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http://www1.lf1.cuni.cz/~kocna/pkweb1.htm

TEST OF EXOCRINE PANCREATIC FUNCTION
^{13}C-MTG BREATH TEST

Advances in pancreatology, KC Brno - April 23, 2004

Motto:

... if only we had
simple, cheap and reliable test
of exocrine pancreatic function ...

PRIMARY DIAGNOSTICS of CHP

NBT-PABA ALTAB TEST

CHP GRADING, CLASSIFICATION

FECAL ELASTASE

LUNDH TEST

FECAL CHYMOTRYPSIN

QUANTITATIVE FAT - 72 HRS.

MONITORING of SUBST. THERAPY

SECRETIN PANCREOZYMIN

BREATH TEST ^{13}C-HIOLEIN

INDIRECT PANCREOLAURYL

PATINETS FOLLOW - UP

BREATH TEST ^{13}C-MTG

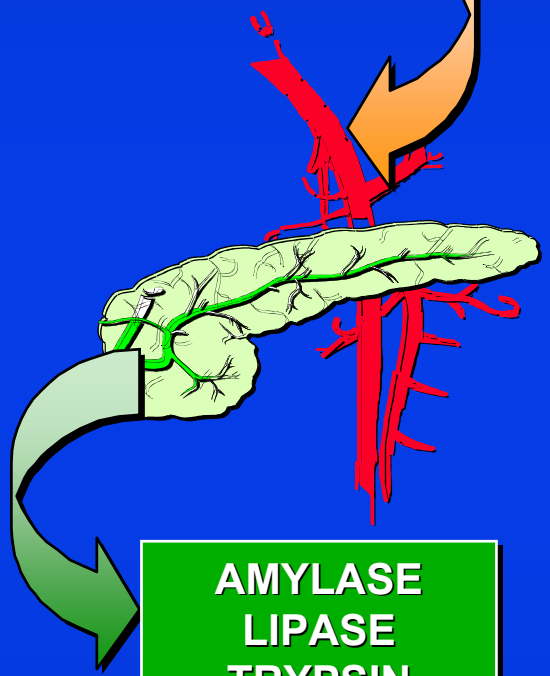
DIF. DIAGNOSTICS of MALABSORPTION

TEST OF EXOCRINE PANCREATIC FUNCTION

Kocna P.

DIRECT PZS TEST

SECRETIN
PANCREOZYMIN

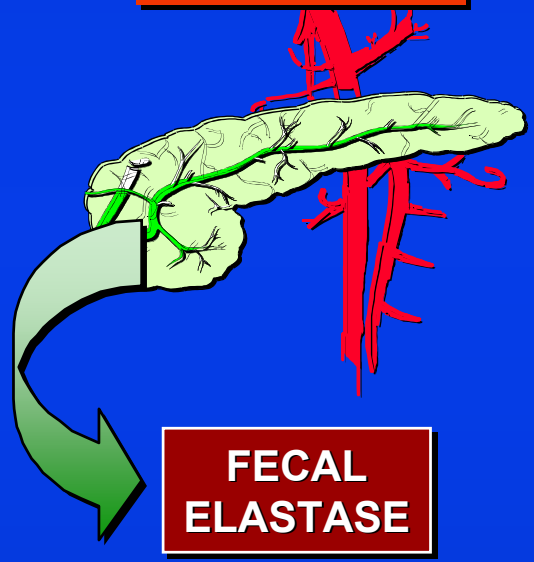


AMYLASE
LIPASE
TRYPSIN
BICARBONATE

DIRECT RESPONSE TO STIMULATION

FECAL ELASTASE

WITHOUT STIMULATION



FECAL ELASTASE

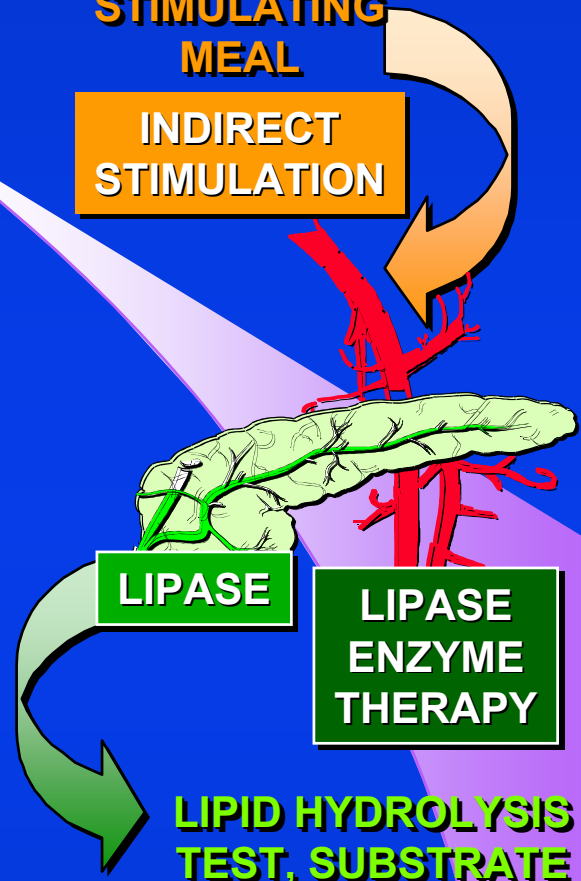
ENZYMES FROM THERAPY/DRUGS WITH mAb NO REACTION

SECRETORY CAPACITY GRADING CHP

PABA, 13C-MTG

STIMULATING MEAL

INDIRECT STIMULATION



LIPASE

LIPASE ENZYME THERAPY

LIPID HYDROLYSIS TEST, SUBSTRATE

DIGESTIVE FUNCTION OF (LIPID) DIGESTION

INDIRECT TEST - ALTAB/^{13}C MTG BREATH TEST

TEST PROCEDURE

STANDARD TEST MEAL
TEST SUBSTANCE - 2000 mg ALTAB/ 250mg ^{13}C-MTG
6 HOUR COLLECTION OF URINE/BREATH SAMPLES

TEST PRINCIPLE

CHYMOTRYPSIN → (Ac) - Tyr - PAB

LIPASE → ^{13}C - MTG

TEST ANALYTICS

DETERMINATION OF SERUM LEVEL AND URINE OUTPUT
MEASUREMENT OF HPAB/ ^{13}C IN BREATH SAMPLES
CALCULATION OF % OUTPUT RATIO

^{13}C - BREATH TEST OF EXOCRINE PANCREAS

SUBSTRATE SELECTION

- ^{13}C - TRIOLEIN
- ^{13}C - HIOLEIN
- ^{13}C - MIXED TRIGLYCERIDE
- ^{13}C - CHOLESTERYL OCTANOATE
- ^{13}C - TRIPALMITIN
- ^{13}C - TRIOCTANOIN
- ^{13}C - STARCH

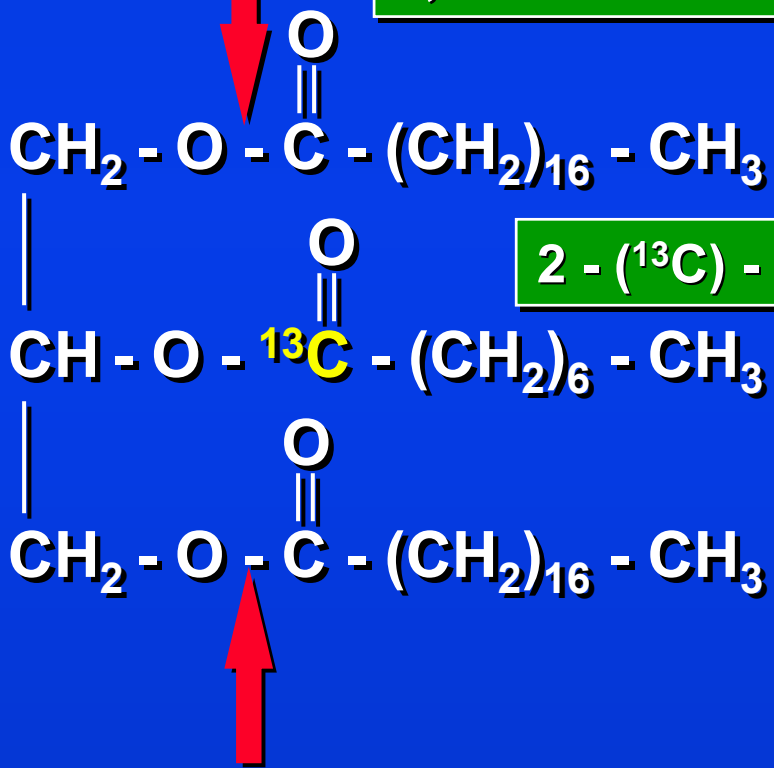
STEATORRHOEA > 11 - 14 g/day
INTRALUMINAL LIPOLYSIS
PANCREATIC LIPASE SPECIFIC
LIPASE OUTPUT < 90 kU/h
PANCREATIC CHOLESTEROL ESTERASE
STEATORRHOEA > 11 g/day
FAT MALABSORPTION
PANCREATIC DAMAGE, FIBROSIS > 30%
AMYLASE SECRETION < 10%

^{13}C-MTG METABOLIC PROCES

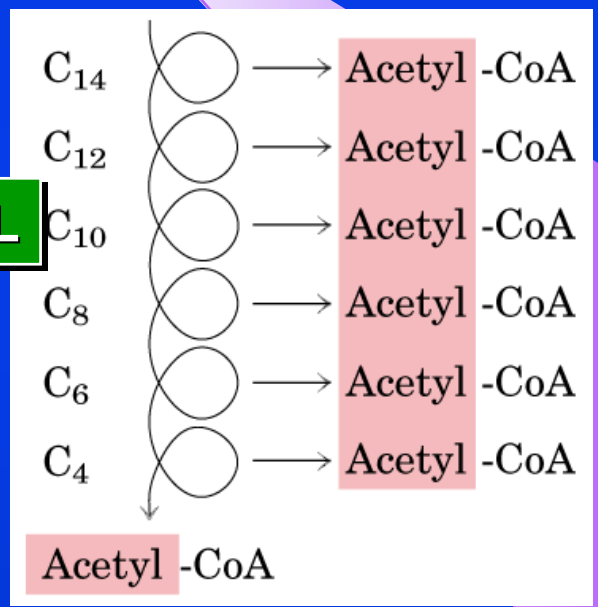
$^{13}CO_2$ IN BREATH

PANCREATIC LIPASE

1,3 DI - STEAROYL



2 - (^{13}C) - OCTANOYL



LIVER β - OXIDATION

^{13}C-MTG BREATH TEST

TEST PROCEDURE

TWO SAMPLE BAGS AFTER FASTING

STIMULATION MEAL

4 CRISP SLICES, MAIZE WITH FIBRES
(WITHOUT CHOLESTEROL, GLUTEN-FREE)

2 x 10g RAMA (VEGETABLE FAT WITHOUT MILK PROTEINS)

TEST SUBSTANCE ADMINISTRATION - 250mg ^{13}C-MTG

STIRRED INTO VEGETABLE FAT

HOURLY BREATH-BAG SAMPLING (1 - 6 hr)

TEST ANALYTICS

DOB MEASUREMENT OF EACH SAMPLE $^{13}CO_2$: $^{12}CO_2$ v ‰

T_x SAMPLE AGAINST T_0 (DOB = Delta Over Baseline)

EVALUATION OF PANCREATIC INSUFFICIENCY

BSA CALCULATED (BASED ON WEIGHT, HEIGHT ONLY)

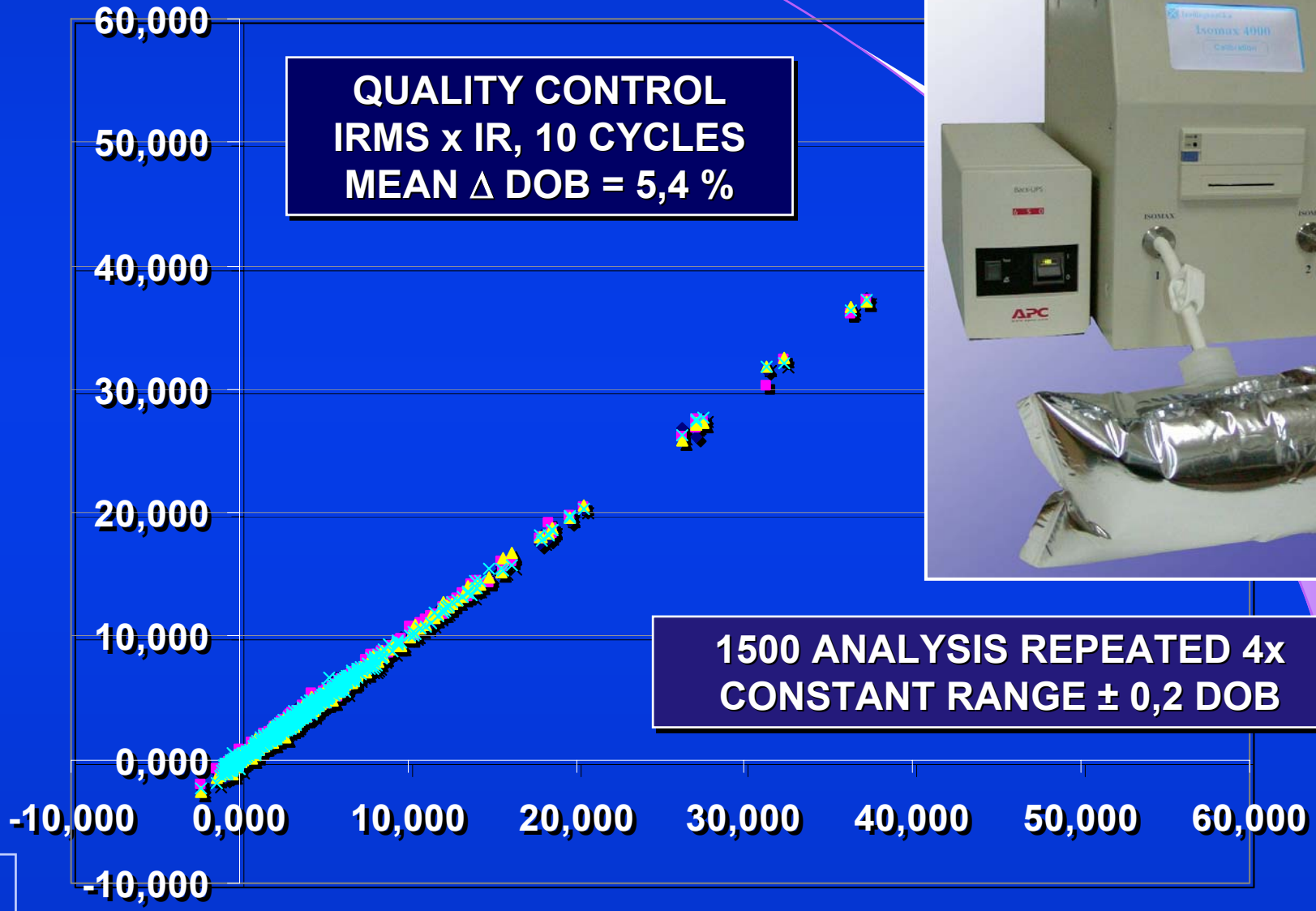
BMR AND CO_2 PRODUCTION CALCULATION

CUMMULATIVE RECOVERY FOR 6 HOURS CALCULATION

ANALYSIS OF ^{13}C:^{12}C RATIO

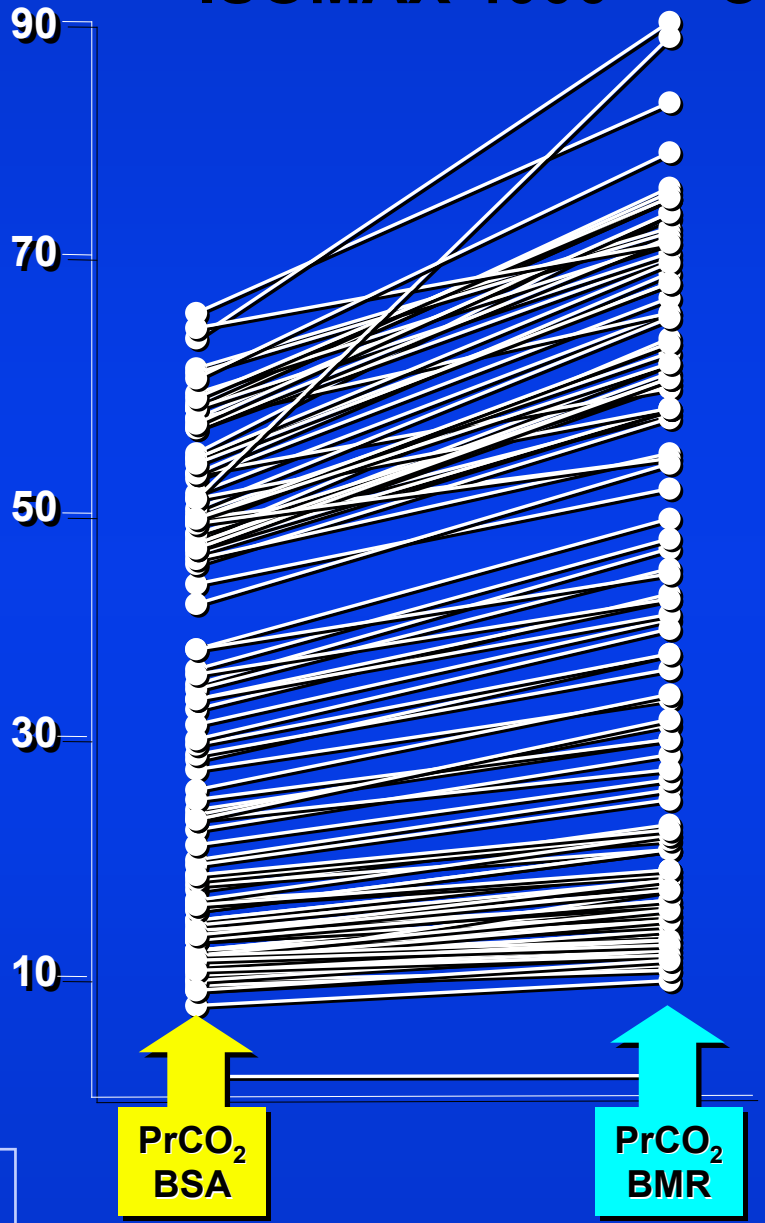
ISOMAX 4000 BREATH TEST ANALYSER

QUALITY CONTROL
IRMS x IR, 10 CYCLES
MEAN Δ DOB = 5,4 %



1500 ANALYSIS REPEATED 4x
CONSTANT RANGE ± 0,2 DOB

ISOMAX 4000 - ^{13}C RECOVERY CALCULATION



$PrCO_2BSA = BSA * 300$ mmol/h
BSA = W^0,5378 * H^0,3963 * 0,024265
body surface (weight, height) only

$PrCO_2BMR = BMR * 2,49$ mol/d
$BMR = \alpha W + \beta H + \gamma$
α, β, γ = constants for age, sex
body surface (weight, height)
age & sex corrected

150 FUNCTIONAL TESTS
AVERAGE DIFFERENCE = 27.1 %
RANGE = 10.8 - 79.4 %

^{13}C-MTG BREATH TEST
REFERENCE VALUES, CUT- OFF VALUE

Published studies with ^{13}C-MTG breath tests defined cut-off value for CHP diagnosis to cPDR 22% - 23%

In these studies were cPDR calculated by body surface - BSA

Mathematical **approximation to use of BMR index**

mean differences BSA x BMR is 27,1% (n = 150)

cut-off value is **28,64 %** = $22{,}5_{(BSA)}$ * $1{,}271_{(BMR)}$

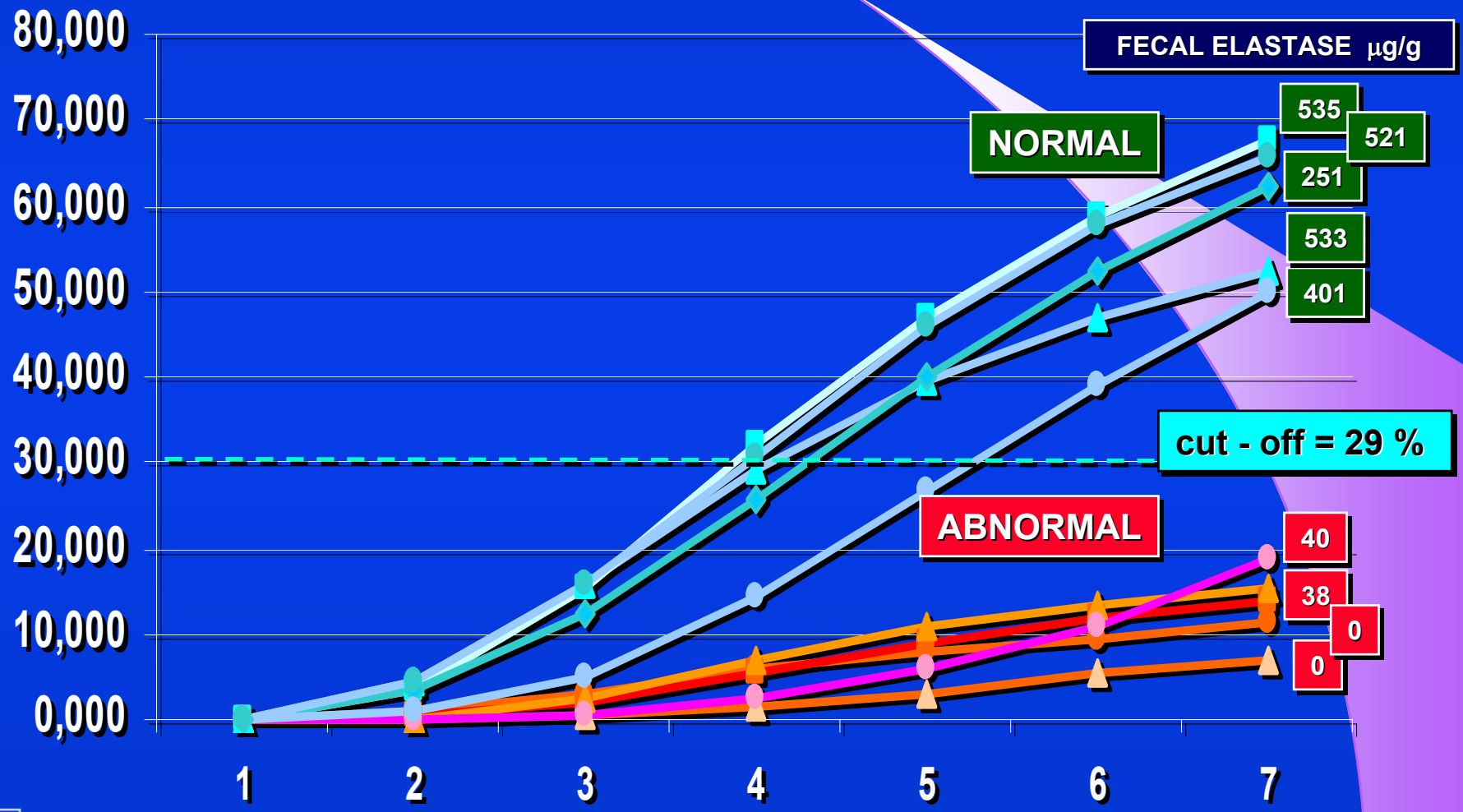
The lower limit of reference range determined with **group of 23 subjects without CHP**

mean value cPDR in NON-CHP is 53,31, SD = 11,71

cut-off value is **29,89 %** = x - 2SD (23 NON-CHP)

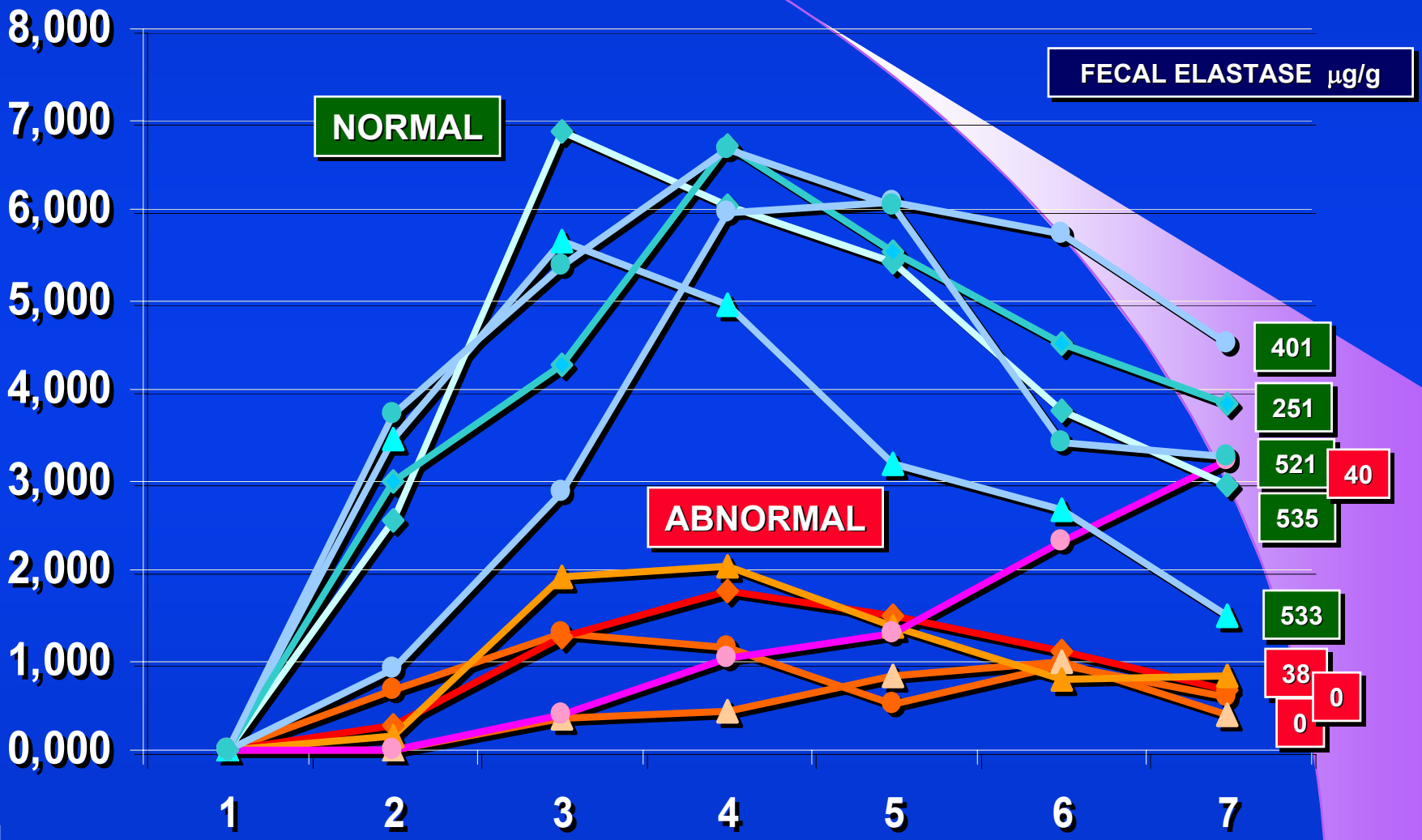
^{13}C-MTG BREATH TEST

CUMMULATIVE RECOVERY $^{13}CO_2$ in %

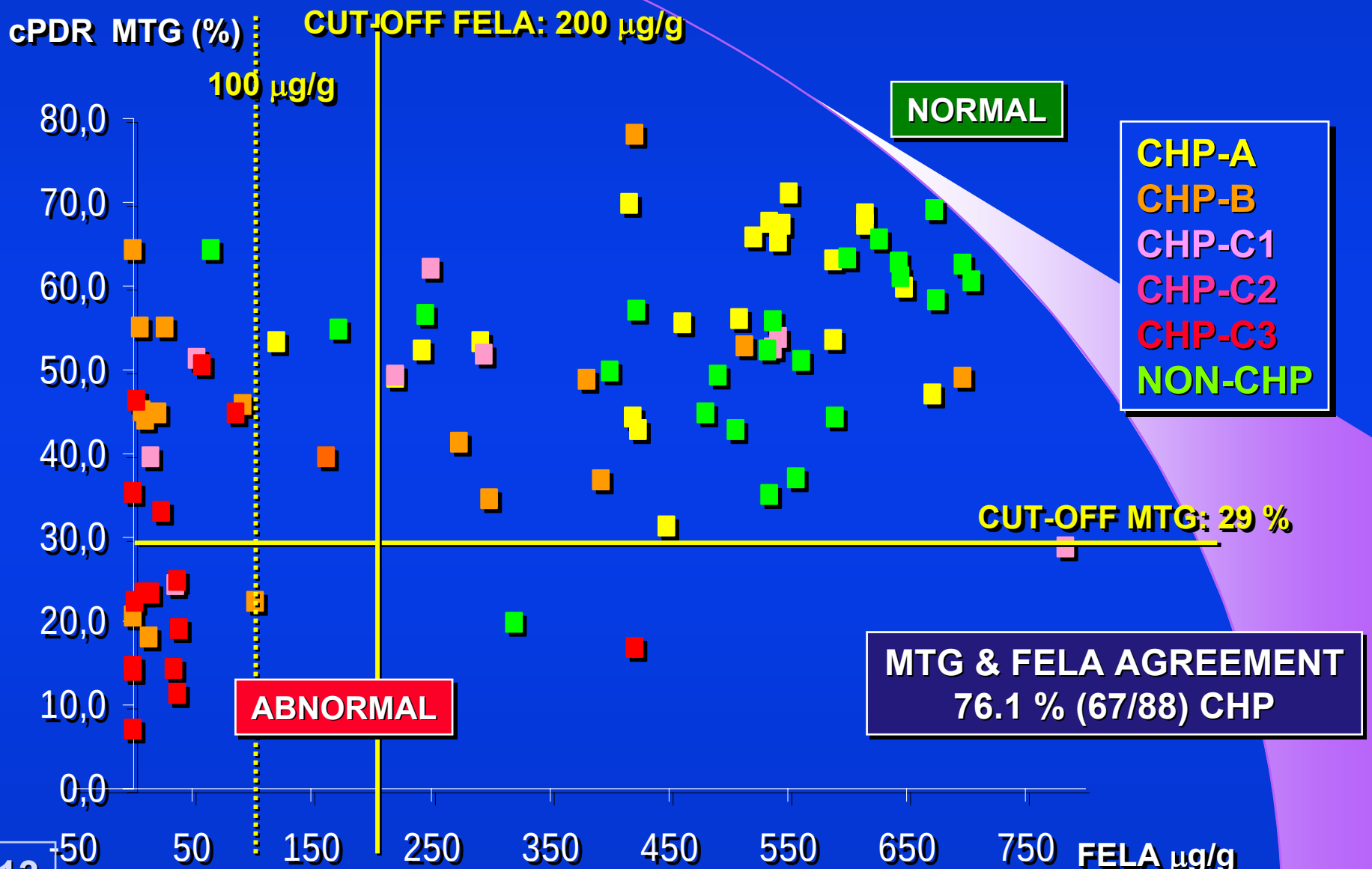


^{13}C-MTG BREATH TEST

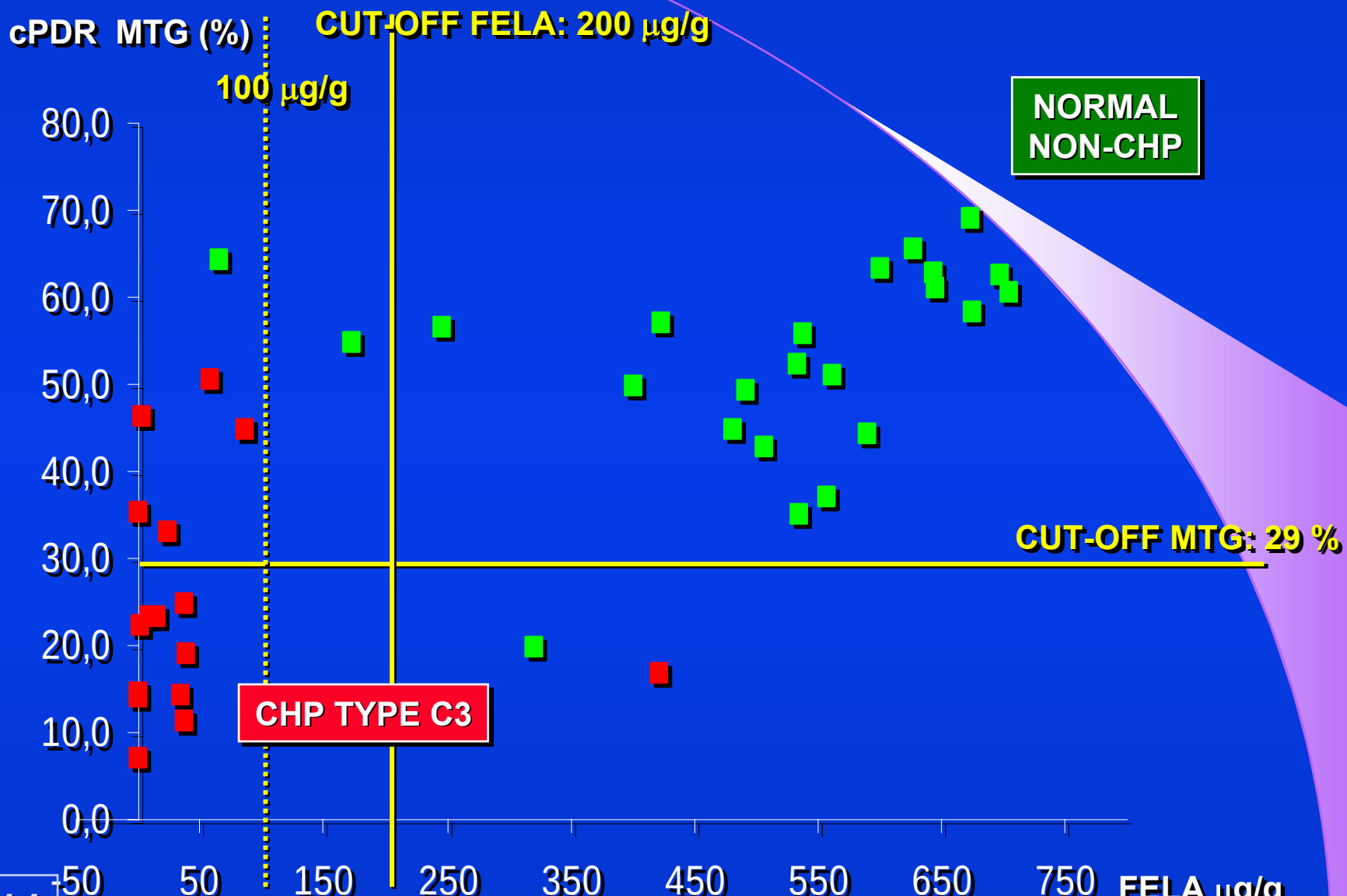
DOB VALUES $^{13}CO_2$: $^{12}CO_2$ in ‰ AFTER 250mg MTG



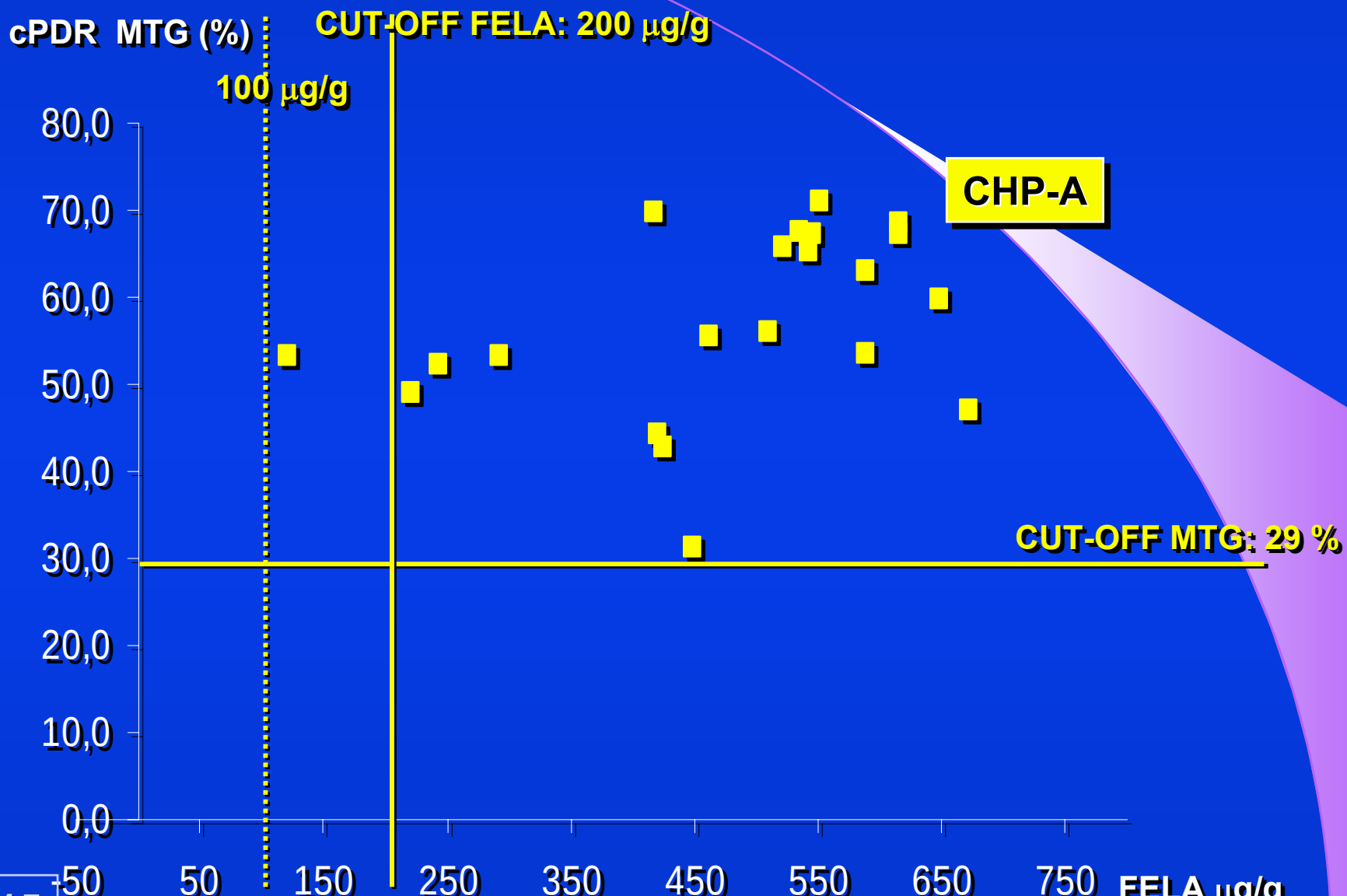
^{13}C-MTG BREATH TEST x FECAL ELASTASE



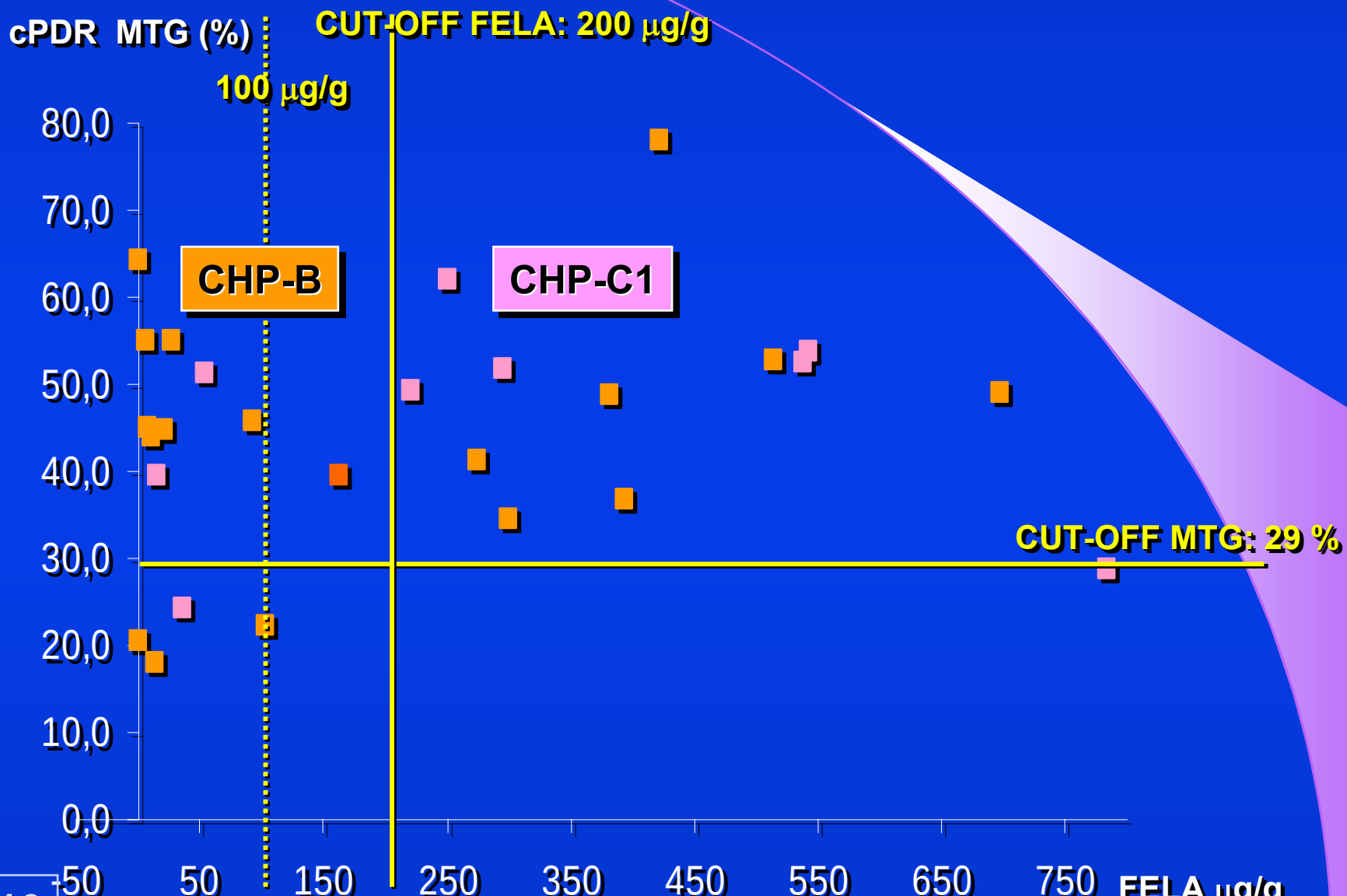
^{13}C-MTG BREATH TEST x FECAL ELASTASE



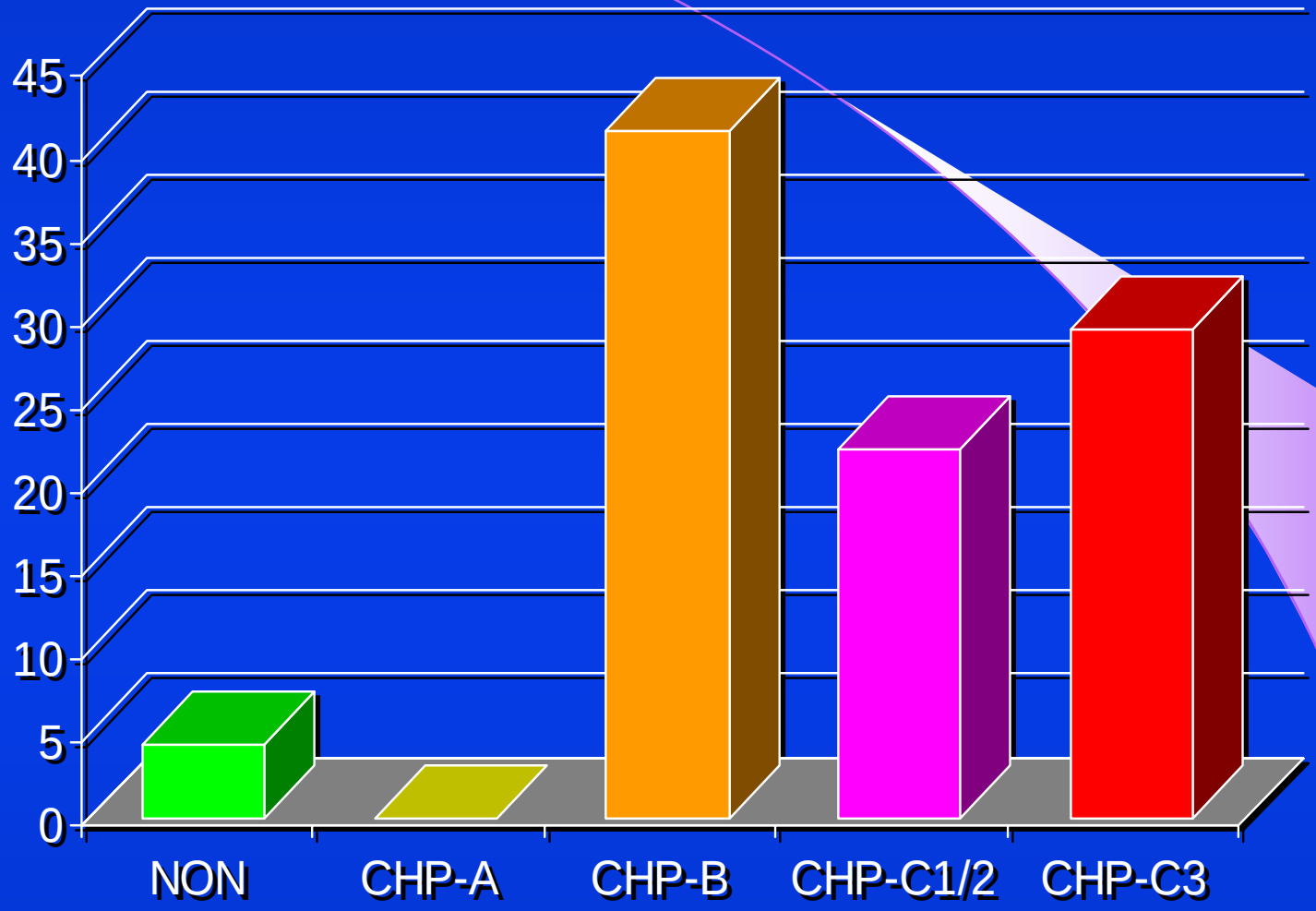
^{13}C-MTG BREATH TEST x FECAL ELASTASE



^{13}C-MTG BREATH TEST x FECAL ELASTASE



^{13}C-MTG BREATH TEST x FECAL ELASTASE



FREQUENCY OF CASES FELA < 100 μg/g & ^{13}C-MTG > 29%

EVALUATION OF EXOCRINE PANCREATIC FUNCTION

Breath test ^{13}C-MTG provide us the complex evaluation of digestive processes - lipid digestion

cPDR value of ^{13}C-MTG is the cummulative value, covering the exocrine pancreatic function + substitution therapy

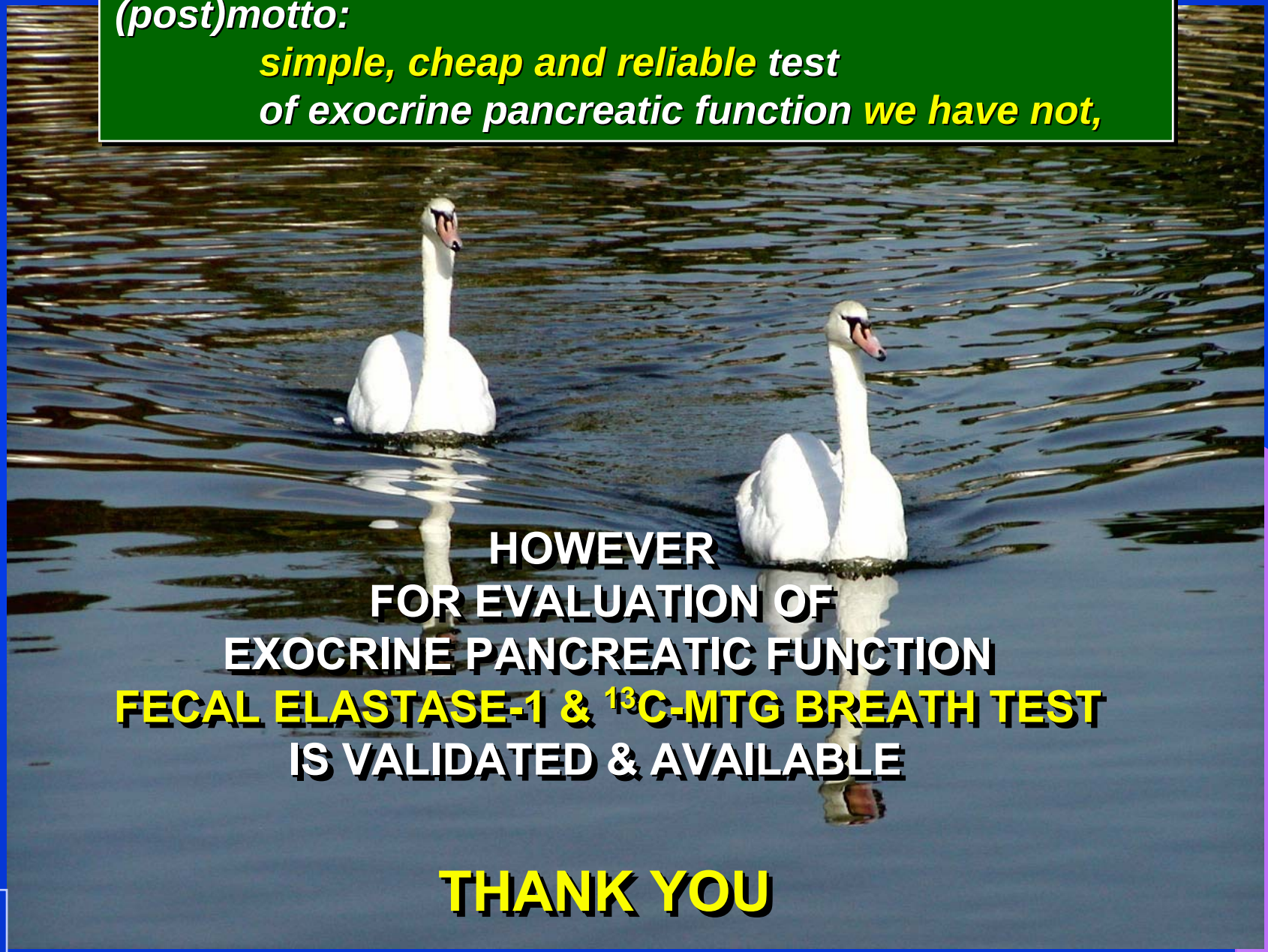
Cut-off value of cPDR ^{13}C-MTG, lower limit determined by mathematical approximation as well using a control group is identical - 29%

Interpretation of ^{13}C-MTG include cummulative output - cPDR, maximal DOB value - DOB_{max}, time to get of maximal DOB - DOB_{time}, and the kinetics - curve type

Combination of both tests covering various aspects - ^{13}C-MTG breath test and fecal elastase 1 could be recommended for evaluation of exocrine pancreatic function

(post)motto:

simple, cheap and reliable test
of exocrine pancreatic function we have not,



HOWEVER
FOR EVALUATION OF
EXOCRINE PANCREATIC FUNCTION
FECAL ELASTASE-1 & ^{13}C-MTG BREATH TEST
IS VALIDATED & AVAILABLE

THANK YOU