

Evidence Tables

INS 3: Are the biphasic analogue preparations effective in the control of blood glucose compared to biphasic human insulin preparations in people with type 2 diabetes?

Reference	Study type Evidence level	Number of patients	Patient characteristics	Intervention	Comparison	Length of follow-up	Outcome measures	Effect size	Source of funding
Boehm BO, Home PD, Behrend C et al. Premixed insulin aspart 30 vs. premixed human insulin 30/70 twice daily: a randomized trial in Type 1 and Type 2 diabetic patients.[erratum appears in Diabet Med. 2002 Sep;19(9):797.]. <i>Diabetic Medicine</i> . 2002; 19(5):393-399. Ref ID: 3190	RCT Open-label 1++	N= 294 from 36 centres in England, Northern Ireland, Germany and Austria	Inclusion criteria: People with Type 1 or Type 2 diabetes using twice-daily insulin. BMI \leq 35.0 kg/m ² and HbA1c \leq 11.0%. Type 1 diabetes (means): age 44.8 yrs, bodyweight 77.9 kg, BMI 26.3 kg/m ² , duration of diabetes 16 yrs, HbA1c 8.38%, 67% male Type 2 diabetes (means):	Biphasic insulin analog formulation (containing 30% soluble insulin apart and 70% insulin aspart crystallized with protamine) (BIAsp 30) twice-daily (Type 1 diabetes n=55; Type 2 diabetes n=85)	Biphasic human insulin 30/70 (BHI 30) twice daily (Type 1 diabetes n=49; Type 2 diabetes n=102)	12 weeks	Blood glucose Hypoglycaemia Patient acceptability	*Blood glucose HbA1c. At 12 weeks, there was no significant difference between BIAsp30 compared with BHI (8.14 (0.06) vs 8.15 (0.06)%; NS) Meal-time blood glucose increment averaged over the three main meals (including lunch) was significantly lower in the BIAsp 30 group than in the BHI 30 group: (1.66 (0.20) vs 2.34 (0.19) mmol/l; p < 0.02). The eight point blood glucose profiles showed significant treatment differences in favour of BIA30 after breakfast (10.40 (SEM 0.37) vs 11.40 (0.36) mmol/l; <0.05), before lunch (6.64 (0.28) vs 7.57 (0.27); p<0.02), after dinner (9.22 (0.33) vs 10.20 (0.32); p<0.02) and at bedtime (8.22 (0.31) vs 9.10 (0.30); p<0.05) Point estimate, CI and p-value for subset analyses by diabetes type: HbA1c: Type 1: 0.19 (-0.05 to 0.43; NS), Type 2: -0.13 (-0.28 to 0.03; NS) Prandial Inc.: Type 1: -1.08 (-2.25 to 0.09; p=0.06), Type 2: -0.29 (-0.88 to 0.29; NS) *Hypoglycaemia BIAsp 30: 20 major and 362 minor episodes BHI 30: 42 major and 361 minor episodes	Novo Nordisk

			age 63.3 yrs, bodyweight 79.5 kg, BMI 28.1 kg/m ² , duration of diabetes 14.7 yrs, HbA1c 8.14%, 50% male					(NS between the groups, 3 patients on BHI 0 accounted for 19/42 major episodes) There was a lower risk of minor nocturnal episodes associated with BIAsp 30 (RR 0.63 (95% CI 0.37 to 1.09; p = 0.06). There was no significant difference between the groups on the number of major nocturnal episodes. *Adverse events Similar adverse event profile reported for both groups *Patient acceptability In the BIAsp 30 group 72% of patients opted to continue treatment after the three-month period compared with 68% in the BHI 30 group.	
Boehm BO, Vaz JA, Brondsted L et al. Long-term efficacy and safety of biphasic insulin aspart in patients with type 2 diabetes. <i>Eur J Intern Med.</i> 2004; 15(8):496-502. Ref ID: 3208	RCT open-label 1++	N=125	Extension trial of {Boehm, 2002 3190 /id}. 125/173 (72%) of patients entered in to the original trial chose to enter the 21-month extension period (patients with type 2 diabetes only). Inclusion criteria: People Type 2 diabetes using twice-	BIAsp30 twice daily (n=85)	BHI30 twice daily (n=102)	24 months	Glucose control Hypoglycaemia Body weight Non-specific insulin antibody formation Adverse events	*Glucose control After 24 months, there was no significant difference in mean HbA1c level (BIAsp30 8.35±0.20% vs BHI30 8.13±0.16%, NS). Whether or not a subject had experienced a minor hypoglycaemic episode did not significantly alter the HbA1c level at 24 months. *Hypoglycaemia During the first year of treatment, 3 patients (5%) in the BIAsp30 group experienced one or more major hypoglycaemic episodes compared with 5 patients (8%; NS) in the BHI30 group. During the second year significantly fewer patients in the BIAsp30 group (0%) than in the BHI30 group (6 patients, 10%; p=0.04) experienced a major episode. There were no significant differences between the groups in risk of minor hypoglycaemia throughout the study. *Bodyweight There were no significant differences between the group in terms of weight gain (BIAsp 0.05±0.81kg vs BHI30 2.00±0.69kg;	Novo Nordisk

			daily insulin. BMI \leq 35.0 kg/m ² and HbA1c \leq 11.0%. Population (means): 62.7 yrs, duration of diabetes 14.2 yrs, BMI 29.6 kg/m ² and HbA1c 8.2%. Male 53%.					NS). *Non-specific insulin antibody formation During the 24-month period, the level of antibodies specific to either IAsp or HI were low with no significant changes in either group during the study. The mean difference in change in non-specific antibody levels and their influence on the total daily insulin dose was no significantly different between the two groups. *Adverse events 90% patients (458 events) in the BIAsp30 group and 88% (428 events) in the BHI group experienced adverse events other than hypoglycaemia. The incidence of events related to the cardiovascular system were similar between treatment groups. Only one patient in the BIAsp30 group and none in the BHI group were deemed to have withdrawn by the local investigator due to an event related to the trial product. There were judged to be no product-related deaths in either group	
Abrahamian H, Ludvik B, Schernthaner G et al. Improvement of glucose tolerance in type 2 diabetic patients: traditional vs. modern insulin regimens (results from the Austrian Biaspart Study). <i>Hormone & Metabolic Research</i> . 2005; 37(11):684-	RCT Open-label 1+	N=177	Patients with type 2 diabetes. Inclusion criteria: Insulin naivety or inadequate treatment with a combination of oral agents and insulin or insulin monotherap	BIAsp30 three-times daily (n=89)	BHI30 twice daily (n=88)	24 weeks	HbA1c Blood glucose Adverse events	*HbA1c There was no significant difference on between BIAsp30 and BHI30 (7.6 \pm 1.1 vs 7.7 \pm 1.1%; NS) *Blood glucose BIAsp30 compared with BHI30 was associated with lower mean blood glucose (BG) values after lunch (156 vs 176 mg/dl, p=0.0289), before dinner (142 vs 166 mg/dl, p=0.0069) and after dinner (154 vs 182 mg/dl, p=0.0022). After 24 weeks, the mean BG range of the 7 BG values for each subject was significantly lower in the BIAsp30 group (104 mg/dl) than in the BHI30 group (123 mg/dl; difference - 19mg/dl; p=0.0111).	Novo Nordisk

689. Ref ID: 18			y. HbA1C $\geq 7\%$ and BMI ≤ 40 kg/m ² . Population (mean): 44% male, age 62.5 yrs, BMI 28.2 kg/m ² , HbA1c 9.8 %, duration of diabetes 11.1 yrs					<p>*Post-prandial glucose The meal-time BG increment was significantly lower at lunch ($p < 0.0005$) in the BIAsp30 group than the BHI30 group. The BG increment calculated over all three meals was significantly lower for BIAsp30 (BIAsp30 25 mg/dl; BHI30 37 mg/dl; $p = 0.0211$).</p> <p>*Adverse events There were 2 major hypoglycaemic episodes in the BIAsp30 and none in the BHI30 group. There were 130 and 185 minor hypoglycaemic episodes in the BIAsp30 and BHI30 groups respectively. There were no treatment differences in the number of nocturnal events. There were 35 adverse events (16 serious) in the BIAsp30 group and 39 (15 serious) in the BHI 30 group</p>	
Kilo C. et al. Starting patients with type 2 diabetes on insulin therapy using once-daily injections of biphasic insulin aspart 70/30, biphasic human insulin 70/30, or NPH insulin in combination with metformin. Journal of Diabetes and its complications 17 (2003) 307-313 ID 31	RCT open label 1+	N=140 (25 centres in the US)	Patients with type 2 diabetes. Inclusion criteria: men or women, ≥ 18 years, body weight ≤ 100 kg and BMI ≤ 40 kg/m ² . Naïve to insulin treatment and had inadequate glycemic control (HbA1c \geq	Insulin aspart NovoLog Mix 70/30 + Metformin (N=46)	NPH insulin (Novolin N) + Metformin (N=47) Biphasic human insulin (Novolin 70/30) + Metformin (N=47)	12 weeks	HbA1c FPG SMBG assessments Insulin dose Body weight Safety	<p>*HbA1c HbA1c levels decreased over the 12-week treatment period by 1.3% in the biphasic aspart group, by 1.2% in the NPH insulin group, and by 1.1% for patients in the biphasic human insulin group. <u>NS</u> difference among the treatment groups.</p> <p>*FPG FPG values decreased (mean \pm SD) from baseline to the end of the study by 31% for the biphasic aspart group (-75 ± 72.3 mg/dl), by 37% (-91 ± 72.0 mg/dl) for the NPH group, and by 28% (-63 ± 86.2 mg/dl) for the biphasic human insulin group. <u>NS</u> difference among the treatment groups.</p> <p>*SMBG assessments Improved glycemic control was also observed in the results of the SMBG assessments. Mean values for the 8-point</p>	Novo Nordisk

			7.5%) on a regimen of \geq 3 months of metformin as monotherapy or in combination with a sulphonylurea or repaglinide.					<p>SMBG profile at week 12 were decreased from baseline values by approx 50mg/dl at each of the assessment times.</p> <p>Although there were no overall significant differences between the treatment groups, SMBG values for before breakfast and before lunch values tended to be lower for the NPH insulin group, while after dinner and 10pm, values tended to be higher for the NPH insulin group as compared to the biphasic insulin aspart and biphasic human insulin groups.</p> <p>*Body weight There were no significant differences between the groups</p> <p>*Adverse Events A total of 203 AE were reported for 87 (62%) patients during the insulin treatment period. Upper respiratory track infection was the most commonly reported event (21 patients). The number and type of AE were similar for each of the treatment groups. Minor symptoms of hypoglycaemia were reported by slightly more patients in the biphasic insulin aspart group as compared to the NPH insulin and biphasic human insulin groups.</p> <p>No major hypoglycaemic events were reported. Nocturnal hypoglycaemia (midnight – 6am) was less frequently reported for patients receiving biphasic insulin aspart (7 patients) as compared to patients in the NPH insulin and biphasic human insulin groups (11 patients in each group)</p>	
Schernthaner G, Kopp HP, Ristic S et al. Metabolic control	RCT Open label crossover 1+	N=40	Patients with type 2 diabetes. Inclusion	Humalog Mix50 (50% insulin lispro and 50% neutral protamine	Human insulin 30/70 twice-daily (n=35)	12 weeks	Blood glucose Hypoglycaemia	*Blood glucose (BG) Mean BG (MBG). There was a significant decrease from baseline following treatment with Mix50 (-20.2 \pm 7.3 mg/dl, p=0.010) but	Eli Lilly

<p>in patients with type 2 diabetes using Humalog Mix50 injected three times daily: crossover comparison with human insulin 30/70. <i>Hormone & Metabolic Research</i>. 2004; 36(3):188-193. Ref ID: 3188</p>			<p>criteria: long standing diabetes and previously treated with insulin. HbA1c $\leq 11\%$ and BMI ≤ 40 kg/m². Population (means): age 67 yrs, BMI 29.2 kg/m², HbA1c 8.4%, duration of diabetes 15.3 yrs), male 23%</p>	<p>lispro suspension) three-times daily (n=35)</p>			<p>Adverse events</p>	<p>not with human insulin 30/70 (-7.4\pm6.1 mg/dl, p=0.237). The effect of Mix50 was significantly greater than the effect of human insulin 30/70 treatment (p=0.035) *Fasting BG (FBG) Mix50: At 12 weeks, there was a significant decrease in baseline at values pre-breakfast (154.4\pm9.9 vs 177.7\pm9.6 mg/dl; p=0.005) and at bedtime (188.0\pm9.9 vs 160.1\pm8.5 mg/dl; p=0.010) Human insulin 30/70: No significant reductions from baseline. There was a significant difference in favour of human insulin 30/70 pre-breakfast (177.7\pm9.6 vs 147.4\pm6.3 mg/dl; p<0.001), but a significant difference favouring Mix50 at bedtime (160.1\pm8.5 vs 176.7\pm9.8 mg/dl; p=0.021) *2-hr post-prandial glucose levels: Mix50: At 12 weeks, there was a significant reduction from baseline in post-lunch (200.6\pm9.5 vs 155.6\pm5.8; p<0.001) and post-dinner (209.1\pm10.4 vs 166.3\pm7.2 mg/dl; p<0.001) values Human insulin 30/70: At 12 weeks, there was a significant reduction from baseline in post-lunch (200.6\pm9.5 vs 192.2\pm8.5 mg/dl; p<0.001) and post-dinner (209.1\pm10.4 vs 198.2\pm10.0 mg/dl; p<0.001) values. The reduction in postprandial glucose excursions was significantly greater with Mix50 compared with human insulin 30/70 after breakfast and lunch (p<0.001 for each) *HbA1c At 12 weeks, there were significantly greater reduction from baseline HbA1c values with Mix50 than human insulin 30/70 (7.6\pm1.1 vs 8.1\pm1.4% ; p=0.021) *Hypoglycaemia</p>	
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<p>Hermansen K, Colombo M, Storgaard H et al. Improved postprandial glycemic control with biphasic insulin aspart relative to biphasic insulin lispro and biphasic human insulin in patients with type 2 diabetes. <i>Diabetes Care</i>. 2002; 25(5):883-888. Ref ID: 3192</p>	<p>RCT open-label crossover 1-</p>	<p>N=61</p>	<p>Inclusion criteria: Patients with type 2 diabetes, ≤18 years of age, with BMI <32 kg/m² and HbA1c <11.0%. Required total insulin dose at entry was <1.4 units/kg per day. Population</p>	<p>BIAsp30 single dose (n=41)</p>	<p>Mix25 single dose (42) BHI 30 single dose (44)</p>	<p>3 days</p>	<p>Blood glucose Adverse events</p>	<p>*Blood glucose Serum glucose excursion 0-5 h after the meal (EXC_{0-5(SG)} (mmol/l x h) was significantly superior with BIAsp30 (16.6±4.4) compared with either BHI30 (20.1±4.9; p<0.001) or Mix25 (18.9±6.1; P<0.05). Glucose excursion was significantly lower during both the early (0-2 h) (7.7±2.7) and the late (2-5 h) (8.3±2.6) post prandial phase with BIAsp30 than with BHI30 (9.4± 2.7 and 10.1± 3.2 respectively) (EXC₀₋₂, P<0.01; EXC₂₋₅, p<0.01). Glucose excursion with BIAsp30 was also significantly lower than with Mix25 during the late postprandial phase (8.3±2.6 vs 9.7±3.8; p<0.05). C_{max(SG)} (serum glucose concentration profile maximum concentration) for BIAsp30 was significantly</p>	<p>Novo Nordisk</p>

			(means): 66% male, age 60.1 yrs, BMI 27.3 kg/m ² , HbA1c 8.3%, duration of diabetes 11.6 yrs					lower than BHI 30 (15.9±2.7 vs 16.7±2.6 mmol/l; p<0.05). Time to maximum concentration was significantly shorter for BIAsp30 than for either of the other preparations (13 min shorter than with BHI30, p<0.01; 11 min shorter than with BHI30, p<0.05). Postprandial serum insulin concentrations. A larger AUC _(0-5 h) (area under concentration curve 0-5 hr after injection) and an approximately twofold higher maximum concentrations were seen after injection with BIAsp30 than with BHI30 (p<0.001). The time to maximum concentrations was 35 min shorter for BIAsp30 than for BHI30 (p<0.001). *Adverse events No adverse events thought to be related to treatment were reported in any group. 53 hypoglycaemic episodes were reported during study days (23 episodes with BIAsp30, 11 with BHI30 and 19 with Mix25). The majority were mild (severe episodes: 2 with BIAsp30, 2 with BHI30 and 5 with Mix25).	
McSorley PT, Bell PM, Jacobsen LV et al. Twice-daily biphasic insulin aspart 30 versus biphasic human insulin 30: a double-blind crossover study in adults with type 2 diabetes mellitus. <i>Clinical Therapeutics</i> . 2002; 24(4):530-539. Ref	RCT Crossover 1-	N=13	Inclusion criteria: 1 year history of type 2 diabetes and twice-daily BHI 30 for at least the previous 6 months. Population (means): Age 64 yrs, glycosylated haemoglobin	Biphasic insulin aspart twice-daily (BIAsp 30) (n=13)	Biphasic human insulin twice-daily (BHI 30) (n=13)	2 weeks	Blood glucose Hypoglycaemic episodes	*Blood glucose BIAsp 30 was more rapidly absorbed than BHI 30 and reached a maximum serum insulin concentration that was 18% higher after dinner and 35% higher after the following day's breakfast than that of BHI 30 (p < 0.05). The area under curve (0-2 hrs) was significantly greater (p < 0.05) for BIA 30 than BHI 30 after dinner and breakfast (p<0.05 for both). Mean area under the total insulin concentration-time profile during the 2 hours after administration was 17% greater for BIAsp 30 than BHI 30 after dinner and 44% greater after breakfast (p<0.05 for both). Following both means,	Novo Nordisk

ID: 3191			7.7%, BMI 28.1 kg/m ² , duration of diabetes 13 yrs					insulin concentrations fell more rapidly and reached slightly lower levels in patients receiving BIAsp 30. Consequently, the insulin level before lunch was lower in the BIAsp 30 group. Serum glucose excursions were significantly lower in the BIAsp 30 group after dinner (p<0.05) and breakfast (p<0.05), representing postprandial glucose concentrations 34% lower after dinner and 44% lower after breakfast. However, serum glucose excursion after lunch was significantly higher with BIAsp 30 (p<0.05). Mean daily prandial glucose excursion was lower for BIAsp30 (16.2 mmol/h/l ⁻¹) than BHI 30 (17.9 mmol/h/l ⁻¹) (p=0.02). *Hypoglycaemic episodes The number of minor and major episodes were similar between groups	
Schmoelzer I, De CA, Pressl H et al. Biphasic insulin aspart compared to biphasic human insulin reduces postprandial hyperlipidemia in patients with Type 2 diabetes. <i>Experimental & Clinical Endocrinology & Diabetes</i> . 2005; 113(3):176-181. Ref ID: 3187	RCT Open-label crossover 1-	N=12	Inclusion criteria: On premixed insulin therapy. Exclusion criteria: Severe or renal insufficiency, patients on prandial or intensified insulin therapy. Population (means): 25% male; age 59 yrs, BMI 30.5 kg/m ² ,	Biphasic insulin aspart single dose (BIAsp 30) (n=12)	Biphasic human insulin single dose (BHI 30) (n=12)	2 days	Blood glucose Triglycerides	*Blood glucose The maximum postprandial increase of glucose was significantly reduced after BIAsp 30 (5.27±1.83 mmol/l) compared to BHI 30 (7.10±2.0 mmol/l, p=0.007). *Triglycerides Significantly lower maximum (SD) postprandial triglycerides were observed with BIAsp 30 compared with BHI 30 (29.7 [12.4] vs 41.9 [18.5] mg/dl, [respectively; p=0.014], as well as significantly lower area over baseline (110.2 [70.9] vs 144.4 [78.3] mg x 8 h/dL, respectively; p=0.024).	Austrian National Bank

			duration of diabetes 9 yrs, HbA1c 8.33%)						
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