Supplemental Method

Study population

Seventy-seven Japanese type 1 diabetes patients were recruited and enrolled in our study after having provided written informed consent. All participants were diagnosed as type 1 diabetes by diabetes specialists at the time of presenting hyperglycemia and/or ketosis in their clinical history, and since that time all had been under treatment with insulin therapy. Most of the participants are considered to be the auto-immune, acute-onset type 1 diabetes, but the inclusion of the fulminant type patients cannot be completely excluded when they are diagnosed before the establishment of the concept and diagnostic criteria of the fulminant type 1 diabetes. The patients with neoplasm, autoimmune diseases, and administration of oral anti-diabetic agents were excluded. All data and blood samples were collected on July 29th at Osaka Police Hospital or August 26th at Osaka University Medical Hospital in 2017.

Preparation of plasma samples for glucagon assay

Whole blood was collected into sample tubes containing aprotinin and EDTA-2Na (NP-EA0205; NIPRO, Osaka, Japan), then immediately chilled on ice. Within 20 min of sampling, the plasma was separated using a 3,000-rpm desktop centrifuge for 20 min at 4 °C, then stored in a -80 °C deep freezer until performing the glucagon assay.

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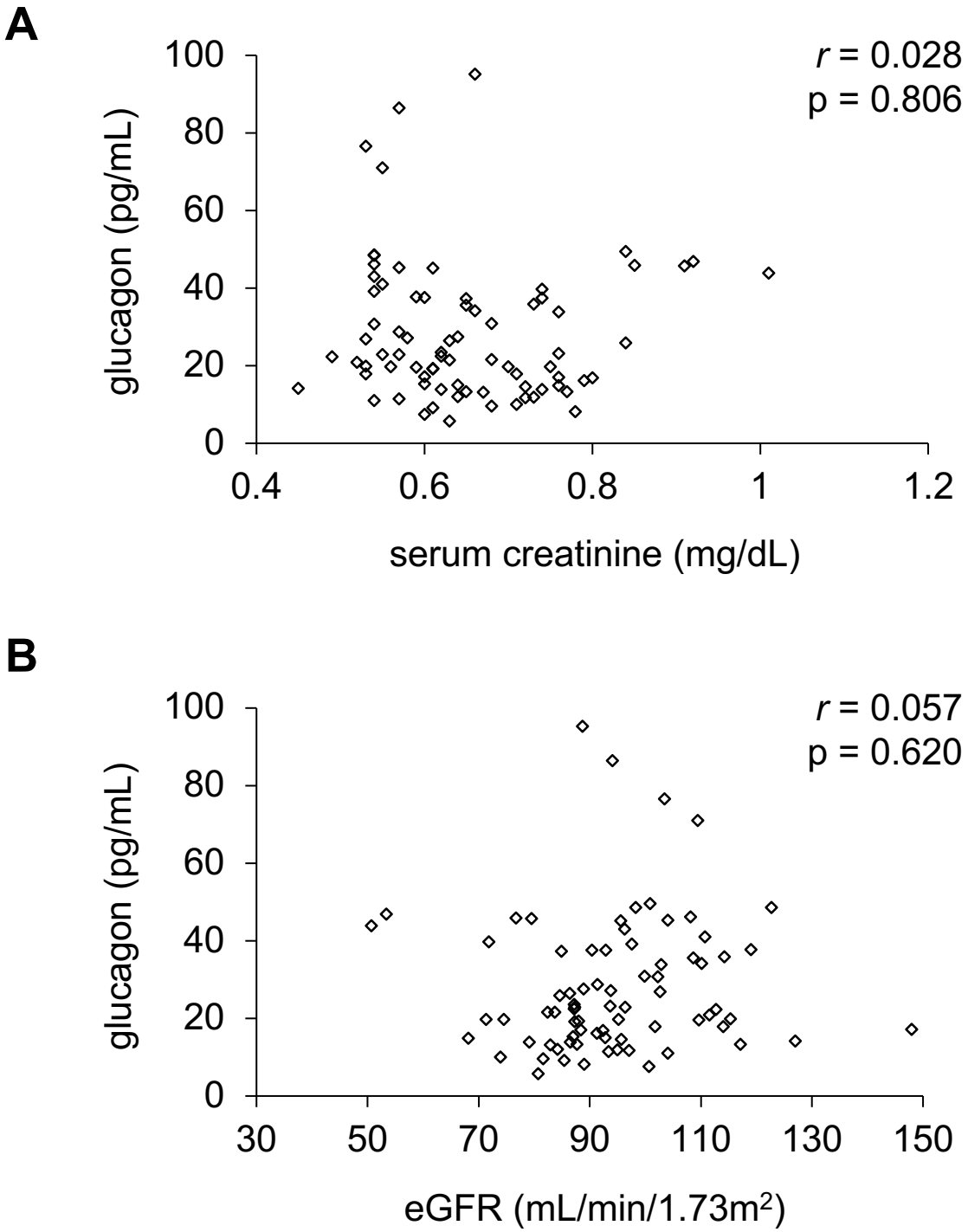
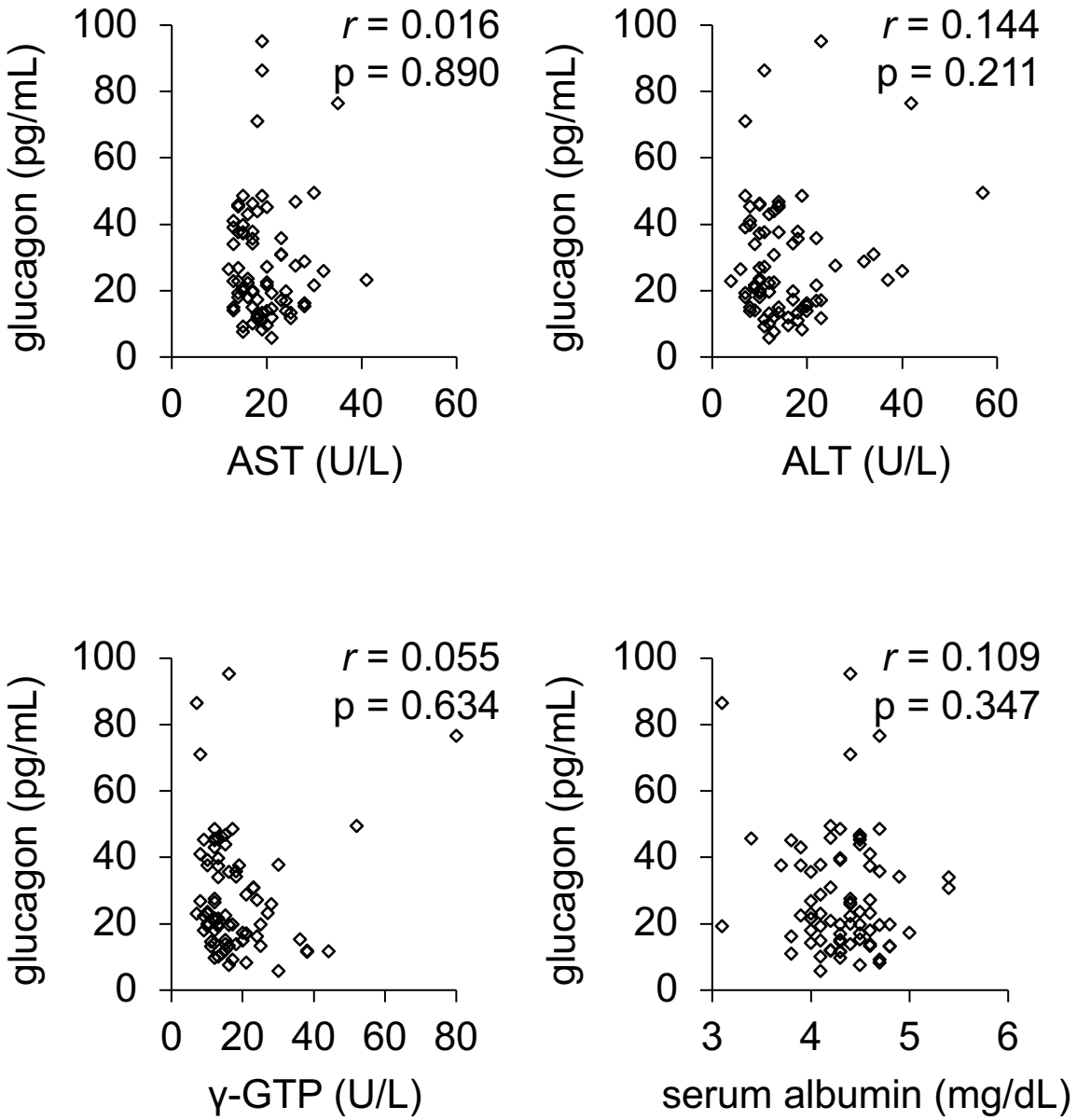
Supplemental Figure 1.



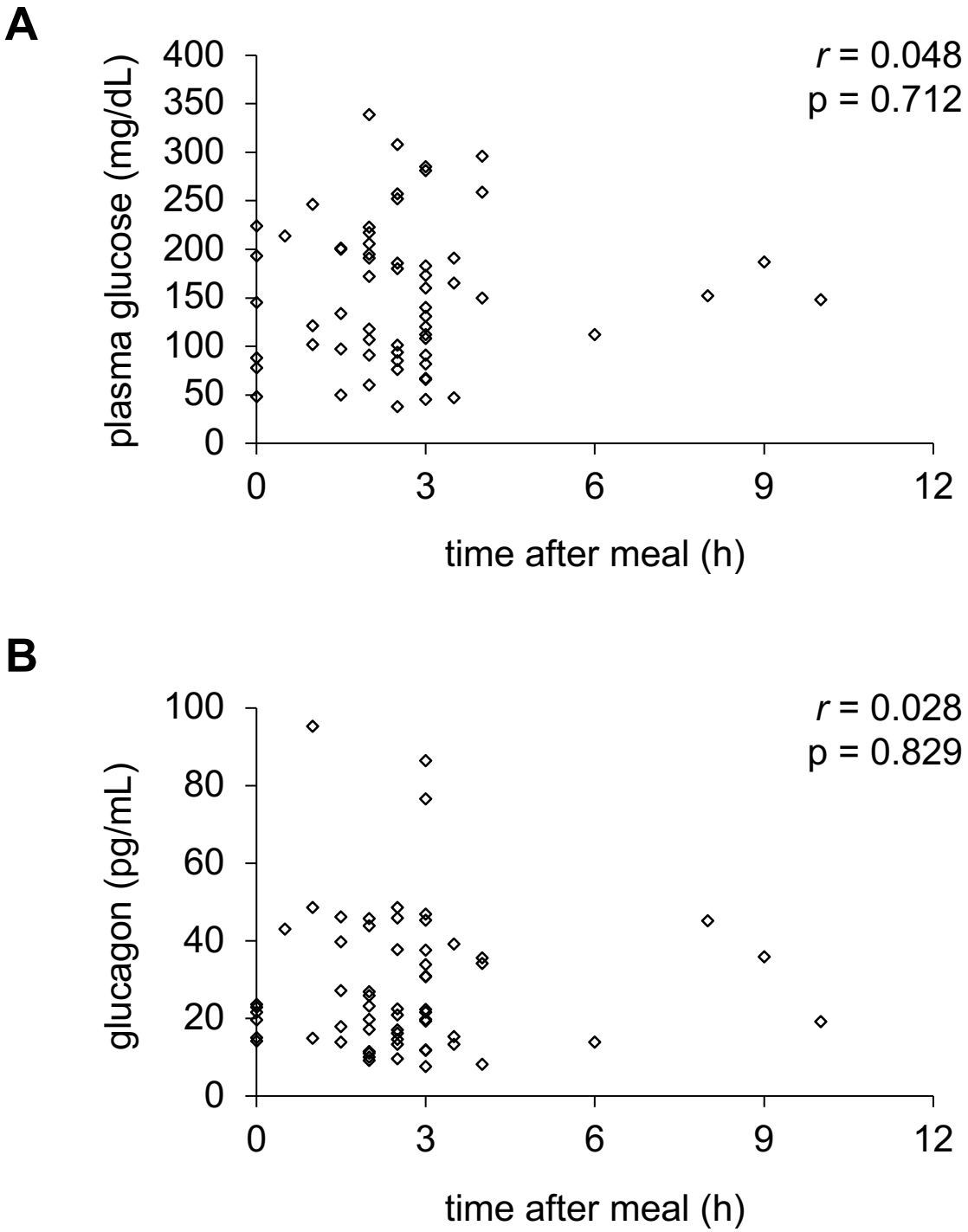
Supplemental Figure 1. A: Values for serum creatinine and plasma glucagon in the type 1 diabetes participants (n=77). **B:** Values for eGFR and plasma glucagon in the type 1 diabetes participants (n=77). Squares indicate individual samples. Statistical analysis for correlation was performed using Pearson's univariate test.

Supplemental Figure 2.



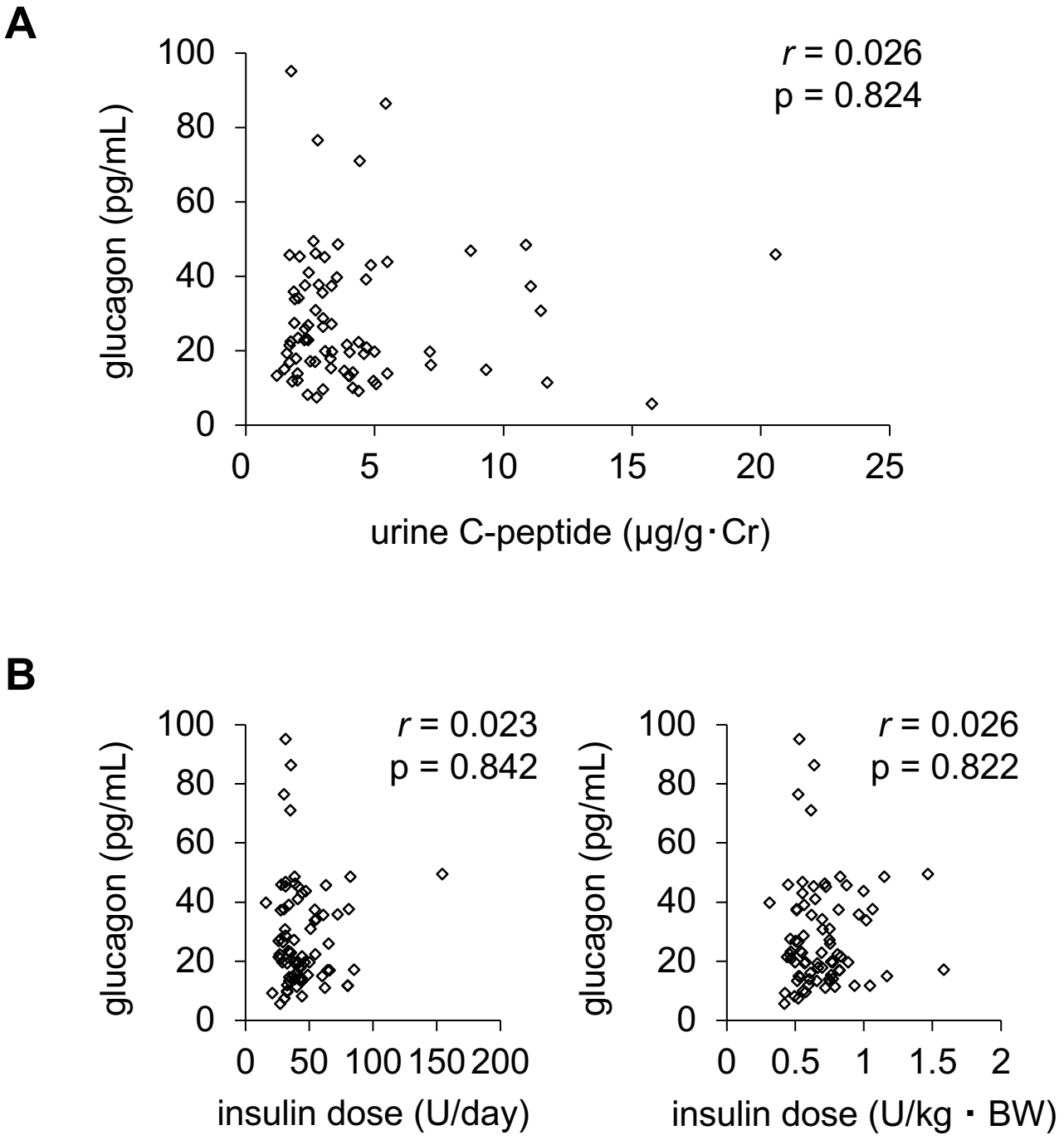
Supplemental Figure 2. Values for parameters representing liver function and plasma glucagon in the type 1 diabetes participants (n=77). Squares indicate individual samples. Statistical analysis for correlation was performed using Pearson's univariate test.

Supplemental Figure 3.



Supplemental Figure 3. A: Values for time after meal and plasma glucose in the type 1 diabetes participants (n=61). **B:** Values for time after meal and plasma glucagon in the type 1 diabetes participants (n=61). Squares indicate individual samples. Statistical analysis for correlation was performed using Pearson's univariate test.

Supplemental Figure 4.



Supplemental Figure 4. A: Values for urine C-peptide and plasma glucagon in the type 1 diabetes participants (n=77). **B:** Values for the treatment insulin dose and plasma glucagon in the type 1 diabetes participants (n=77). Squares indicate individual samples. Statistical analysis for correlation was performed using Pearson's univariate test.