THE NEGATIVE NITROGEN BALANCE IN POST-OPERATIVE PAEDIATRIC PATIENTS

Pages with reference to book, From 55 To 58

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Abstract

The spectrum of the protein waste in 36 paediatric patients undergoing abdominal explorationsyv/ho were infused three different concentrations of dextrose solutions without aminoacids is presented. When 10 and 15 per cent dextrose solutions were infused insulin levels increased, free fatty acids decreased and much more protein was wasted. The mean nitrogen losses in groups of 5%, DW, 10% DW and 15% DW were 146.39, 22.56, and 333.69 mg/kg/ day, respectively. This means that, low glucose and insulin levels allow greater endogenous fat mobilization, thus spare more body protein. (JPMA36: 55, 1986).

INTRODUCTION

After major surgical operations patients are in a severe period of catabolic response to stress and starvation. During such period limited nutritional intake results in negative nitrogen balance leading to increased morbidity and mortality.

It is known that intravenous dextrose solutions stimulate insulin secretion and it inhibits fat mobilization. Because of decreasing lipolysis, greater proteolysis might occur to meet obligatory energy requirements. Therefore, body protein cannot be preserved[1,2].Some investigators demonstrated the protein sparing effect of dextrose-free aminoacid solutions. They suggested that mobilization of body lipids could be possible at low insulin levels[1,3-5] Since the release of insulin by the pancreas is stimulated normally by increasing concentrations of blood glucose, efficient protein sparing cannot possibly be achieved by dextrose infusions.

In the present study, an attempt was made to investigate the spectrum of the protein waste in surgical paediatric patients who were infused three different concentrations of dextrose solutions: 5%, 10%and 15%.

MATERIAL AND METHODS

Thirty six children (21 boys and 15 girls) 3 to t5 years of age and an average of 24 kilograms weight were studied. Patients undergoing elective abdominal operations were divided into three groups to be infused after operations. In group 1,5 per cent dextrose, group II, 10 per cent and group III, 15 per cent dextrose solutions were given for five days with routine electrolytes and vitamins, without aminoacid solutions and without any oral intake.

All the patients had normal electrolyte, blood counts, BUN and blood proteins pre and postoperatively. Patients with diabetes, malnutrition, sepsis, malignancies, liver or kidney failure and other complications were not included. There was no statistically significant difference in the average preoperative weight among the three groups (P> 0.500). The dextrose solutions with the electrolytes were prepared in the Hospital's pharmacy. Amounts given to each patient were administrated through peripheral veins using metal scalp needles.

The patients were weighed every morning and daily fluid intake and output were recorded. Blood glucose, urine glucose and ketone levels were measured twice (Figure I). On the fifth day blood glucose, insulin, free fatty acids (FFA) and urine nitrogen losses were measured. 24 hour urine was collected through a cathater and urinary nitrogen losses were determined by macro Kjeldahl technic with Nessler solution[6]. Insensible nitrogen losses through the gastrointestinal tract and skin were also included. Insensible nitrogen losses were estimated at 15mg per kilogram per day[2,7]. Free fatty acid levels were measured by the method of Dole[8], and insulin determinations with radioimmunoassay technic[9,10].

Preoperatively blood glucose, insulin and free fatty acid levels were in normal limits. Twelve patients, 4 from each group, given normal balanced diet were studied preoperatively and nitrogen balances were calculated according to the difference of nitrogen intake and output. It was estimated that every gram of nitrogen is the product of 6.25gm of protein[11,12]. Twelve preoperative patients who had taken normal diet were given approximately 1-2 gm/kg protein orally, and they were all in positive nitrogen balance. Statistical measurements were done by using Student 't' test.

RESULTS

During the infusion of the solutions, no serious electrolyte imbalance, liver and renal abnormalities occurred. Local infections were not seen either. Urine glucose levels were not higher than 3 + .Mean glucose levels of all patients in each group is shown in Figure I.

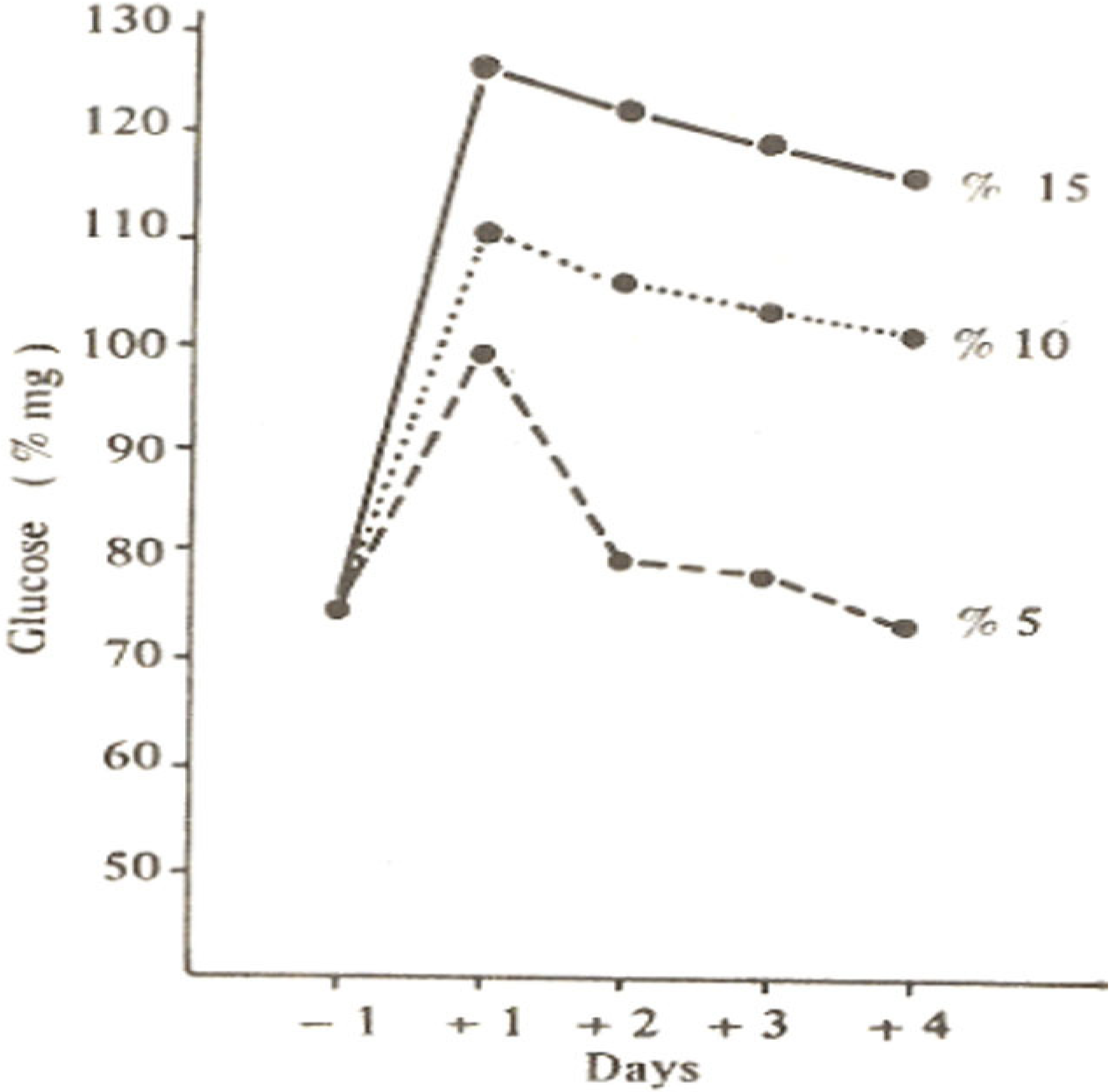

Fig. 1. Daily serum glucose levels in postoperative patients.

orally, and they were all in positive nitrogen balance.

Statistical measurements were done by using Student 't' test.

Differences in calorie intake in each group were statistically significant (P< 0.001) (Table I).

TABLE I
Mean Calorie intake per Day and Mean Weight loss during the Postoperative Period.

Groups	Calorie intake (Cal/kg/day)	Weight loss (kg)
Group I (5 % DW)	10.75 ± 0.69	0.60 ± 0.11
Group II (10%DW)	20.11 ± 1.29	0.73 ± 0.19
Group III (15%DW)	32.95 ± 2.45	0.70 ± 0.16

mean nitrogen loss was 229.56 mg/kg/day, and in group III where 15 per cent dextrose was used it was 333.69 mg/kg/day. It can be clearly seen that as glucose levels rise, FFA levels fall and nitrogen losses increase.

Mean glucose, insulin free fatty acid levels and urine nitrogen on the fifth day is shown in Table II.

TABLE II
Mean Glucose, Insulin, Free – fatty Acid levels and Urine Nitrogen on the Fifth Day

Dextrose	I 5%	II 10%	III 15%
Glucose % mg	74.50 ± 3.69 (47–88)	102.66±8.34 (63–156)	117.33±6.59 (72–158)
Insulin μU/ml	19.28±3.40 (9–30)	46.42±14.04 (13–108)	92.28±18.99 (27–165)
Free Fatty acids m mol/lt.	1.100±0.333 (0.660–1.650)	0.589±0.239 (0.165–0.900)	0.390±0.222 (0.110–0.750)
Urine nit-rogen mg/kg/day	146.39±29.64 (36.60–376.60)	229.56±27.16 (88–410.15)	333.69±26.04 (194.28–506.93)

In group I, who were infused 5 per cent dextrose solution, FFA mean level was I.I mmol/lt., in group II, its levels fell to 0.589 mmol/lt., and in group III, it fell to 0.39 mmol/lt. In group I, nitrogen loss was 146.39 mg/kg/ day. It is less than in other groups. In group II, mean nitrogen loss was 229.56 mg/kg/day; and in group III where 15 per cent dextrose was used it was 333.69 mg/kg/day. It can be clearly seen that as glucose levels rise, FFA levels fall and nitrogen losses increase.

Before beginning infusions, 12 preoperative patients who had taken normal diet were in positive nitrogen balance as they should be. All of the 36 postoperative r tients who had taken no proteins orally or intravenously, however, were in negative nitrogen balance (Figure 2).

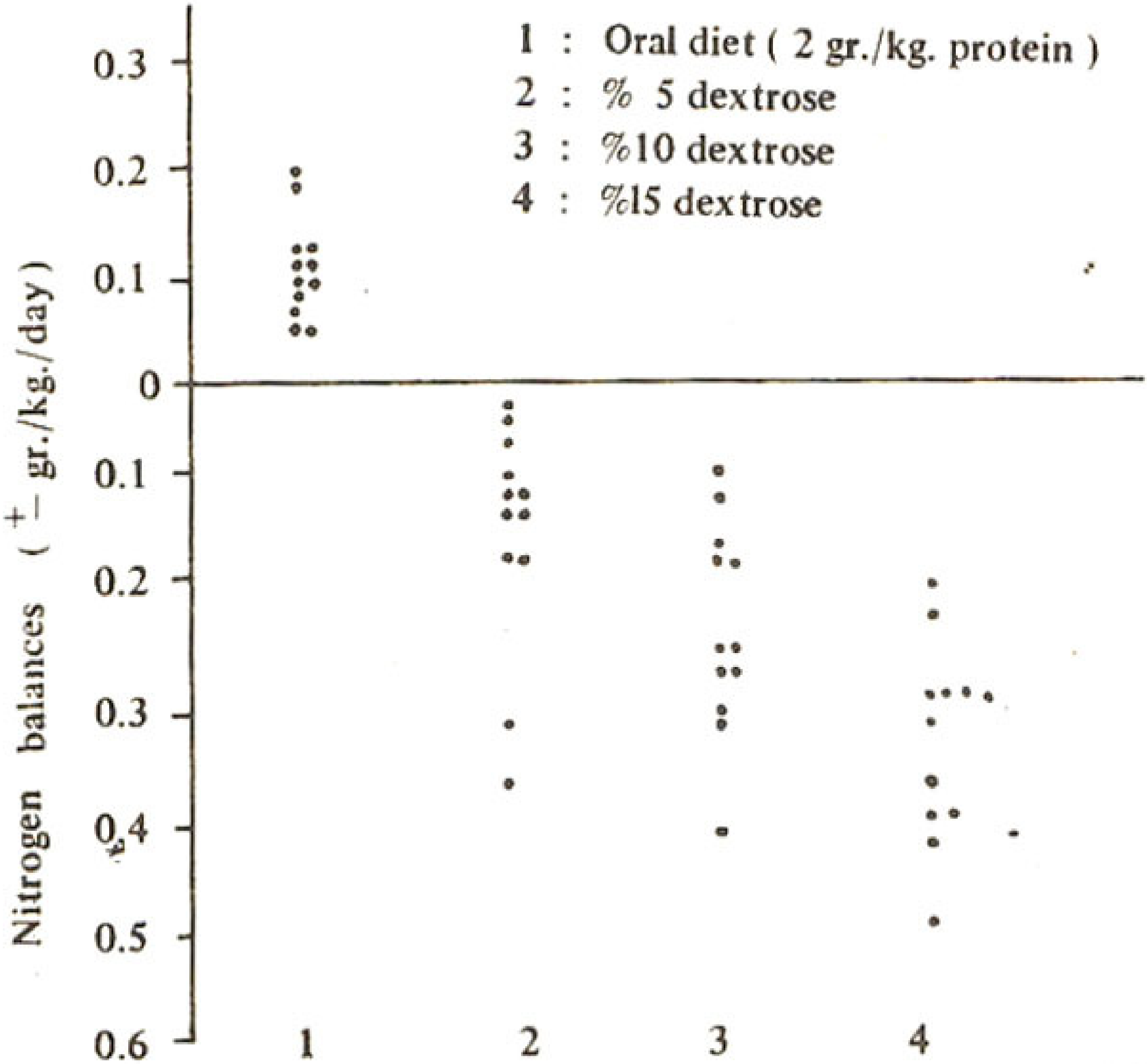

Fig. 2. Nitrogen balances of 12 preoperative and 36 postoperative patients.

Nitrogen losses in each group were different and all were statistically significant ($P < 0.001$). The relationship between serum glucose and free fatty acid levels and the correlation of nitrogen balance with serum free fatty acid levels are shown in Figures 3 and 4.

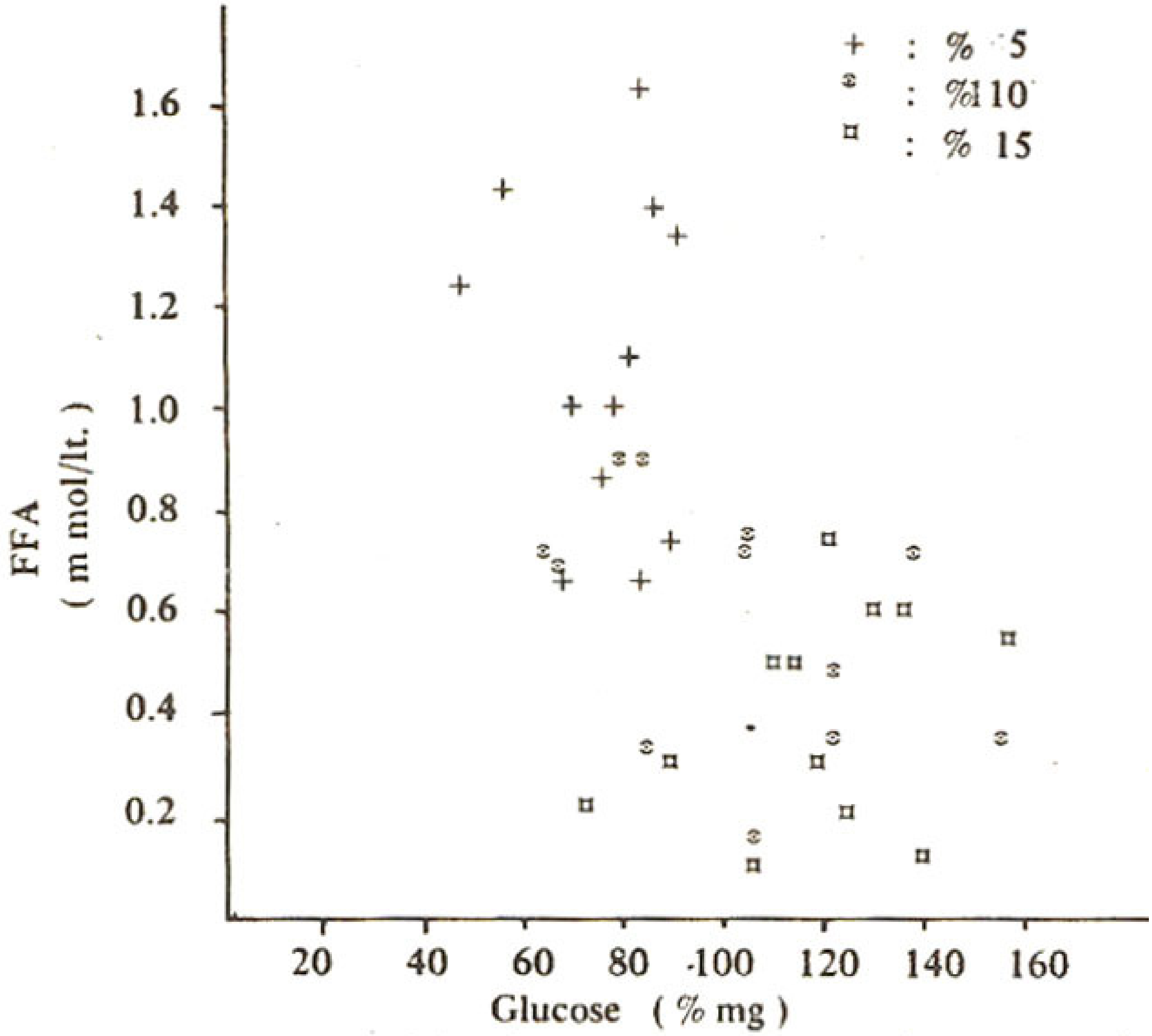

Fig. 3. The relationship between serum glucose and free fatty acid levels. Small glucose levels were associated with the greatest free fatty acid levels.

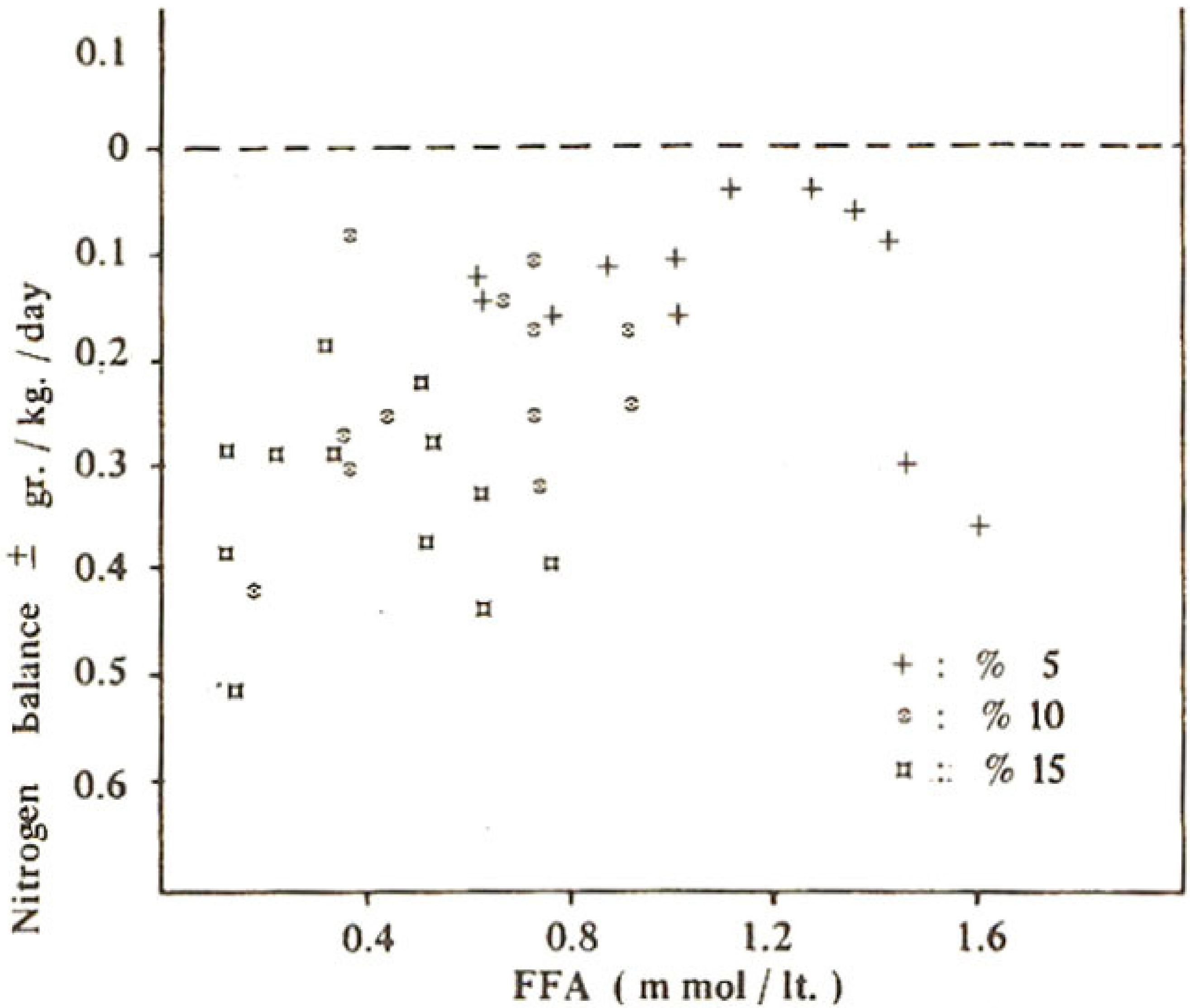

Fig. 4. The correlation of nitrogen balance with serum free fatty acid levels. Improved nitrogen balance was associated with higher free fatty acid levels.

DISCUSSION

During the early postoperative period elective abdominal operations, usually 5 per cent dextrose-in-water solutions are used, and amino-acid solutions are not given routinely, unless total parenteral nutrition is indicated. Some paediatric surgeons, however, prefer 10 per cent and even more concentrated dextrose solutions for extra calories. Those little extra calories will not help much to the nitrogen balance since decreased energy and protein intake still continue[1-3]. For the hypoglycemic conditions, more concentrated dextrose solutions should be necessary, but for the normoglycemic conditions they are useless.

For prolonged periods of fasting total parenteral nutrition is necessary with the use of carbohydrates, aminoacids and lipids[13-15]. Although aminoacid

As a result, when 10 per cent or 15 per cent dextrose solutions without aminoacids were infused instead of usual 5 per cent dextrose, it was found that insulin increased, free fatty acids decreased and much more protein is wasted.

solutions are not always given routinely for short periods of fasting after abdominal operations, it should be kept in mind that negative nitrogen balance still continues to be a problem. Beyond 24 hours of fasting, after glycogen deposits are finished, the body has only two main energy depots which enable him to survive: fat and protein. Since proteins are essential to all vital functions of the body, our main purpose should be to use the fat as the main energy source[13,16]. By giving more concentrated dextrose without aminoacids, much more protein is wasted. Glucose administration provokes an insulin response; insulin decreases the release of free fatty acids and leads to a reduction in fat mobilization. So, protein is wasted instead of fat[1,16]

Infusion of 5 per cent dextrose-in water is enough for the replacement of the glucose cata-bolised by the patient and spares the patient's tissue protein by reducing the need for gluconeo-genesis[16]. But, as the energy demands become higher, more energy sources like fat will be necessary[1,5,16]. It has been shown by Cahill[17] that the anabolic effects on muscle occurs at low insulin concentrations. Higher insulin levels are required for the inhibition of lipolysis. It means that a moderate reduction in serum insulin would be advantageous in postoperative patients, allowing active mobilization of fat stores while still maintaining muscle anabolism. So, fat mobilization will be possible by giving less glucose, and more protein will be spared. [1,2,16,17]

In conclusion, it can be said that the greatest nitrogen losses are seen to occur when free fatty acid levels are the lowest. It can be recommended that the body's own fat which has been already stored, should be used for better nitrogen balance.

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