Net acid excretion in people with and without type 1 diabetes before, during and after fasting

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Introduction & Objectives:

Fasting, a well-known holistic therapy refers to the voluntary renunciation of solid food and stimulants for a limited period of time [1]. According to fasting physicians, fasting or food withdrawal in people with type 1 diabetes (t1d) is a risk and should only be carried out under medical supervision [2]. Without sufficient insulin supply, people with t1d can develop ketoacidosis [3]. Therefore, ketone bodies in t1d are usually regarded as an alarming sign of ketoacidosis. The determination of the net acid excretion within one day allows accurate statements to be made about the acid-base balance. According to Remer, the most specific parameters for representing the acid load of the organism are urinary pH and renal net acid excretion in the 24 hours urine collection [4]. We aimed examining whether fasting produces a higher endogenous acid load measured as NAE in people with type 1 diabetes compared to fasting in healthy controls as reference group.

Materials & Methods:

Thirty participants were included (20 with and ten without t1d) at three places in Germany. The intervention for both groups included ten days of fasting according to Buchinger fasting method and took place in a Seminar-Center near Brandenburg.

Liquid consumption of Buchinger fasting method:

- 2-2.5 liters per day (teas, juices and broths, water as desired)
- vegetable broth, based on carbohydrate-free vegetables (e.g. tomato, carrot, celery, leek, onion, zucchini etc.), freshly prepared:
  - depending on basic constitution (250 ml/350 ml/500 ml)
  - optional addition of (minimal) salt doses
- Vegetable juice (¼ l) with max. 3-4 CU/d; e.g. contain 250 ml carrot juice 1.5 CU and 75 kcal
- Herbal teas to taste (fennel, anise, caraway, chamomile, horsetail, nettle, blackberry, etc.)
- Gruel

Dietary intake: The intake of all food was documented by the participants per collection time in the dietary protocol. The energy supply of the respective foods and beverages was calculated in kcal. PRAL was calculated according to Remer and Manz [4, 5].

Dietary intake	Blood analyses	Urine analyses
• Kcal • PRAL	• Glucose • Ketone bodies	• NAE • Organic acid • Citrate • Urea • Creatinine

Fig 1: Methods

Measurements and laboratory analyses: Blood glucose and ketone bodies were measured daily at 4 fixed times (6 am, 12 pm, 6 pm and 10 pm) and documented in the case report files. The participants collected four successive 24-h urine samples in the study. Urine was collected at the respective days 0/2/5/8 in the designated containers. The measurement of net acid excretion (NAE) was calculated as titratable acid plus ammonium minus bicarbonate (NAE = TA + NH_4^+ - HCO_3) [6]. Further methods are shown in Figure 1.

Results:

A total of 30 participants were recruited in the trial centers, as shown in the flow chart according to the Consort 2010 Flow Chart (Figure 2). Finally, the data of 26 participants, 17 diabetics and 9 non-diabetics could be evaluated. The data analysis included 23 women and 3 men.

The data on energy supply (kcal) between the groups did not indicate any significant difference (p = 0.810). Thus, the energy supply was the same between both groups in the fasting process (day 0 to day 8) and especially in fasting (day 2 to day 8).

The analysis of PRAL of diabetics was lower than that of non-diabetics across all days (p =0.0-09). The descriptive statistics as well as the analysis of the repeated measurements made it clear that the diabetics in fasting with and without day 0 had a lower potential renal acid load and thus had a more basic diet. It was clear that the diabetics had a tendency towards lower NAE values. The proc-mixed analysis by SAS did not find any significant difference between the two groups in fasting (p = 0.139), see Figure 3. On fasting days without day 0, the acid excretion in the groups was significantly different (p = 0.028).

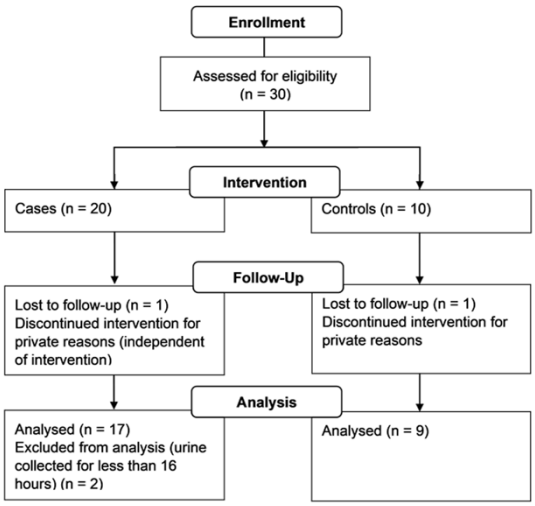
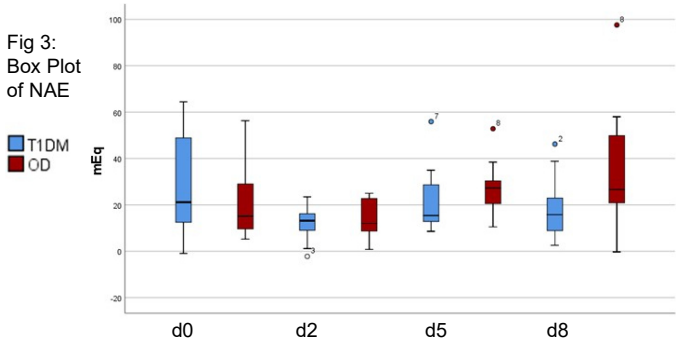


Fig 2: Flow chart from enrollment to data analysis

Fig 3: Box Plot of NAE



Conclusion:

On one hand, according to descriptive statistics, the energy intake of diabetics was higher than that of the controls, and on the other hand, the acid load (PRAL) was lower because diabetics drank significantly more juices and thus had a more basic diet. The urinary pH decrease reflects the increased acid load during fasting, which is probably mainly the result of an increased production of organic acids such as ketone bodies [7]. All in all people with type 1 diabetes do not seem to be at higher risk of acid-base disbalance when fasting.

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