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Gastric emptying and intestinal retention time in two different breakfast versions: a combined sodium- ^{13}C acetate / lactose- ^{13}C ureide-breath test study

^{13}C -Atemtest und Magenentleerung

Introduction

Werner Kollath (1892-1970) described the transit time of various nutrients according to their degree of processing.

Aim

The aim of the presented study was to measure gastric emptying and intestinal transit time by using a ^{13}C breath test in two different breakfast versions.

Materials and methods

Twelve healthy volunteers aged 28-55 years ingested two different kinds of breakfast in a cross-over study. One breakfast consisted of whole-grain wheat flakes as a basis (Kollath-breakfast), the other breakfast version was a conventional breakfast made up of wheat flour rolls, marmalade, butter, and coffee with sugar. The volunteers ingested 50 mg sodium- ^{13}C acetate and 1 g lactose- ^{13}C ureide with each breakfast. Breath samples were taken over a 24-hr-period. ^{13}C enrichment in breath was measured by CF-IRMS (Europe Scientific, Crewe, UK).

Results

After intake of the conventional breakfast vs. the KOLLATH-breakfast two ^{13}C peaks were measured. The first ^{13}C peak reached maximum levels after 1.25 h with DOB-values of 12.0 vs. 12.5. Gastric emptying was, therefore, identical in both breakfast versions. The lowest CO_2 levels were reached after 3.5 h and 2.5 h with DOB-values of 5.2 and 7.8, respectively. The maximum ^{13}C levels of the second peak were reached after 7.0 h and 6.5 h with DOB-values of 11.4 and 22.2, respectively. After 14 h ^{13}C enrichments declined to near base-line level. Intestinal retention times were 11.5 h after the Kollath-breakfast and 10.5 h after the conventional breakfast. The oro-coecal transit time, therefore, was 1 h shorter in the KOLLATH-breakfast than in the conventional breakfast group.

Discussion

The first ^{13}C peak is the result of resorption and oxidation of sodium- ^{13}C acetate and reflects the gastric emptying time - this was equal in both breakfast versions. The second ^{13}C peak is the result of bacterial degradation of lactose- ^{13}C ureide in the colon. It could be shown that the KOLLATH-breakfast prolonged intestinal retention time by 1 h compared to the conventional breakfast.

Conclusion

The combined sodium- ^{13}C acetate / lactose- ^{13}C ureide breath test is an adequate non-invasive method of measuring gastric emptying time and intestinal retention time. This study revealed that an ingested whole-grain wheat meal vs. a conventional meal consisting of wheat flour has the same gastric emptying time, a shorter oro-coecal transit time, and a prolonged intestinal retention time.