

The Assessment of the Absorption of Elemental Diet (E028) by Crohn's Patients, Using Breath Hydrogen Measurements

CROHNLU HASTALARDA ELEMENTAL DİYET EMİLİMİNİN HİDROJEN NEFES TESTİ YAPILARAK DEĞERLENDİRİLMESİ

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SUMMARY

The hydrogen (Hz) breath test have been used for the diagnoses of the gastrointestinal disease. Elemental diets may be effective in the treatment of Crohn's disease, because the remission in the disease activity mainly provided by improved nutritional status, exclusion of toxic dietary factors and the results of bowel rest. It is thought to occur because elemental feeds contain protein as individual amino acids, carbohydrate as glucose or oligosaccharides and either a low lipid content or medium chain triglycerides, and so they require little enzymatic hydrolysis in the lumen or mucosa.

38 patients with Crohn's disease receiving special nutrition (22 E028, 6 Peptide and 10 TPN), 5 patients with irritable bowel syndrome (IBS) (all receiving E028) and 3 obese patients who had starved at least 72 hours allowed to drink only spring water were studied.

The mean average breath H₂ concentration during the 8 hour study period for patients with Crohn's disease receiving elemental diet was 8.5 ppm (range 4.5-30.5) and for patients with IBS receiving elemental diet was 8 ppm (range 5.5-10). The mean breath H₂ in fasting obese patients was 6.5 ppm (range 5-7.5) and in testing whilst receiving TPN 6 ppm (range 4.5-8.5). This suggests that an average 4.5-8.5 ppm Hz is derived from the fermentation of colonic mucopolysaccharides.

The mean breath Hz in volunteers after an overnight fasting was 8 ppm (range 6-11) and after mouth washing with E028 over one hour the Hz concentration rose to 10 ppm (range 9-12). This suggests that at least an additional 2-3 ppm Hz comes from the dental flora. The expected average breath Hz for patients on an elemental diet would be 4-8 ppm from colonic mucopolysaccharides fermentation plus 2-3 ppm from the dental flora.

In conclusion it appears that even in the presence of small bowel Crohn's disease an elemental diet is completely absorbed in the small bowel and may therefore be providing 'bowel rest', and fasting or receiving TPN patients producing Hz because colonic bacteria influencing on the mucopolysaccharides secreted by the mucosa.

Key Words: Elemental diet, Hydrogen breath test, Crohn's disease

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ÖZET

Solunum hidrojen (Hz) testi son yıllarda gastroenteroloji kliniklerinde yaygın olarak kullanılan, bakterilerin kolonda karbonhidratları parçalamasıyla oluşan, Hz'nin solunum havasından ölçülmesi esasına dayanan, noninvaziv, ucuz ve kolay bir tanı yöntemidir. Ayrıca karbonhidratların kolona ulaşmadan önce bakteriel parçalanmaya uğrayıp uğramadığını ve ince barsakta aşırı bakteri üremesinin olup olmadığını gösterebilmesi açısından da oldukça önemli teşhis kolaylıkları sağlamaktadır.

Ağızdan gıda alınmasının hiç olmadığı durumlarda da (total parenteral beslenme (TPN) ve starvasyon) solunum Hz testiyle kolonda az miktarda Hz üretildiğinin gösterilmesi, barsak sekresyonundaki mukopolisakkaritlerin bakterilerce parçalanıp Hz üretildiğine işaret etmektedir.

Crohn hastalığının tedavisinde barsak istirahatinin önemli olduğu ve nutrisyonel durumun düzelmesinde remisyona sağlanmasında etkisi dikkati çekmiştir. Elementel diyetin tümüyle ince barsakta emildiği ve kolonda bakterilerin fermentasyon etkisini minimuma indirdiği bildirilmiştir.

Klinikte çeşitli yöntemlerle tedavi gören 38 Crohn'lu hastada solunum Hz testi yapıldı. Bunlardan 22'si elementel diyet, 6'sı peptid diyet ve 10'uda TPN almaktaydı. Ayrıca iritabl kolon sendromlu 5 hasta elementel diyet almakta iken ve 3 obes hastaya da bir haftalık starvasyon uygulanırken, Hz nefes testi yapıldı. Ayrıca sağlıklı 6 kişi oral floranın hidrojen üretimine etkisi açısından değerlendirilmek üzere kontrol grubu olarak çalışıldı.

Sabah 9° akşam 17° saatleri arasında her yarım saatte bir 20 ml'lik plastik şırıngalarla alınan solunum havasında Hz konsantrasyonu GMI ile ölçüldü ve günlük ortalama değerler (Parts Permillion) ppm olarak karşılaştırıldı.

Elementel diyet alırken yüksek Hz üreten 3 hastanın ince hamaklarında aşırı bakteri üremesi olduğu başka bir gün yapılan glukoz-solunum Hz testi ile gösterildi.

Sonuç olarak elementel ve peptid diyetlerin tam olarak ince barsakta emildiği, TPN alan ve starvasyon uygulanan hastalar ile eşit oranda Hz üretildiğinin göstermesiyle kanıtlandı. Hiç oral besin almayan (TPN ve starvasyon) hastalarda da az ve sabit miktarda solunum havasında Hz ölçülmesi barsaktan sekrete edilen mukopolisakkaritlerin bakterilerce parçalanmasına bağlı olduğu düşünüldü. Ayrıca elementel diyet absorpsiyonu bozulmuş olan 3 hastanın ince barsağında bakteriel aşırı üremenin söz konusu olduğu glukoz-solunum Hz testi ile gösterilmiş olup emilim bozukluğuna aşırı bakteri üremesinin sebep olduğu, normal şartlarda elementel diyetin kolona ulaşmadan emiliminin tamamlandığı kanaatine varılmıştır.

Anahtar Kelimeler: Elementel diyet, Hidrojen nefes testi, Crohn hastalığı

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Table 1. Patients studied

	No	H ₂ ppm (Average Results)
Crohns disease	38	
TPN	10	6(4.5-8.5)
Peptide	6	9 (5-23)
Elemental diet (E028)	22	8.5 (4.5-30)
Irritable bowel syndrome (E028)	5	8 (5.5-1.0)
Obese persons (only water by mouth)	3	6.5 (5-7.5)
Healthy volunteers (fast and clean mouth)	6	8 (6-11)
(Some patients while mouth rinsing with E028)	6	10 (9-12)
Total	52	

Small bowel bacterial overgrowth is a syndrome of nutrient malassimilation associated with various clinical conditions. Three of our patients with Crohn's disease had produced abnormal breath H₂ (>11 ppm) and a 50 gr glucose load have been given and H₂ breath test performed on these patients who had small bowel involvement (Table 2).

The expected average breath H₂ for patients on an elemental diet would be 4-8 ppm from colonic fermentation plus 2-3 ppm from the dental flora, following mouth rinsing with elemental diet (E028). This agrees with the observed results of Crohn's 3 patients elevated (i.e.>11 ppm) average breath H₂.

DISCUSSION

The technique of exhaled breath H₂ monitoring is a non-invasive, simple and inexpensive test (11). It has major advantages over traditional methods for the investigation of suggested upper intestinal bacterial overgrowth, carbohydrate intolerance or disordered transit (11,12).

This study confirms that the carbohydrate in elemental diets is fully absorbed in most patients with Crohn's disease (3,12). It is likely that this is paralleled by complete absorption of the amino acid and fat content (5).

An alternative treatment which has found many advocates in recent years, is limited bowel rest by elemental diet or complete bowel rest by TPN (14). The proposed rationale for such treatment is that the absence of intraluminal nutrients, i.e. bowel rest, minimises motor and transport functions of the diseased bowel and thus allows for a reduction in the inflammation (3). The use of standard hypotonic intravenous solutions with bowel rest in patients with Crohn's disease

would result in rapid protein-calorie depletion (12). Total parenteral nutrition, however, by delivering adequate calories and other essential nutrients offers the advantage of maintaining or improving the nutritional state, that could also contribute to patient recovery (1,3,8).

Most studies to date have assessed the overall effectiveness of elemental diet in a large number of patients with Crohn's disease. The effect of site and severity of the disease on the success of treatment, induced by bowel rest and the longterm outcome after diet induced remission (14,15,16).

There is evidence from others that an approach involving the removal of antigens from the gastrointestinal tract may be effective (7). O'Morain et al (3) showed that an elemental diet -without antibiotics- was as effective after 28 days of therapy as corticosteroids in patients with mild or moderately active disease. Hunter and coworkers (7) have stimulated considerable interest in their preliminary findings that some patients with non-specific diarrhoea and Crohn's disease may symptomatically improve by exclusion of specific foods from their diet (7a).

The measurement of H₂ may be diagnostically useful in the patients who produce high levels of H₂ after, E028 by evaluating glucose load (17). 3 of 38 patients had an abnormally high breath H₂ profile. A glucose-breath H₂ test was performed in those 3 patients and the result was abnormal, suggesting that the rise in breath H₂ whilst taking E028 represents small bowel colonisation and that carbohydrate fermentation by bacteria (8,11). These patients had an underlying cause to explain raised level of H₂ production, extensive disease or extensive resection which could lead to small bowel colonisation (Table 2).

Table 2. The clinical details of 3 patients with abnormal level of H₂ breath test.

Patients	Average breath H ₂ with E028	Glucose breath test	Clinical details
1	30.5 ppm	+	extensive small bowel resection (110 cm)
2	28.7 ppm	+	extensive ileitis
3	16.0 ppm	+	ileocolitis

H₂ production by the oropharyngeal microflora adversely influences data interpretation (18). After an overnight fast and abstinence from morning teeth brushing, six healthy volunteers collected basal breath **H₂** samples which was repeated every 10 minutes for 1 hour, following two minute mouth rinse with E028 solution. The results suggest that at least an additional 2-3 ppm **H₂** comes from the fermentation by dental flora (17,18).

The early peak is not caused by rapid transit of a component of the meal consistent with fermentation by small intestine bacteria. Oral application of E028 gives rise to breath hydrogen levels 2-3 ppm above basal which was reduced by oral hygiene. This response occurred within minutes of administration but its duration was not monitored for longer than five minutes. Thompson et al (18) showed a similar rise in breath hydrogen after oral application of 20% sucrose. The timing of the rise, peak and fall in breath hydrogen after sucrose was very similar to that observed in our study using E028 solution.

The mean breath **H₂** in the fasting obese patients was 6.5 ppm (range 5-7.5) and in those patients receiving TPN 6 ppm (range 4.5-8.5). This suggests that an average 4.5-8.5 ppm **H₂** is derived from the fermentation of colonic mucopolysaccharides (18).

In summary, it appears that even in the presence of small bowel Crohn's disease an elemental diet is completely absorbed in the small bowel and may therefore be providing 'bowel rest', patients fasting or receiving TPN produced **H₂** because colonic bacteria influencing on the mucopolisaccharides secreting by the mucosa.

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