largest carbohydrate content

CONTINUE basal insulin at the current dose

CONTINUE metformin, consider tapering sulfonylureas as glycaemic control improves

MONITOR two-hour postprandial BGL. Continue to assess FBG and preprandial glucose levels – goal is 4.0–7.0 mmol/L

STEP 3. TITRATION

Increase rapid-acting (prandial) insulin dose by 2 units every three days to achieve target

Two-hour postprandial BGL (mmol/L)	Rapid-acting (prandial) insulin dosage adjustment
≥8 (for three consecutive days)	No change or ↑ by 2 units
6.0–7.9	No change
4.0–5.9	No change or ↓ by 2 units
<4.0 on any day	↓ by 2–4 units

STEP 4. Basal plus titration to basal bolus – intensification

When?

If HbA1c is not at target after three months, add a further prandial insulin dose to another meal (eg basal plus 2 to basal bolus)

How?

1. Keep the current prandial and basal insulin doses unchanged
2. Add a new rapid-acting (prandial) insulin to the next largest meal of the day (starting at 10% of the basal insulin dose or 4 units)
3. ↑ new prandial insulin dose by 2 units every three days until postprandial target is achieved as per Step 3 above

References

1. Lau ANC, Tang T, Halapy H, Thorpe K, Yu CHY. Initiating insulin in patients with type 2 diabetes. CMAJ 2012;184(7):767–76.
2. Wong J, Tabet E. The introduction of insulin in type 2 diabetes mellitus. Aust Fam Physician 2015;44(5):278–83.
3. Howard-Thompson A, Khan M, Jones M, George CM. Type 2 diabetes mellitus: Outpatient insulin management. Am Fam Physician 2018;97(1):29–37.