TREATMENT OF CHILDREN WITH HELICOBACTER PYLORI INFECTION AND MALABSORPTION SYNDROMES WITH PROBIOTICS: COMPARISON WITH CONVENTIONAL METHODS

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Abstract

It is stated that in developing countries a high rate of Helicobacter pylori infection among new-borns and young children occurs. It is further assumed that this incidence may lead to inhibition of defense mechanism (inhibition of acid secretion) against bacteria, per orally ingested. This may result in excessive colonisation of the small intestine by bacteria. This situation may become a major cause for chronic malnutrition and diarrhoea syndrome with failure to thrive. This project aims at determining the occurrence of Helicobacter pylori infection in children at young age. It is aimed also at tracing the relationship between the Helicobacter pylori infection and the state of undernourishment. Finally it is aimed at comparing the usefulness of pre-/probiotics as anti-infection treatment.

The methods used to demonstrate above mentioned parameters are based on stable isotopes, $^{13}CO_2$ and H_2 breath tests mainly. To assess nutritional status and progress in growth conventional anthropometric techniques will be used, complementary to the results obtained by stable isotopes.

It is put forward that the use of pre-/probiotics, instead of antibiotics, will suppress upper gastrointestinal infection and restore the intestinal cell capacity to assimilate all food ingredients.

1. SCIENTIFIC BACKGROUND OF THE PROJECT AND SCOPE OF THE PROJECT

Helicobacter pylori establishes a persistent, probably life-long infection in the stomach of its host. The infection can develop into chronic inflammatory conditions such as active gastritis, peptic ulcer disease and incidentally gastric cancer [1-3]. In acute infections, there is a period of hypochlohydria. During this period the gut mucosas first line defense is undermined. This renders the host more susceptible to assaults from other intestinal pathogens. It results in promotion of colonisation of pathogens in the small intestinal tract, which come into competion for nutrition of the host. Undernourishment and failure to thrive are signs of this pathological condition [4-7].

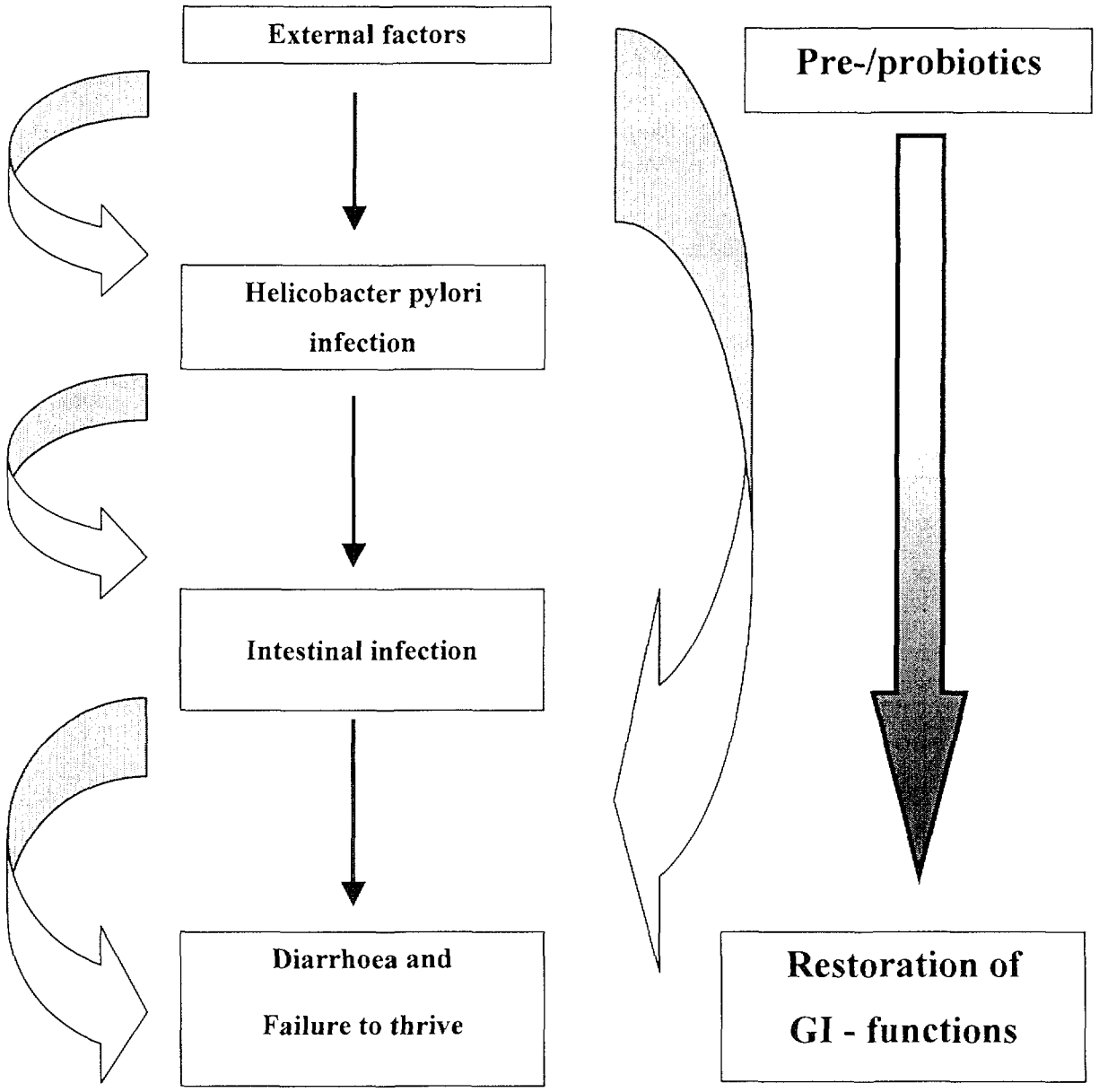
This statement however has seriously been compromised by a recent consensus, issued by the European Helicobacter pylori Study Group and the Helicobacter pylori Working group of the European Society for Paediatric Gastroenterology [8], which groups agreed that in developed countries there is at present no indication for widespread screening for Helicobacter pylori infection in symptomatic and asymptomatic children. But in developing countries the prevalence of infection is very high and may represent a long-life condition, which makes the gastrointestinal tract very vulnerable to pathological bacterial invaders.

Therefore the scope of the present project is double:

First: Which is the significance of bacterial infections of the upper part of the gastrointestinal tract in view of diarrhoea morbidity, mal-assimilation and failure to thrive?

Second: Can pre-/probiotics improve the nutritional status of infected children, and are they a promising tool to use on a larger scale in developing countries?

This goal can be visualised as follows:



1.1. Gastro-intestinal infections

Developmental regulation and nutritional processes influence bacterial toxin interaction to microvillous membrane receptors and signal transducers. The mucosa forms the first barrier to antigens presented at epithelial surface. The mucosal barrier comprises several components, including gastric pH, gastric and pancreatic enzymes, a glyco-protein rich mucin layer and an intact microvillous enterocyte surface under growth control. Surface immunoglobulin IgA and IgM also provide surface protection

On exposure to antigens and bacteria, the intestinal epithelium mounts an immune response. This immune response depends on the balance between the antigen-handling and antigen-presenting capabilities of the intestinal mucosa. It also depends on the bacterial adherence and colonisation and the release of inflammatory cytokines from the epithelium. There is a fine balance between the release of pro-inflammatory and anti-inflammatory response at the epithelial surface [9].

Toxins, secreted by bacteria may damage the immunological mechanisms of the intestinal barrier, form the basis of diarrhoea in childhood and may lead to morbidity and mortality [10]. However some bacterial products may play a beneficial role in the maintenance of the integrity of the intestinal epithelium. Such metabolite is butyrate, a short-chain fatty acid that is formed upon fermentation of carbohydrates (prebiotics). Butyrate may not only be energy source for colonocytes, but also stimulates epithelial cell proliferation and cytokine release [11].

1.2. Pre- and probiotics: definitions and properties

Prebiotics: "a nondigestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria"[12]. Preferred target organism for prebiotics are species belonging to the *Lactobacillus* and *Bifidobacterium* genera, which are part of the normal gut flora. The yeast *Saccharomyces boulardii*, normally not present in the gut flora, may also be considered as probioticum.

Prebiotics are beneficial for the epithelial cell in a direct way by providing cell fuel (butyrate) and energy for the host (propionate, acetate) and in an indirect way by stimulating microorganism that shows probiotic properties.

Probiotics: probiotics aim to produce a beneficial effect on the host by administration of viable microorganisms [13]. A review of the role of probiotics in the control of human health has recently been given [14]: enhancing host's immune response, suppression of growth and/or activity of pathogenic intestinal microorganism, production of butyrate. Among the list of probiotic agents, of which the genera *Lactobacillus* and *Bifidobacteria* are the most prominent, the yeast species *Saccharomyces boulardii* has been shown to exert very beneficial effects too. The yeast is therapeutically in use as effective treatment in case of antibiotic induced diarrhoea, *Clostridium difficile* infection, infectious diarrhoea, diarrhoea in critically ill tube-fed patients, HIV-associated diarrhoea.and very recently is has been demonstrated that *Saccharomyces boulardii* exerts pronounced probiotic properties by adhering to *Escherichia coli* and *Salmonella tiphimurium* cell surface [15].

The administration of Saccharomyces is safe. In very seldom case *Saccharomyces boulardii* may give rise to sepsis, in the presence of indwelling catheders [16].

The interrelationship of pathological conditions and the use of pre-/probiotics are given on a separate figure.

1.3. Important note on the use of pre-/probiotics

In the Western countries it is most common to use ANTIbiotics to cure bacterial infections. In the present project the use of PRE-/PRObiotics is aimed at solving problems of small intestinal infection in young children in developing countries. The latest results on the use of Lactobacillus casei in the eradication of Helicobacter pylori are very promising [17]. Furthermore the use of pre-/probiotics precludes the problem of resistance to antibiotics. The technology to prepare pre-/probiotics can be acquired by the country itself, and makes it less dependent from foreign enterprises. It also guarantees that the pre-/probiotic substances become readily available to the population.

2. METHODS

The methods of investigation are twofold:

A. First: classical methods: growth will be assessed through measurements of body weight, length and mid-upper arm circumference at regular intervals. It is to be discussed which immunological parameter has to be analysed in blood serum to demonstrate immunological status: IgA, sIgA or IgM, number of neutrophiles.

B. Second: methods based on the use of $^{13}CO_2$ breath tests. These methods will be applied to demonstrate Helicobacter pylori infection and to investigate digestion-absorption or malabsorption of food ingredients. Special attention has to be given to the demonstration of bacterial overgrowth. This is done by measurement of H_2 in breath after administration of a non-absorbable carbohydrate (lactulose, insulin), given with the meal. (Hydrogen is a gas, which is typically formed by fermentation of carbohydrates and which is rapidly absorbed by the epithelial cell and excreted by the lungs.)

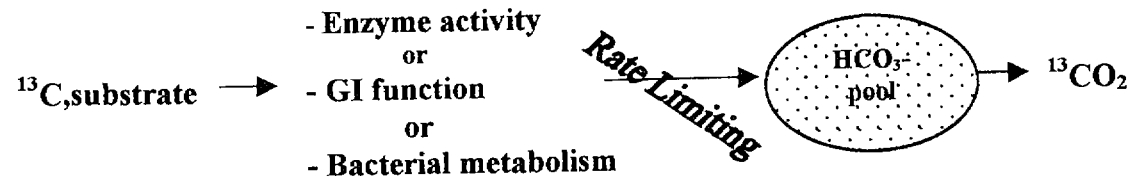
a. Introduction to $^{13}CO_2$ breath tests (BT):

The principle of $^{13}CO_2$ BT is the following:

Breath tests have the common characteristics that to an individual a substrate is administered, that bears the functional group in which a normally present ^{12}C atom has been replaced by the stable isotope ^{13}C. This functional group is cleaved enzymatically under specific circumstances, either during the transit through the gastro-intestinal tract, either during the absorption, or during further metabolism of the absorbed substrate. After cleavage the marked subgroups undergo a metabolic process that

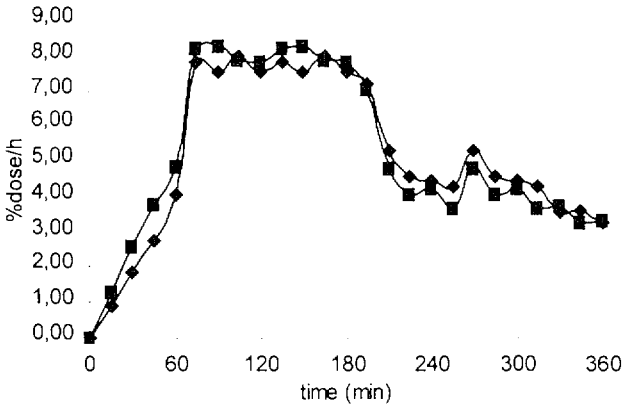
ends with expiration of the labelled CO_2. It is necessary that the speed determining (rate limiting) factor of the whole physiologic process is directly related to the genesis of $^{13}CO_2$. The $^{13}CO_2$ mixes with the body pool of CO_2 - HCO^-_3 and is breathed out. In this way the exhalation of $^{13}CO_2$ reflects the function to be investigated.

Schematically this process can be shown as follows:

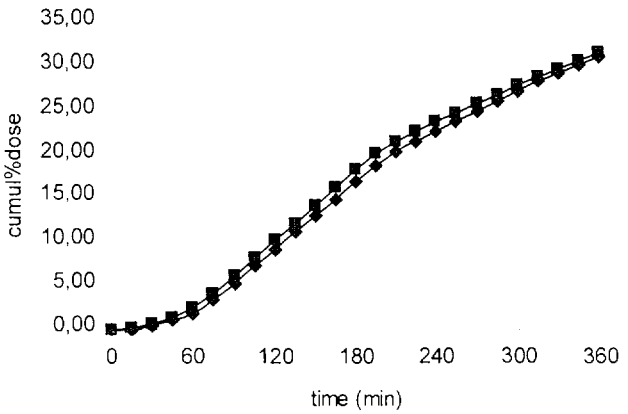


The ^{13}C,substrate has to be chosen in such a way that the enzyme/function/bacteria is the rate-limiting step in $^{13}CO_2$ production to demonstrate either enzyme activity, either a well-defined GI function, either bacterial metabolism by $^{13}CO_2$ measurement.
When the excretion of the tracer in breath is expressed as % dose per hour and/or as cumulative % dose excreted over a defined time period, a dynamic analysis of the examined parameter of the GI tract is obtained in course of time.

b. An example is given: ^{13}C, corn flakes to measure starch digestion



The curve above shows the evolution of $^{13}CO_2$ in breath, expressed in % dose /h, after the intake of a corn flakes meal. The curve below expresses the data in % dose cumulative over 6 hours. Both curves are the mean of 6 individuals; the experiment has been done in double to show reproducibility.



c. The mode by which the date, obtained by isotope ratio mass spectrometry are converted to the curves is given on the following page

- the amount of ^{13}C in breath CO_2 is measured by isotope ratio mass spectrometry (IRMS) as a delta-value (per mil) and can be transformed in mole fraction MF and mole percent MP(%), according to the following equations:

$$MF = \frac{1}{1 + \frac{1}{0.0112372 * \left(1 + \frac{\delta}{1000}\right)}}$$ with 0.0112372 = $^{13}C/^{12}C$ in the reference PDB

$$MP(\%) = MF \times 100$$

- these MF values are converted to percentage dose recovery (PDR) per hour of the initial amount administered

$$PDR(\%/h) = 100 * \frac{\text{excess } amount\,^{13}C_{\text{breath}}}{\text{excess } amount\,^{13}C_{\text{administered}}}$$

$$excess\ amount\ ^{13}C_{\text{administered}} = \left(MF_{\text{substrate}} - MF_{t0}\right) * \frac{m}{M} * n$$

with m = administered dose of the substrate in mg
M = molar mass of substrate, i.e. 60 mg/mmol for urea
n = number of labeled positions in the substrate molecule, i.e. 1

$$excess\ amount\ ^{13}C_{breath} = \left(MF_t - MF_{t0}\right) * CO_2\ production$$

with CO_2production = 300 mmol/(h.m^{2}BSA) (BSA = body surface area)

$$BSA = 0.024265 * \left(W^{0.5378} * H^{0.3964}\right)$$

W = weight of the subject in kg
H = height of the subject in cm

- the cumulative percent dose recovery (CPDR) is calculated from the PDR using numerical integration

$$CPDR_t = CPDR_{t-1} + \frac{PDR_t + PDR_{t-1}}{2} * (\Delta t)$$ with Δt = 0.30 h

d: $^{13}CO_2$ breath tests under consideration in the project:

^{13}C,urea breath test to demonstrate the presence of *Helicobacter pylori* in the stomach.

This is a well-known test, based on the use of ^{13}C,labelled urea which is cleaved by urease activity of the bacterium [17]. The test meal is pre-packed food which contains the ^{13}C,label. The instructions to perform the test are given on a separate sheet. Also given separately is the test protocol.

Corn flakes test to demonstrate starch digestion:

This test is based on the fact that corn-products are ^{13}C,enriched in a natural way. When milk and some sugar (as sweetener) is added to the corn flakes a very attractive meal is presented, which is well accepted by children (an example of $^{13}CO_2$ excretion in breath has been given above). On a separate sheet the instructions to perform the test are given. This test is new and data have has not

been published before. However, the results obtained coincide with the results, published previously, when pure starch has been administered [18].

The corn flakes test makes the test better accepted by the children as when only starch would have been given.

Choco cream test to demonstrate lipid digestion:

The choco smear contains the ^{13}C,mixed triglyceride which is the substrate of choice to demonstrate the digestion and absorption of lipids. The test meal differs considerably from the test meal as described originally [19]; the results are similar however. It is undoubtly great advantage that the ^{13}C,label is given in a meal which all children like. Instructions to perform the test are also included as Annex.

Other $^{13}CO_2$ breath tests may be considered to explore gastrointestinal functions also, i.e. protein breath test, gastric emptying, orocecal transit time. However some are of minor importance in relation to the project, others are too expensive (protein breath test) to be used at the early set-up of the study.

The main problem, encountered in the demonstration of food ingredient absorption by the use of labelled $^{13}CO_2$ is the CO_2 formed by bacteria in the small intestine. The bacterial contribution to CO_2 production to be taken into account. In all instances the presence of bacteria in the small intestine has to be documented in a non-invasive way (by measuring H_2 in breath).

Proposal of the study:

This design is subject to discussion by the participants and is open to modifications to improve the achievement of the final goal.

The study will be conducted in a parallel manner: two groups of patients, both *Helicobacter pylori* (Hp) positive, will be studied in a parallel way:

Group 1: patients to be treated in the conventional way to eradicate Hp
In children the treatment (ten days period) will be the following
Losec: 1 mg/kg and per day: single daily gift
Clamoxyl: 50 mg/kg, three times per day
Flagyl: 7.5 mg/kg, three times per day

Group 2: patients to be treated by pre-/probiotics, period three months
Pill of Saccharomyces boul. + 5 gram insulin, three times per day
Pill and insulin have to be suspended in water

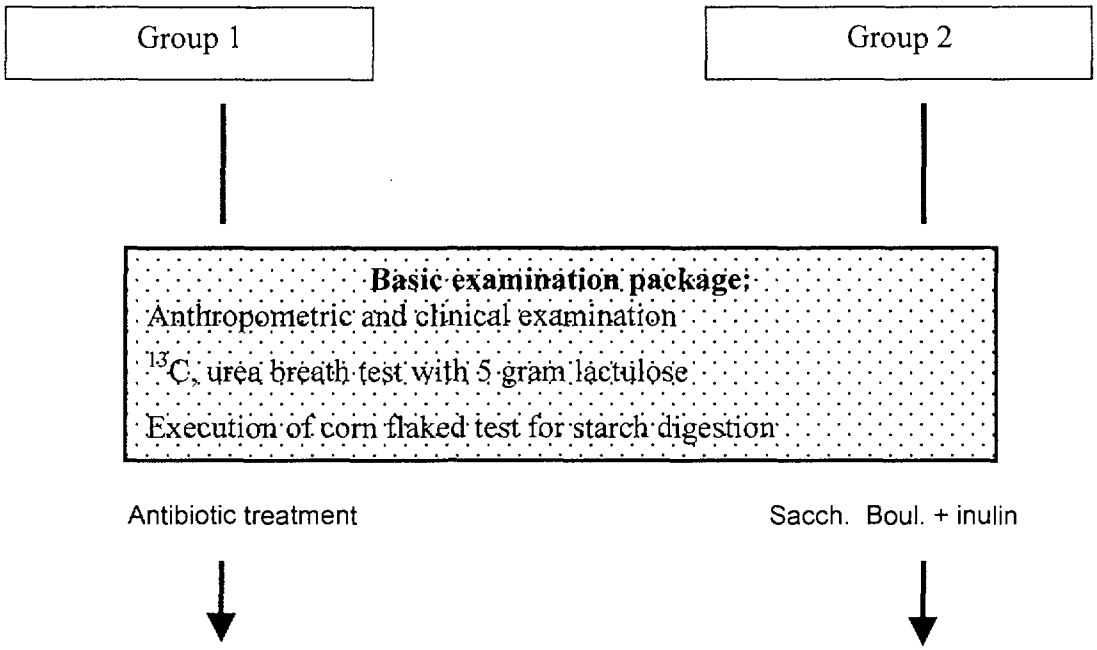
Santiago de Chile will contain an additional group of 50 patients: period three months
Treatment: pill of lacteol (suspended in water), three times per day
Number of patients: 50
Age of patients to be determined

Schedule of examination:

Before the start: execution of the ^{13}C,urea breath test (one hour as conventional) to screen for Hp positiveness, examination of a large group of patients to be included in the study; selection of patients, presentation of the study, informed and signed consent of the parents.

At the start: re-execution of the ^{13}C,urea breath test with 5 gr of lactulose (to demonstrate bacterial overgrowth); test execution over 4 hours to collect hydrogen.

Re-examination (i.e. basic package) after three months
Centralisation of results (at the Leuven unit), evaluation and preparation of report to be presented at the meeting of all participants.



The expected data will be the following:

Before the start:
- ^{13}C,urea breath test to include the patient

At the start:
- ^{13}C,urea breath test with H_2 measurement in breath
- anthropometric data of each individual
- corn flakes breath test ($^{13}CO_2$ and H_2)

After three months

- ^{13}C,urea breath test with H_2 measurement in breath
- anthropometric data of each individual
- corn flakes breath test ($^{13}CO_2$ and H_2)

After that period: Evaluation of results.
Outline of further strategy

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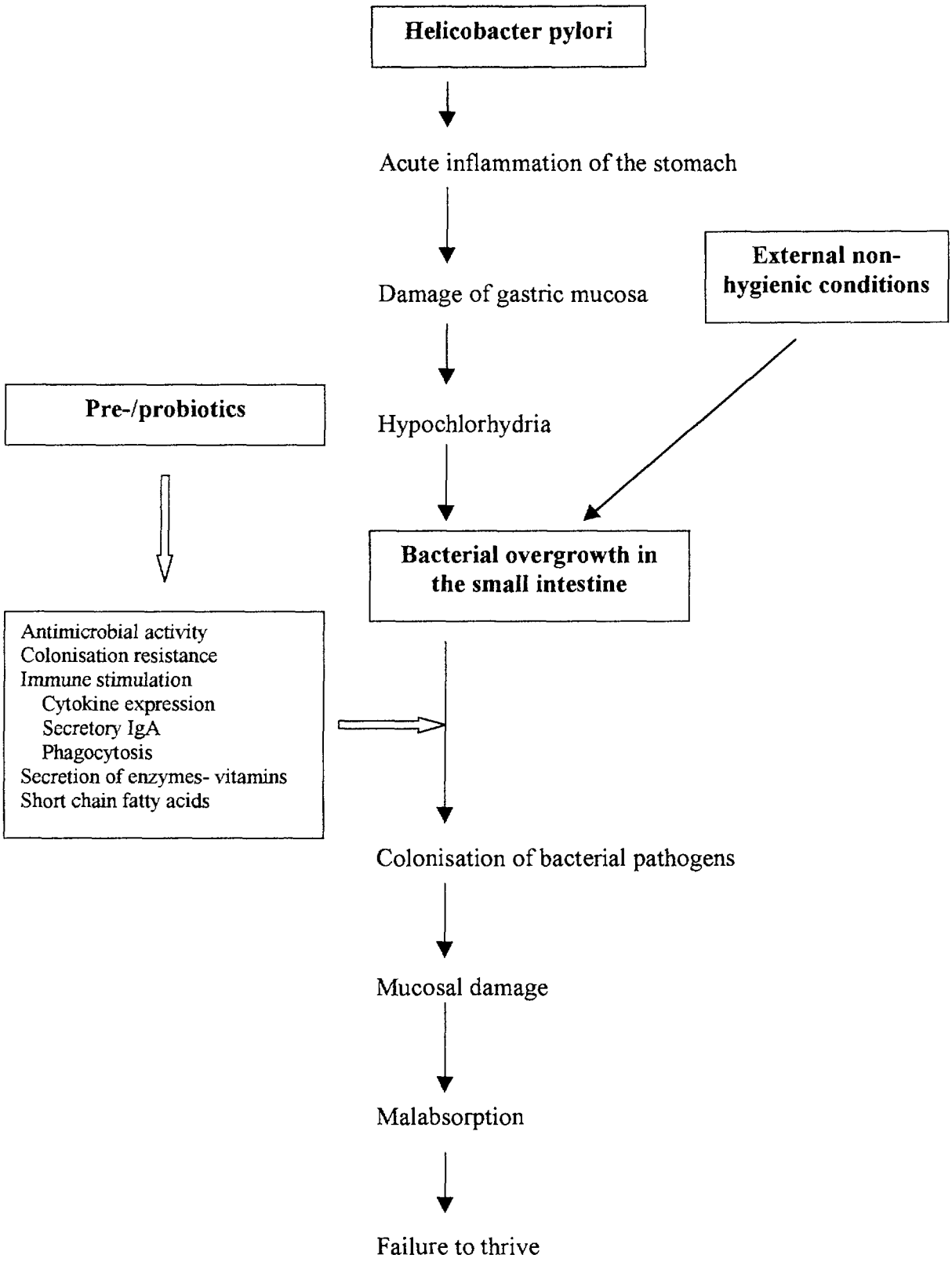
Interlationship between pathological conditions and the use of pre-/probiotics:



Gasthuisberg , Lab. Digestie-Absorptie E462, B-3000 Leuven
Prof. Y. Ghoos, Prof. P. Rutgeerts *tel:016-344390 fax:016-344399*

Test respiratoire pour dépistage d'absorption d'amidon

Nom et adresse de la personne qui fait le test	Taille:	Poids:	Date:
Nom du médecin:			

A.Qu'est-ce qui se trouve dans le carton?

- un sac,contenant du corn flakes, un sac contenat du sucre
- une paille à souffler (dans les tubes)
- 14 tubes numérotés
- un autocollant (pour renvoyer le carton, après)

B. Deux règles directives

1. Pendant l' exécution du test, on reste en REPOS
2. Comment fournir l' échantillon d'air: tenir la paille au bout du tube
   bien souffler dedans pendant quelques secondes
   et le fermer

C. Comment faire le test?

1. Les préparatifs:

- Remplir nom, adresse, taille, poids
- Eventuellement: noter la médication
- Le test débute le matin, quand on est à jeune
- Verser le cornflakes dans 150 ml de lait, puis le sucrer après

2. L' exécution du test:

- avant de commencer, souffler dans les tubes, marqués 1 et 2.
- consommer le repas au cornflakes

Notez le temps, parce que le test commençe maintenant

- 30 minutes après on souffle dans le tube 3
- 60 (1 heure) minutes---------- tube 4
- et ainsi chaque demie-heure jusqu'à la fin (durée du test est 6 heures)
- néanmoins, après 4 heures on est permis de prendre un repas **LEGER** pour couper la faim.

Gasthuisberg , Lab. Digestie-Absorptie E462, B-3000 Leuven
Prof. Y. Ghoos, Prof. P. Rutgeerts *tel:016-344390*

Test à l'air expiré: ^{13}C, urée

Nom et adresse:	Taille:	Poids:	Date:
Nom du docteur:			

Le principe du test: La bactérie *Helicobacter pylori* peut se nicher dans la muqueuse gastrique et y induire des lésions. Son dépistage prompt est souhaitable, qui se fait par le test à l'air expiré. Ce test est basé sur le fait que la bactérie est capable d'hydrolyser l'urée. Si l'urée est marquée au carbon C-13, la présence d' *Helicobacter pylori* se laisse démontrer par la teneur en C-13 dans l' air expiré.

A. Le contenu du carton

- un sachet, contenant une substance nutritive, ainsi que l' ^{13}C,urée
- une paille et 6 tubes, numérotés de 1 à 6.

B. Comment faire réussir le test ?

1. Pendant l' exécution du test il faut se tenir au **repos**.
2. Comment livrer un échantillon d' air ?
   Placer la paille au fond du tube.
   Bien respirer et expirer profondément par la paille. Fermer le tube

C. L' exécution du test:

1. Avant que le test commence:

- Remplir la fiche d' identification: nom et adresse, taille, poids, date .
- On commence le test le matin, **à jeun**.
- Dissoudre le contenu du sachet dans un verre d' eau (chaude pour faciliter la solution)

2. Le test même:

- Souffler dans le tube numéro 1, puis une minute après dans tube 2
- Boire le liquide (contenu du sachet), et bien rinçer la bouche à l'eau.
  15 minutes après la prise du liquide, souffler dans le tube 3
  30 minutes après, dans le tube 4
  45 minutes après, dans le tube 5
  60 minutes aprés, dans le tube 6
- Fin du test.

Le test est à renvoyer à l' adresse suivante: Prof. Dr. Y. Ghoos, UZ Gasthuisberg, Laboratoire " Digestion - Absorption", Herestraat, 49, 3000 Leuven.
Pour toute explication supplémentaire le personnel du labo est à votre disposition; 016-344390.

Le test a été conçu d'une telle façon qu'il puisse être exécuté à domicile et au jour choisi. Son résultat sera transmis au docteur au maximum deux jours après son arrivée au labo.

Gasthuisberg , Lab. Digestie-Absorptie E462, B-3000 Leuven
Prof. Y. Ghoos, Prof. P. Rutgeerts *tel:016-344390 fax:016-344399*

Test respiratoire pour dépistage d'absorption des lipides

Nom et adresse de la personne qui fait le test	Taille:	Poids:	Date:
Nom du médecin:			

A.Qu'est-ce qui se trouve dans le carton?

- une quantité de choco, qui contient la lipo-molécule, ^{13}C,marquée
- de la margarine
- une paille à souffler (dans les tubes)
- 14 tubes numérotés
- un autocollant (pour renvoyer le carton, après)

B. Deux règles directives

1. Pendant l' exécution du test, on reste en REPOS
2. Comment fournir l' échantillon d'air: tenir la paille au bout du tube
   bien souffler dedans pendant quelques secondes
   et le fermer

C. Comment faire le test?

1. Les préparatifs:

- Remplir nom, adresse, taille, poids
- Eventuellement: noter la médication
- Le test débute le matin, quand on est à jeune
- Tartiner 2 tranches de pain **à la margarine et au choco**

2. L' exécution du test:

- avant de commencer, souffler dans les tubes, marqués 1 et 2.
- prendre les tartines (bien chargées par la margarine et le choco), avec un peu d'eau
  Notez le temps, parce que le test commençe maintenant
- 30 minutes après on souffle dans le tube 3
- 60 (1 heure) minutes---------- tube 4
- et ainsi chaque demie-heure jusqu'à la fin (durée du test est 6 heures)
- néanmoins, après 4 heures on est permis de prendre un repas **LEGER** pour
  couper la faim.

UZ Gasthuisberg , Lab. Digestie-Absorptie E462, B-3000 Leuven
Prof. Y. Ghoos, Prof. P. Rutgeerts *tel:016-344390*

^{13}C- starch breath-test

Name:	Length:	Weight:	Date:
Name of the doctor:			

A. What's in the box?

- a sac with cornflakes, a little sac with sugar
- 1 plastic straw
- 14 tubes with screw cap
- the present paper for instructions

B. Two rules to execute the test:

1. Stay in **REST** during the test (a slow walk is permitted).
2. Stay in UPRIGHT position the first two hours of the test; after that time a more comfortable position may be adopted, but never lay down in bed.
3. **How to provide a breath sample?**
   Keep the straw at the bottom of the tube.
   Inhale deeply and expire 5 seconds through the straw.
   Close the tube immediately thereafter.

C. How to execute the test?

1. Before the test:

- Fill in name length, weight and date.
- The test is done preferentially in the morning (at starvation).
- The corn flakes is taken with 150 ml of milk; add some sugar to sweeten

2. The test itself:

- Blow in vial 1; half a minute thereafter in vial 2.
- Eat the meal within 10 minutes. During the meal only small amounts of drinks are allowed to moisten the lips and mouth. Thereafter drink (100 ml at maximum) only water, coffee or tea (coffee or tea can be creamed and/or sweetened, but not with cane sugar): NEVER take a soft drink or fruit juice. The same rules of drinking apply in case of the light meal (after 4 hours). During the test, small quantities (20 ml) of drinks can be taken, just to cut thirst.
- Notice time carefully, because
  30 minutes after the meal : blow into tube 3
  60 minutes after drinking : blow into tube 4
  every 30 minutes thereafter blow in the next tube, up to 6 hours (360 min)
- The test ends after 6 hours. To remind: keep quite during the test.

Important notice:
After 4 hours (after filling tube number 10), a light test meal is allowed. If so, this meal is composed of 60 gram of white bread (at maximum), smeared with 10 gram of margarine (at maximum), cheese or ham (marmelade is not allowed). Drinks can be taken under the conditions as stated above. **Note hereafter if this meal has been taken.** Yes.....; No .....

Gasthuisberg , Lab. Digestie-Absorptie E462, B-3000 Leuven
Prof. Y. Ghoos, Prof. P. Rutgeerts *tel:016-344390*

^{13}C-mixed triglyceride breath-test

Name:	Length:	Weight:	Date:
Name of the doctor:			

A. What's in the box?

- a little pot with chocolate
- 1 plastic straw
- 14 tubes with screw cap
- the present paper for instructions

B. Two rules to execute the test:

1. Stay in **REST** during the test (a slow walk is permitted).
2. Stay in UPRIGHT position the first two hours of the test; after that time a more comfortable position may be adopted, but never lay down in bed.
3. **How to provide a breath sample?**
   Keep the straw at the bottom of the tube.
   Inhale deeply and expire 5 seconds through the straw.
   Close the tube immediately thereafter.

C. How to execute the test?

1. Before the test:

- Fill in name length, weight and date.
- The test is done preferentially in the morning (at starvation).
- The chocolate paste is smeared on 60 (± 5)gram of white bread (no butter or margarine).

2. The test itself:

- Blow in vial 1; half a minute thereafter in vial 2.
- Eat the meal within 10 minutes. During the meal only small amounts of drinks are allowed to moisten the lips and mouth. Thereafter drink (100 ml at maximum) only water, coffee or tea (coffee or tea can be creamed and/or sweetened, but not with cane sugar): NEVER take a soft drink or fruit juice. The same rules of drinking apply in case of the light meal (after 4 hours). During the test, small quantities (20 ml) of drinks can be taken, just to cut thirst.
- Notice time carefully, because
  30 minutes after the meal : blow into tube 3
  60 minutes after drinking : blow into tube 4
  every 30 minutes thereafter blow in the next tube, up to 6 hours (360 min)
- The test ends after 6 hours. To remind: keep quite during the test.

Important notice:
After 4 hours (after filling tube number 10), a light test meal is allowed. If so, this meal is composed of 60 gram of white bread (at maximum), smeared with 10 gram of margarine (at maximum), cheese or ham (marmelade is not allowed). Drinks can be taken under the conditions as stated above. **Note hereafter if this meal has been taken**. Yes.....; No .....

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^{13}C-urea breath-test

Name:	Length:	Weight:	Date:
Name of the doctor:			

A. What's in the box?

- Nutridrink 200 ml
- 1 plastic vial which contains ^{13}C-urea
- 1 plastic straw
- 6 tubes

B. Two rules to execute the test:

1. Stay in **REST** during the test.
2. **How to provide a breath sample?**
   Keep the straw at the bottom of the tube.
   Inhale deeply and expirate 10 seconds through the straw.
   Close the tube immediately thereafter.

C. How to execute the test?

1. Before the test:

- Fill in name length, weight and date.
- The test is done preferentially in the morning (at starvation).
- Dissolve the ^{13}C-urea in ± 100 ml of water.
- Pour the nutridrink into a glass.

2. The test itself:

- Blow in vial 1; one minute thereafter in vial 2.
- Drink **half of** the nutridrink.
- Drink the watery ^{13}C-urea solution.
- Drink **the rest** of the nutridrink.
  15 minutes after drinking : blow into tube 3
  30 minutes after drinking : blow into tube 4
  45 minutes after drinking : blow into tube 5
  60 minutes after drinking : blow into tube 6
- End of the test.

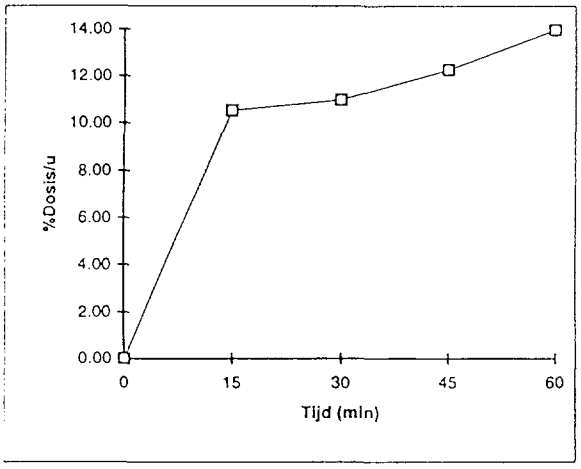
GASTHUISBERG LEUVEN
Dienst Gastro-Enterologie (Prof. dr. J. Janssens)
Lab Digestie-Absorptie
Prof. dr. Y. Ghoos - Prof. dr. P. Rutgeerts

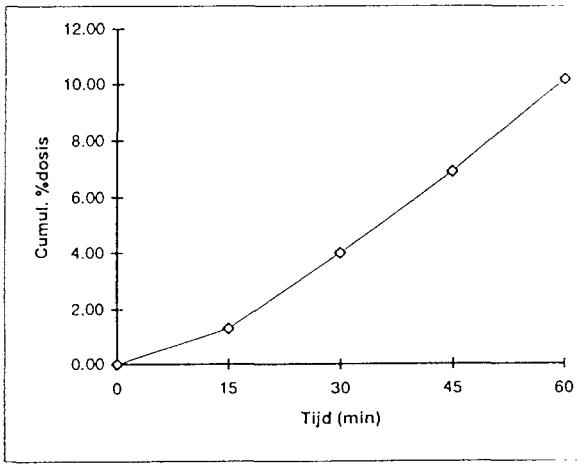
Isotopenademtest voor Helicobacter pylori infectie

Stabielisotoop C 13

Patiënt	[redacted]	Ureum	
Admin.nr.	[redacted]	Molaire massa (g)	60
Lengte (cm)	159	aantal gemerkte C	1
Gewicht (kg)	66.5	substraat AP	99
Datum	22/05/2000	Dosis (mg/kg)	1.13
Aanvrc	Dr. Feys Ch.	BSA	1.73
	1-07706-61-580 O.L.V.hospitaal Ieper	CO2 prod (mmol/kg u)	7.80

tijd (min)	*delta13*	*% Dosis/u*	*Cumul. % dosis*
0	-24.61	0.00	0.00
15	-2.03	10.52	1.32
30	-1.07	10.97	4.00
45	1.69	12.25	6.90
60	5.37	13.97	10.18





Parameters:

	normaal	*patiënt*
cumulatieve excretie na 1 uur (%):	< 1	10.18

Helicobacter pylori infectie van de maag:

☐ negatief

☒ positief

mede namens Prof. dr. J. Janssens
Prof. dr. Y. Ghoos

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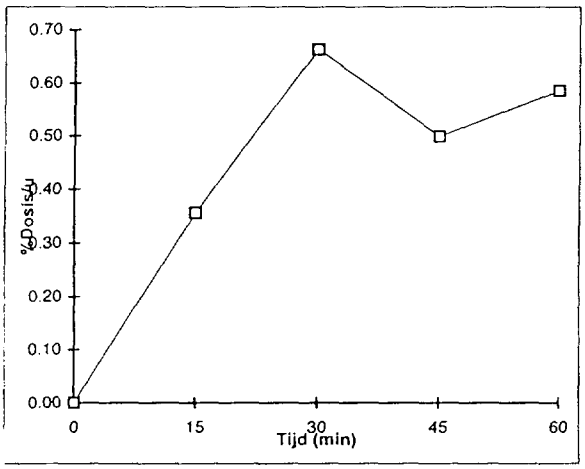
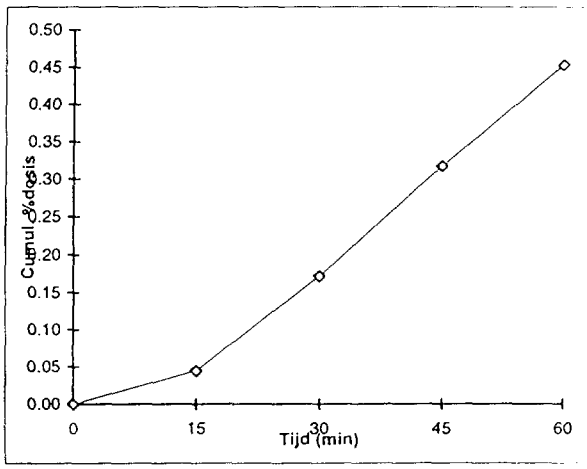
Isotopenademtest voor Helicobacter pylori infectie

Stabiel isotoop C13

Patiënt	[redacted]	Ureum	
Admin.nr.	[redacted]	Molaire massa (g)	60
Lengte (cm)	160	aantal gemerkte C	1
Gewicht (kg)	52	substraat AP	99
Datum	30/05/2000	Dosis (mg/kg)	1.44
Aanvrc	Dr. G.Coremans	BSA	1.52
	1-03522-74-650 409	CO2 prod (mmol/kg u)	8.76

tijd (min)	*delta13*	*% Dosis/u*	*Cumul. % dosis*
0	-25.63	0.00	0.00
15	-24.76	0.36	0.04
30	-24.01	0.66	0.17
45	-24.41	0.50	0.32
60	-24.2	0.59	0.45





Parameters:

	normaal	*patiënt*
cumulatieve excretie na 1 uur (%):	< 1	0.45

Helicobacter pylori infectie van de maag:

☒ **negatief**

☐ **positief**

mede namens Prof. dr. J. Janssens
Prof. dr. Y. Ghoos

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