REPORT E-8

UPPSALA UNIVERSITET
GERIATRISKA INSTITUTIONEN

UNIVERSITY OF UPPSALA
DEPARTMENT OF GERIATRICS

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FRANCE

Dear Dr Leroy!

Enclosed please find a signed report regarding our studies of Lycasin as a sweetener in diabetes mellitus.

The approximated cost for the study has been Swedish crowns.

With best regards.

Yours sincerely,

Bengt Yessby
M.D.

Courrier Reçu le
8 DEC. 1982
Labo-Microbio-Animalerie

-7 DEC. 1982
DIRECTION SCIENTIFIQUE

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Lycasin as a sweetener in diabetes mellitus? A report from a pilot study.

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The aim of the present study was to investigate how blood glucose and serum insulin values are affected by administration of Lycasin, compared with other sweeteners, in healthy persons and patients with diabetes mellitus.

The study was performed in two parts. The aim of the first part of the study was to investigate how blood glucose and serum insulin concentrations varied after an oral load of glucose compared with an oral load of Lycasin. In a second part of the study a standard breakfast was designed and blood glucose and serum insulin concentrations were measured before and after breakfast when sucrose, Lycasin or sorbitol was used as a sweetener.

Materials and methods

Study I: Five healthy females, age 35-61, and five patients with type II diabetes, two females, aged 63 and 55, and three males, age 60-62 years, took part in the study. Patients and healthy subjects were given 50 g glucose or an identical amount of Lycasin measured as a dry weight diluted in water to a final volume of 500 ml. Blood for quantitation of blood glucose and serum insulin was drawn at time 0, 30, 60, 90 and 120 min and at 3 h.

Study II: Five healthy persons, one male aged 39, and four females aged 49- 58, and five type II diabetics, three males aged 61-66, and two females aged 27 and 65, were studied on three different occasions before and after a standardized breakfast with the addition of different sweeteners. The composition of the breakfasts is given in Table I and Table II. The energy content of the breakfasts was 500 kcal (2.1 MJ). The content of sweeteners was 25 g of sucrose, 33 g of Lycasin or 25 g of sorbitol, respectively. Blood for blood glucose and serum insulin determinations was drawn at 0, 30, 60, 90, 120 and 180 min. The breakfast was eaten during the first 15 min of the study.

All diabetics included in the study were on a diabetic diet. The patients, as well as the healthy subjects, were told to stick to their

habitual diet throughout the study period. The medication, if any was unchanged during the study.

Glucose concentrations were determined by the glucose oxidase method and the serum insulin concentrations by the Phadebas insulin test (Pharmacia AB, Uppsala, Sweden) which is based on a radio-immunosorbent technique (Wide L, Axén R and Porath J (1967). Radioimmunosorbent assay of proteins. Chemical couplings of antibodies to insoluble dextran. Immunochemistry 4: 381).

The data presented are based on individual comparisons between results recorded when Lycasin or other sweeteners were administered as an oral load (study I) or during a standardized breakfast (study II). The significances of the differences between mean values were estimated with paired t-test (two tailed test). * = $p < 0.05$ and ** = $p < 0.01$ compared with corresponding values after glucose (study I) and sucrose (study II) administration, respectively.

Results and conclusions

Study I: Figures 1 and 2 show the blood glucose and serum insulin response in healthy persons after oral administration of 50 g of glucose or Lycasin. The blood glucose peak at 30 min was significantly higher after glucose administration while there was a slightly higher glucose concentration at 180 min after Lycasin administration. The serum insulin response was significantly higher after glucose administration at 30, 60 and 90 min.

Figures 3 and 4 show corresponding curves for the diabetic patients. The blood glucose concentration was significantly higher after glucose administration at 30, 60 and 90 min. There was a tendency to increased serum insulin concentrations after glucose but the difference between the glucose and Lycasin load was not significant. The data show that there is a higher blood glucose and serum insulin response after an oral load of 50 g glucose than after an oral load of 50 g Lycasin.

TABLE I

Standard breakfast

Food stuff	Weight (g)
Sour milk	200
Bread	30
Crisp bread	12
Margarine (45% polyunsaturated fat)	8
Cheese (17% fat)	20
Bran	4
Orange juice conc.	25
Tomatoes	30
1. Sucrose	25
2. Lycasin	33.3
3. Sorbitol	25
P/S ratio	0.46
Fibre	3.3
Kcal	500
MJ	2.1

Study II: Figures 5 and 6 show blood glucose and serum insulin concentrations before and after breakfast in healthy persons using sucrose, Lycasin and sorbitol as sweeteners, respectively. The highest blood glucose peak at 30 min was seen with sucrose, the lowest with sorbitol. The Lycasin sweetened breakfast gave intermediate values. A similar picture was seen with regard to the serum insulin response. In the diabetic patients (Figs 7 and 8) there were, virtually no differences between the blood glucose and serum insulin responses after addition of the three different sweeteners to the standard breakfast. However, these data are somewhat hard to interprete as the fasting blood glucose levels were not identical in all patients at all three investigations.

Thus it seems as if the differences in blood glucose and serum insulin concentrations which can be observed in healthy people after breakfast using the three different sweeteners are much less pronounced in diabetic persons. However, a possible difference between the three sweeteners may be more easy to demonstrate if only well controlled diabetics are studied. The fasting mean blood glucose of the patients in study II were 12-14 mmol/l indicating a very poor metabolic control. In a second step it could be advisable to study well controlled diabetics only using different sweeteners in a standardized breakfast.

Information about digestible carbohydrates in standard breakfast according to food tables.

Standard breakfast		Starch	Glucose	Fructose	Maltose	Lactose	Sucrose
		g	g	g	g	g	g
Food stuff	Weight (g)						
Sour milk	200					9,40[1]	
Bread	30	10,70[2]	0,16	0,11	0,68		0,18
Crisp bread	12	6,94[3]	0,06[4]	0,11	0,06		0,16
Margarine (45% polyunsaturated fat)	8						
Cheese (17% fat)	20					0,38[1]	
Bran	4	0,49[2]	0,02	0,02			0,06
Orange juice ready to drink	100		1,60[1]	2,20			3,20
Tomatoes	30		0,33[1]	0,42			0,06
		Σ 18,1	2,2	2,9	0,7	9,8	3,7

References:

1. Statens Livsmedelsverk: Livsmedelstabeller, skolupplaga. Statens Livsmedelsverk 1981.
2. Helms P: Naeringstoftabeller. Laegeføreningens førlag, København 1978.
3. Personal communications, B Garping, Wasa Bröd AB, Filipstad.
4. Southgate D A T, Paul Alison, Dean Ann and Christie A A: Free sugars in foods. Journal of Human Nutrition 32: 335-347, 1978.

Fig 1.

Blood glucose concentrations in healthy subjects (n=6) before and after an oral load with glucose (50 g) or Lycasin(50g) (X ± SD)

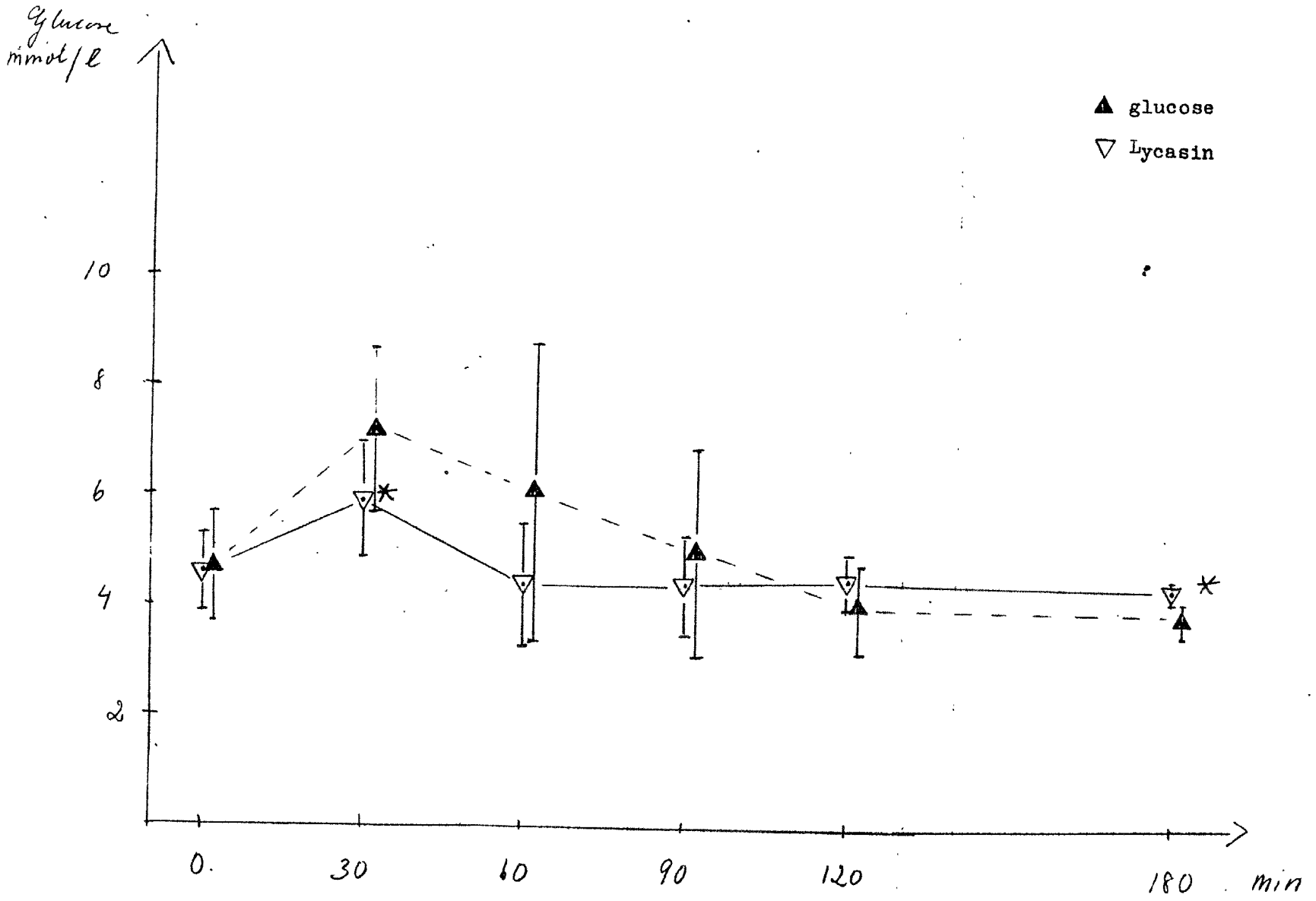


Fig 2.

Seruminsulinconcentrations in healthy subjects (n= 6) before and after an oral glucose (50g)or Lycasin(50 g) load (X ± SD)

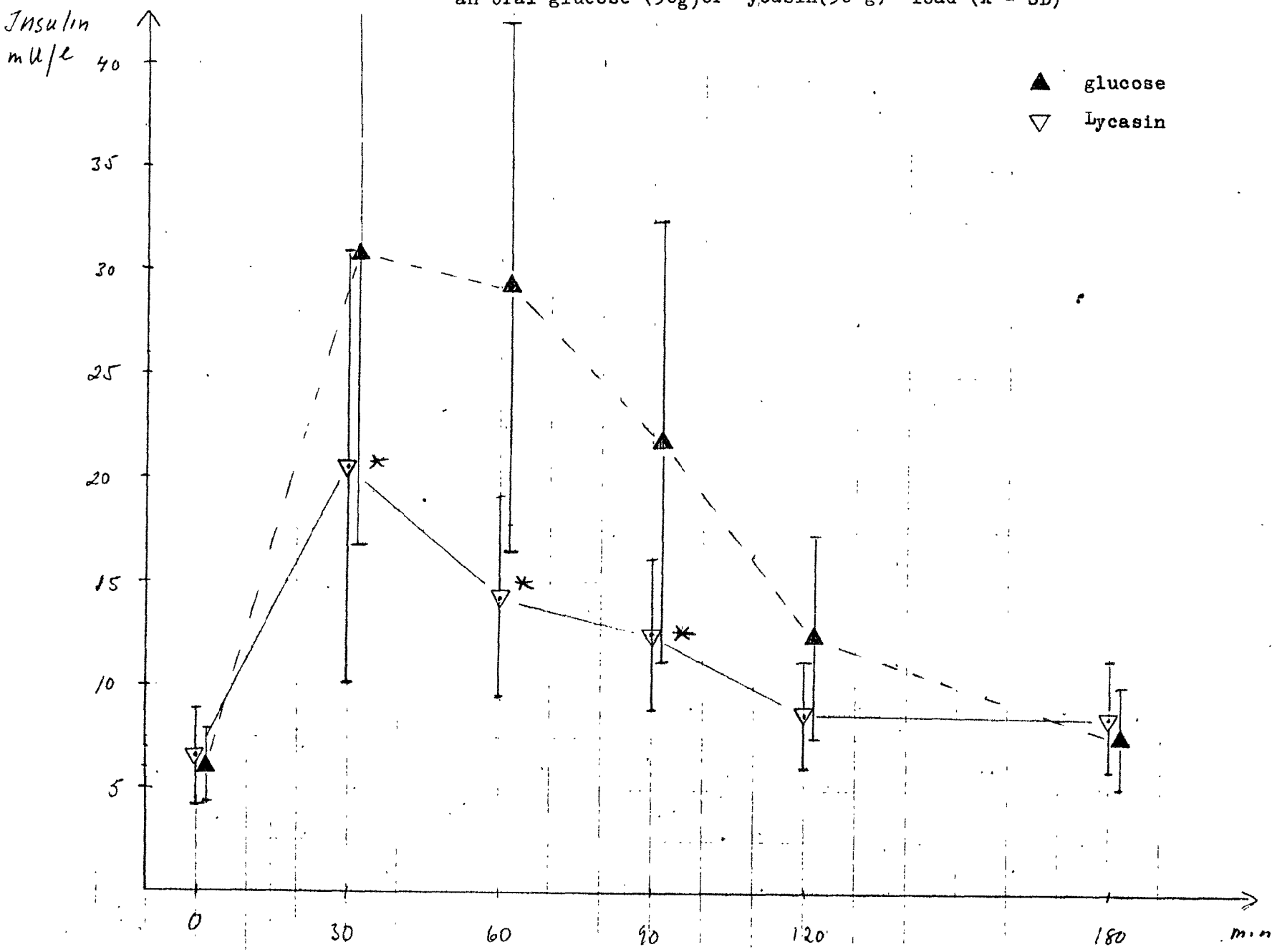


Fig 3.

Blood glucose concentrations in type 11 diabetics (n=5) before and after an oral glucose or Lycasin load (50g) ($\bar{X} \pm SD$)

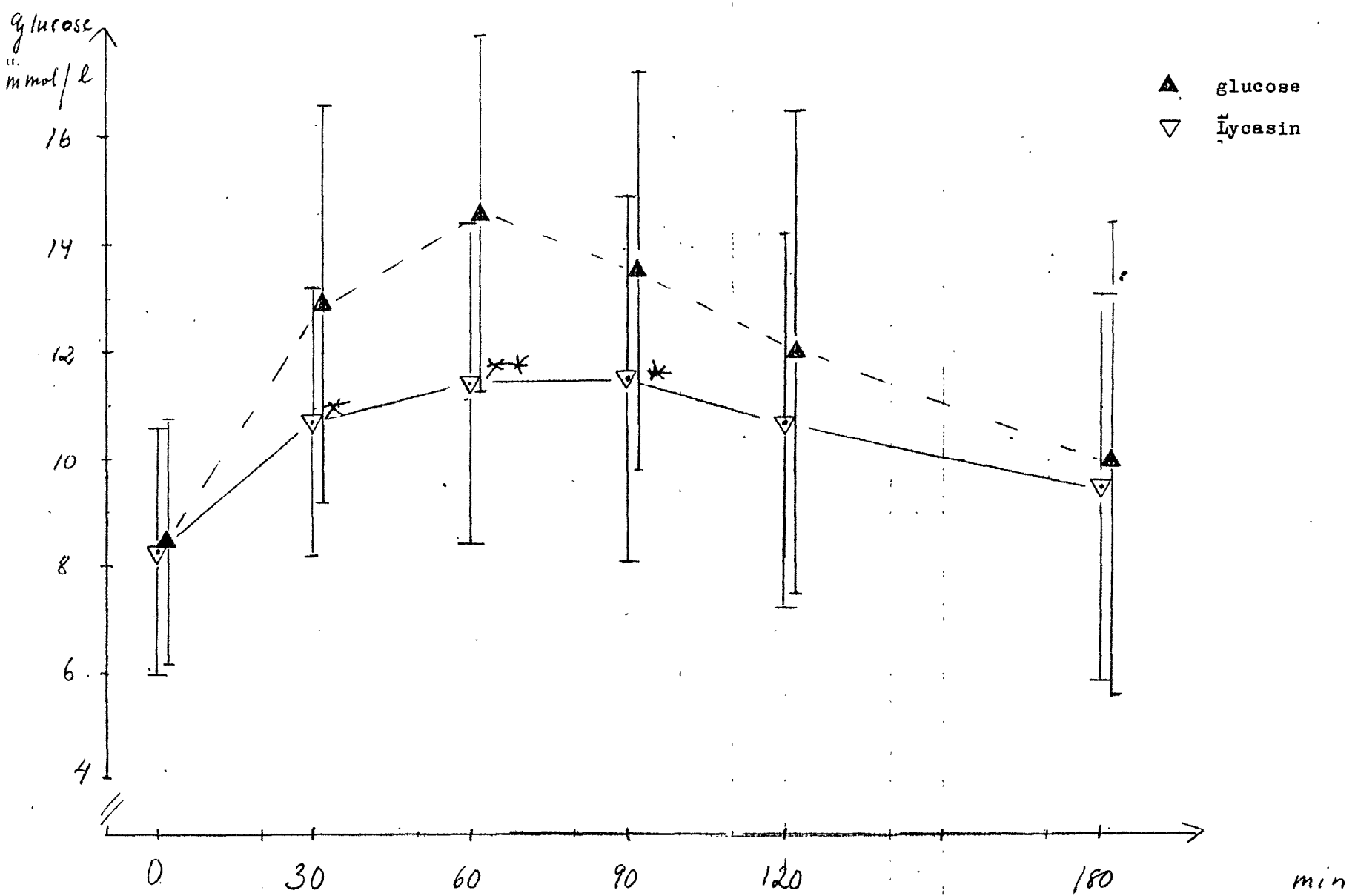


Fig 4.

Serum insulin concentrations in type ll diabetics (n = 5) before and after an oral glucose or Lycasin load (50 g) (X ± SD)

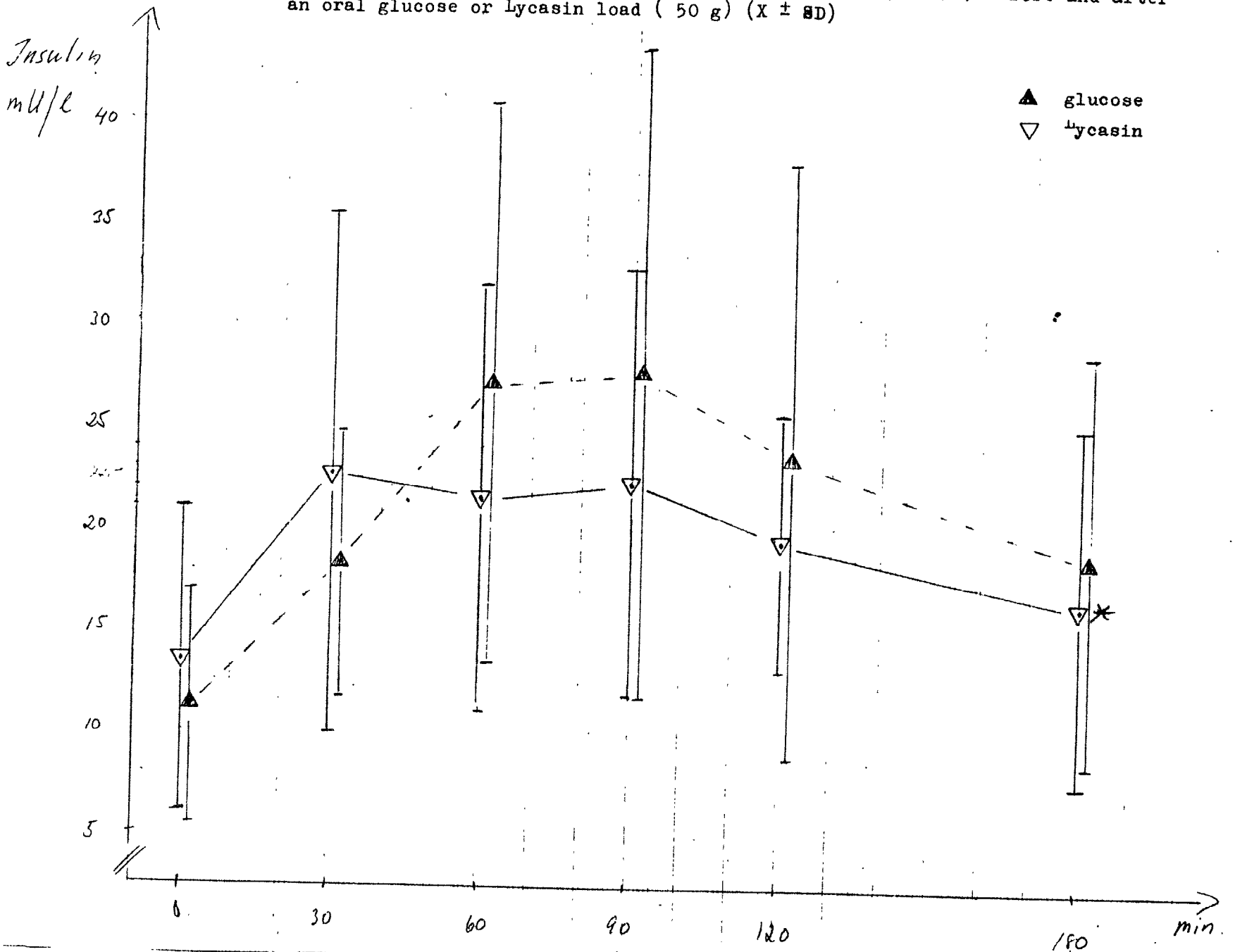
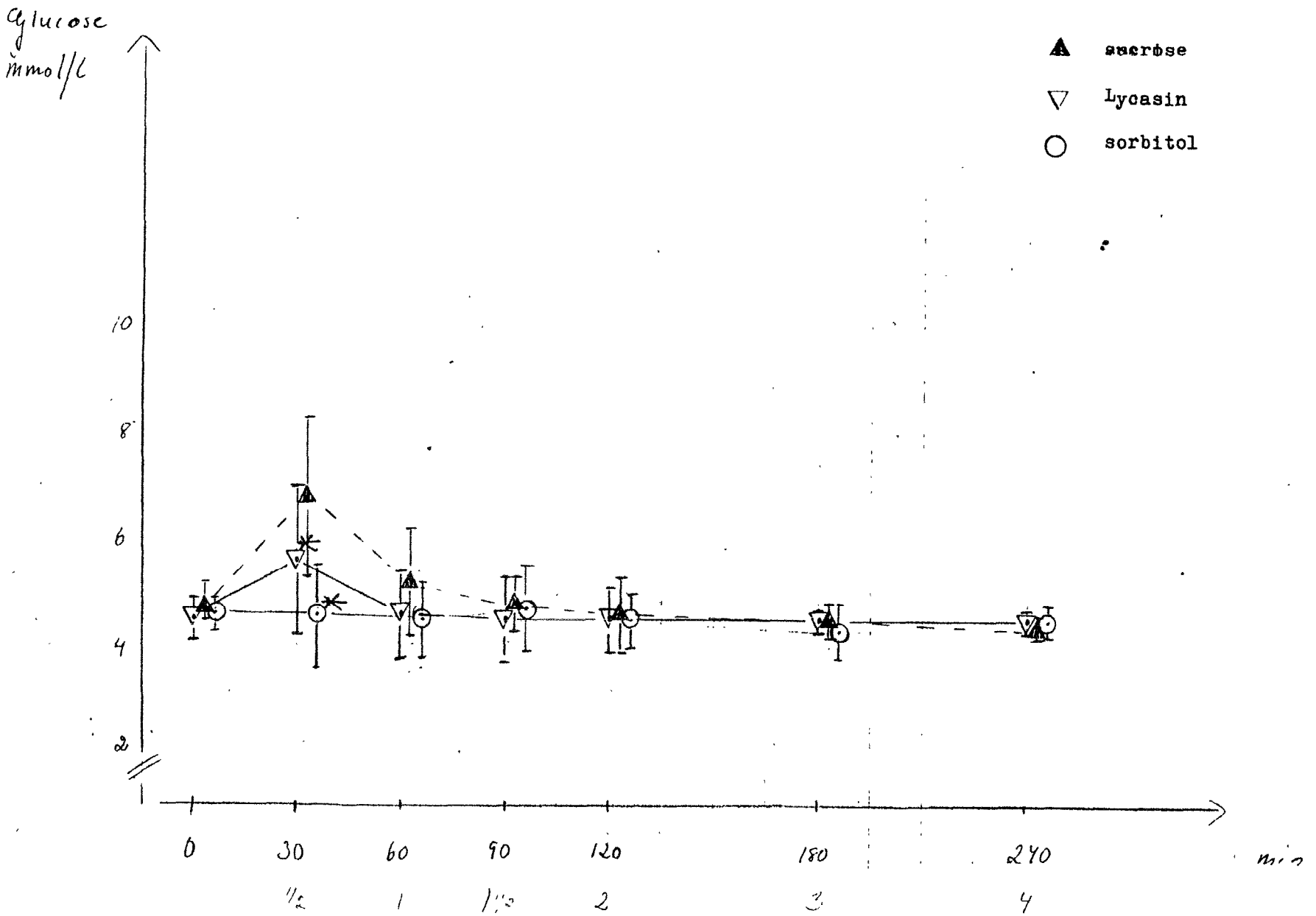


Fig 5.

Bloodglucose concentrations in healthy subjects (n=5) before and after a standardized breakfast (X ± SD)



Serum insulin concentrations in healthy subjects (n=5) before and after a standardized breakfast ($\bar{X} \pm SD$)

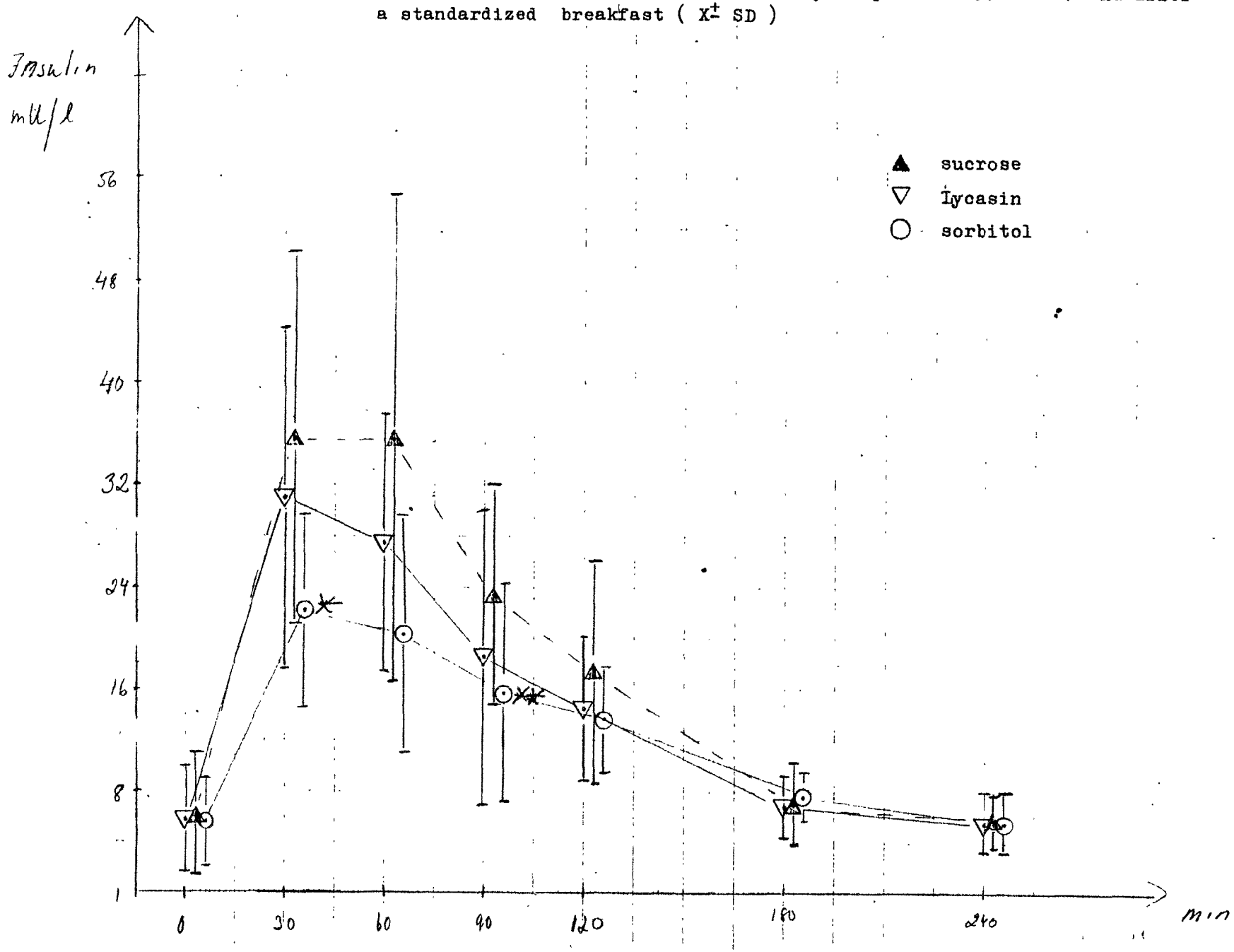


Fig 7.

Blood glucose concentrations in type ll diabetics (n= 5)
before and after a standardized breakfast (X ± SD)

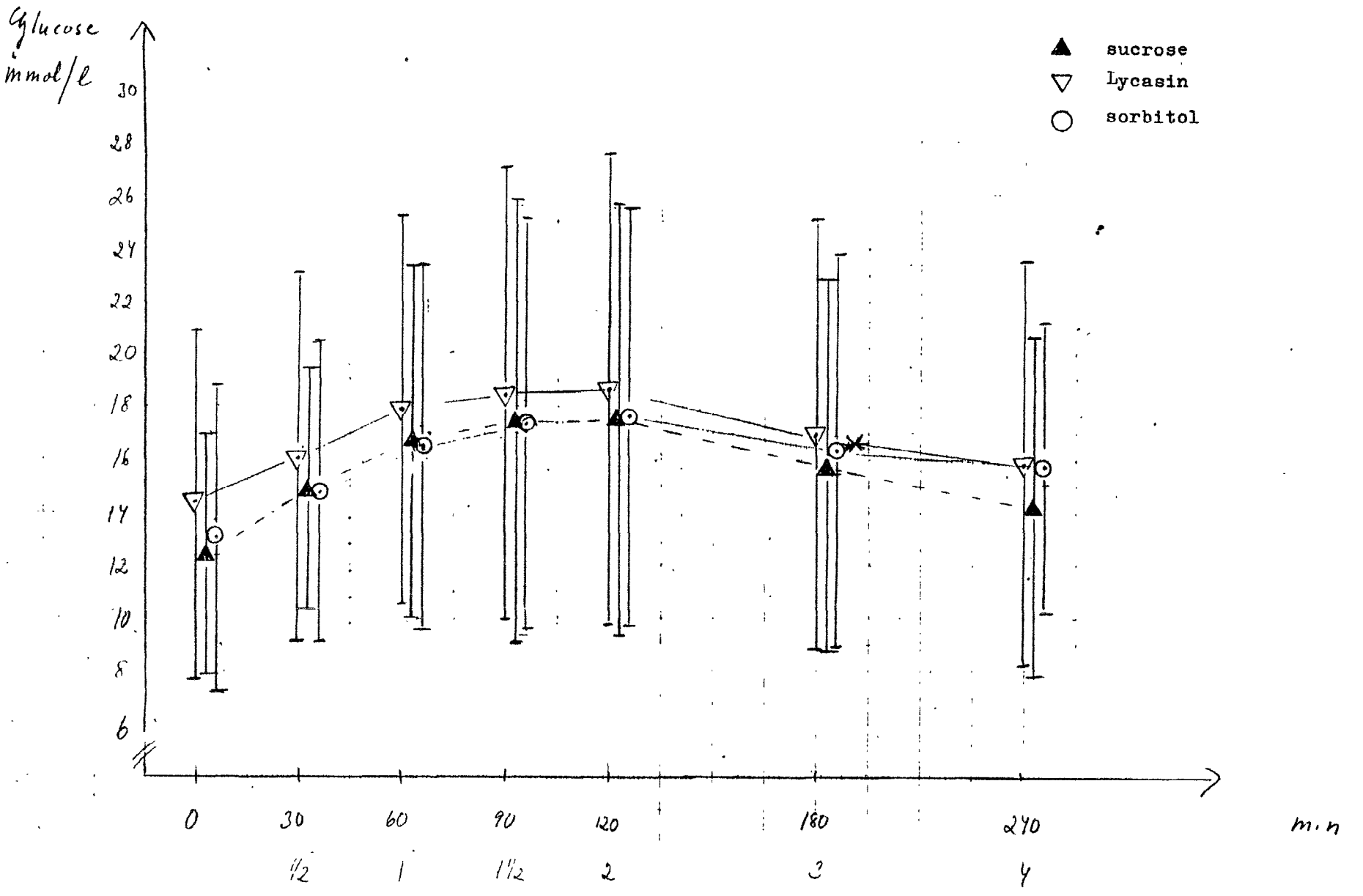


Fig 8.

Serum insulin concentrations in type II diabetics (n=5) before and after a standardised breakfast (X ± SD)