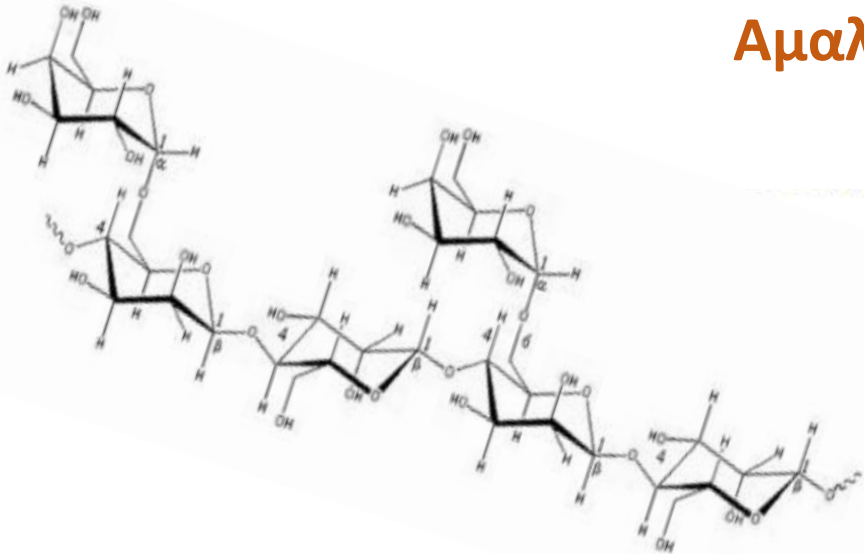


Λειτουργικές Ιδιότητες Υδατανθράκων

Διαιτητικές Ίνες

Αμαλία Γιάννη, Δρ. Χημικός



Διαιτητικές Ίνες-Ορισμός



- Υπάρχουν διάφοροι ορισμοί
(AACC, FDA, EFSA, Codex Alimentarius)

«Οι διαιτητικές ίνες αποτελούνται από υδατανθρακικά πολυμερή με τρεις ή περισσότερες μονάδες μονομερών (monomeric units, MU) τα οποία δεν πέπτονται ούτε απορροφώνται από το έντερο του ανθρώπου και περιλαμβάνουν: (1) τους μη αμυλούχους πολυσακχαρίτες από τα φρούτα, τα λαχανικά, τα δημητριακά και τους βολβούς που είτε υπάρχουν εγγενώς είτε εκχυλίζονται είτε χημικά, φυσικά και/ή ενζυμικά τροποποιούνται είτε πρόκειται για συνθετικά πολυμερή ($MU \geq 10$), (2) τους ανθεκτικούς (μη-πεπτόμενους) ολιγοσακχαρίτες ($MU 3-9$) και (3) το ανθεκτικό άμυλο(RS) ($MU \geq 10$). Όταν πρόκειται για ουσίες που είτε εκχυλίζονται είτε χημικά, φυσικά και/ή ενζυμικά τροποποιούνται είτε πρόκειται για συνθετικά πολυμερή θα πρέπει να υπάρχουν γενικώς αποδεκτά επιστημονικά δεδομένα για τα οφέλη τους για την υγεία προκειμένου να χαρακτηριστούν ως διαιτητικές ίνες».

Διαιτητικές Ίνες-Ορισμός

Οι κύριες διαφορές μεταξύ των ορισμών σχετίζονται με:

- (1) Τις συνδεόμενες ουσίες (κυρίως τη λιγνίνη)
- (2) Τον ελάχιστο αριθμό μονάδων μονοσακχαριτών που πρέπει να περιλαμβάνονται.
- (3) Την προϋπόθεση κυρίως για τα υδατανθρακικά πολυμερή που έχουν εκχυλιστεί, απομονωθεί, τροποποιηθεί ή συνθετικά παρασκευαστεί, ότι εμφανίζουν ευεργετικές για την υγεία επιδράσεις.

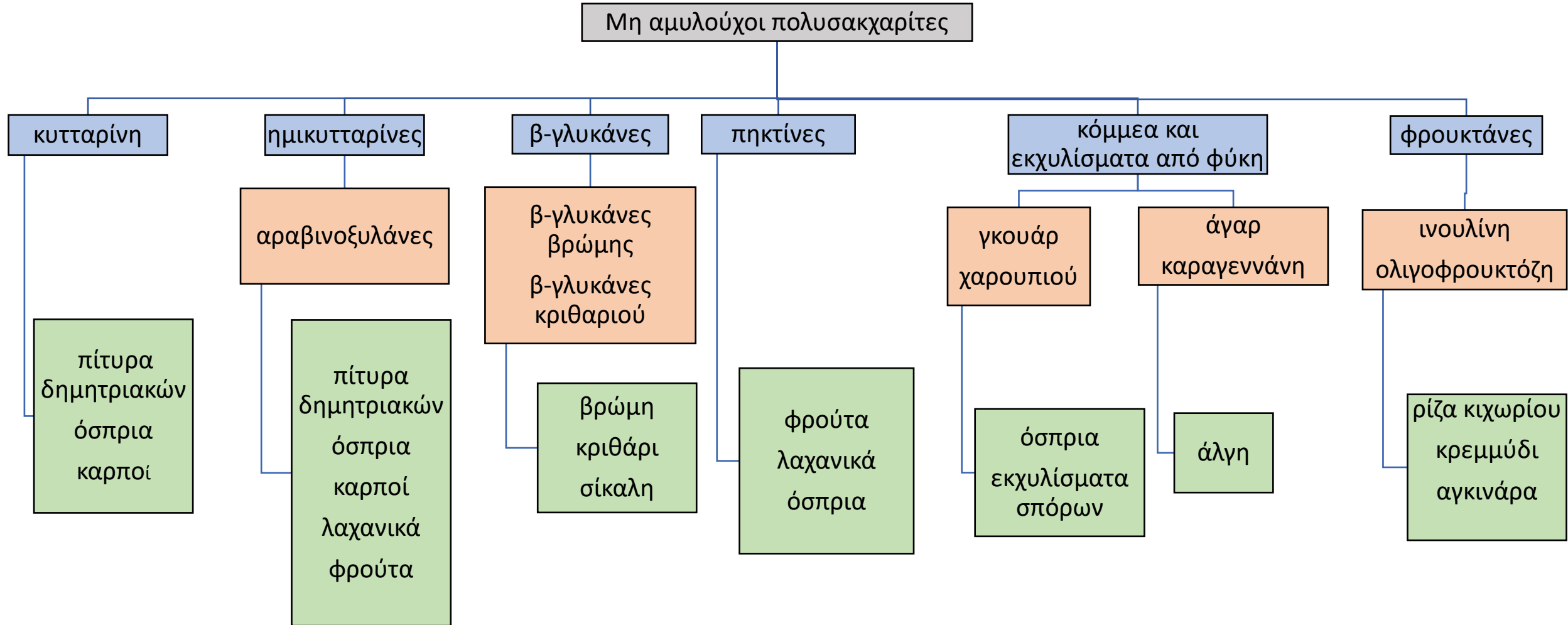


- Λειτουργία του παχέος εντέρου
- Χοληστερόλη αίματος
- Γλυκόζη αίματος

Χρήση των ισχυρισμών «πηγή ινών» και «υψηλής περιεκτικότητας σε ίνες» στην επισήμανση των τροφίμων (EU Regulation No1924/2006):

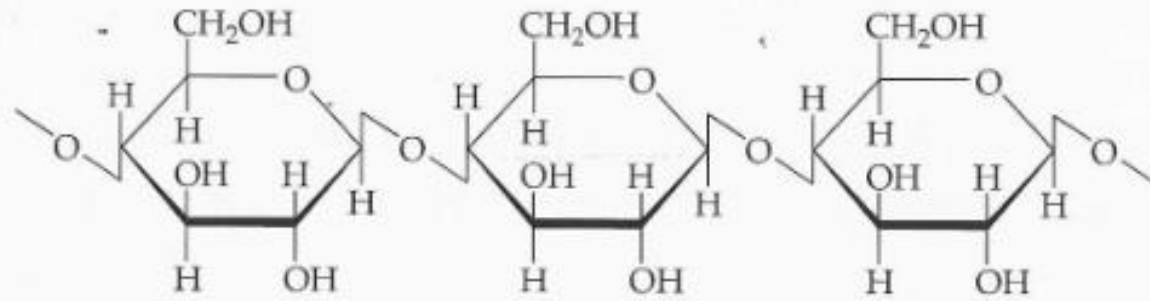
- «Πηγή ινών»: μπορεί να γίνει όταν το προϊόν περιέχει τουλάχιστον 3g ινών/100g ή τουλάχιστον 1,5g ινών/100 kcal.
- «Υψηλής περιεκτικότητας σε ίνες»: μπορεί να γίνει όταν το προϊόν περιέχει τουλάχιστον 6g ινών/100g ή τουλάχιστον 3g ινών/100 kcal»

Διαιτητικές Ίνες-Κατηγορίες και Πηγές



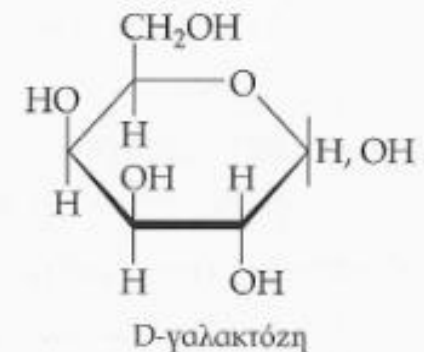
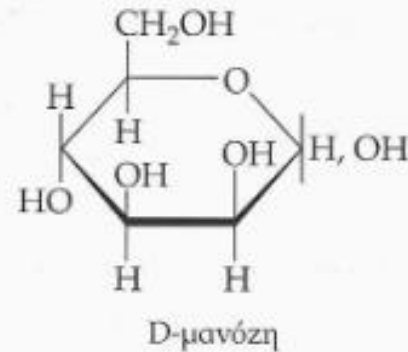
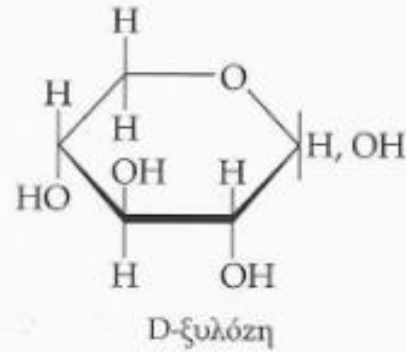
Διαιτητικές Ίνες-Χημική δομή

(α) Κυτταρίνη

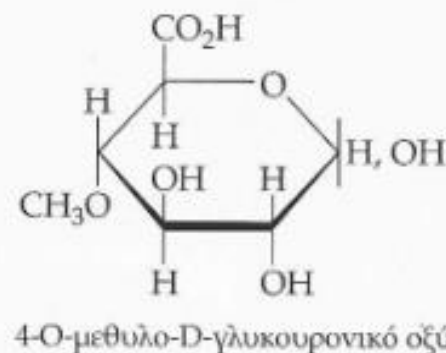


(β) Ημικυτταρίνη (κύρια σάκχαρα που συμμετέχουν στη δομή)

Αλυσίδα
του σκελετού

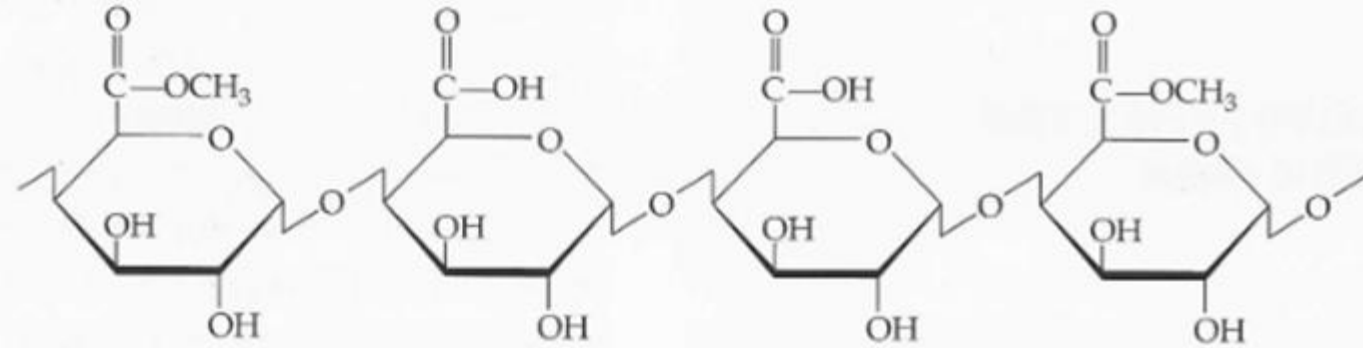


Πλευρικές αλυσίδες

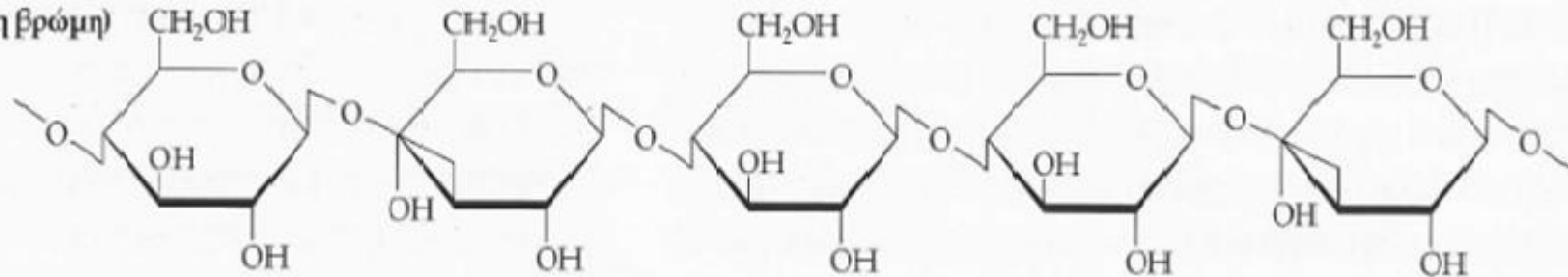


Διαιτητικές Ίνες-Χημική δομή

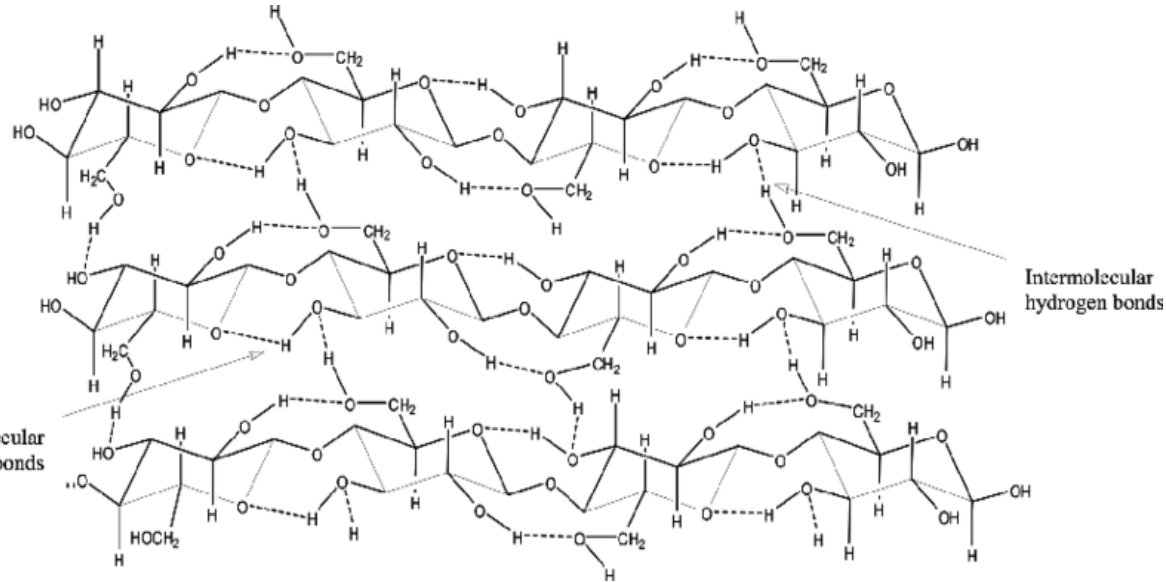
Πηκτίνη



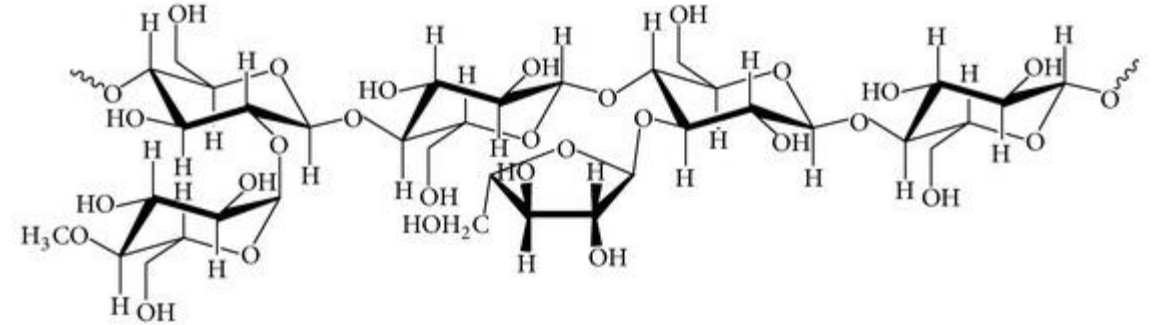
β -γλυκάνη (από τη βρώμη)



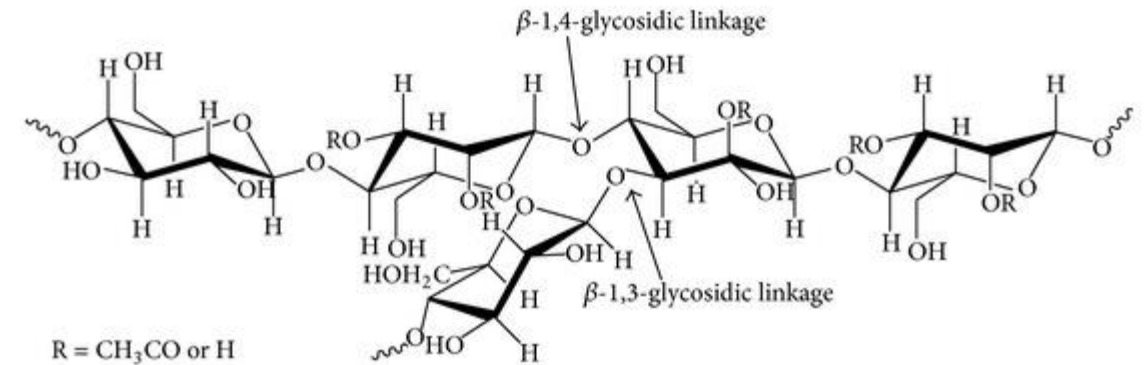
Διαιτητικές Ίνες-Χημική δομή



(i) Xylan

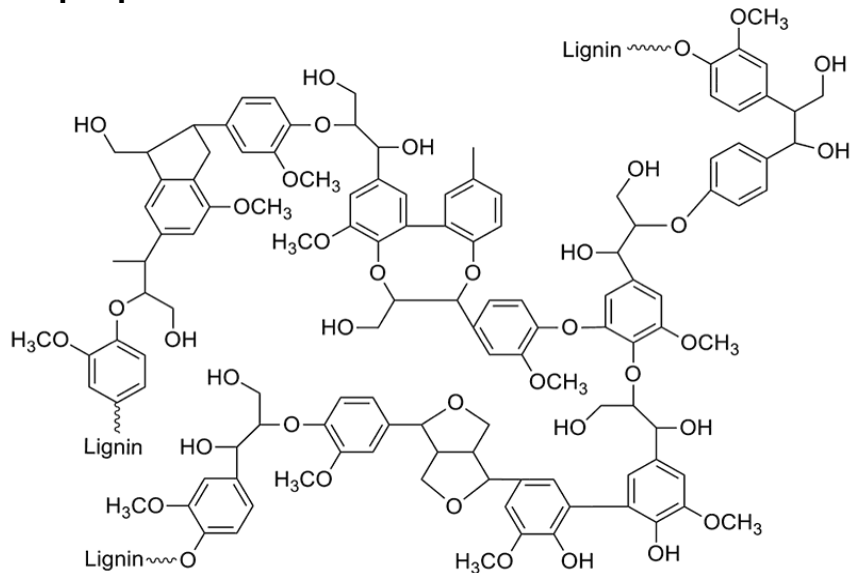


(ii) Glucomannan



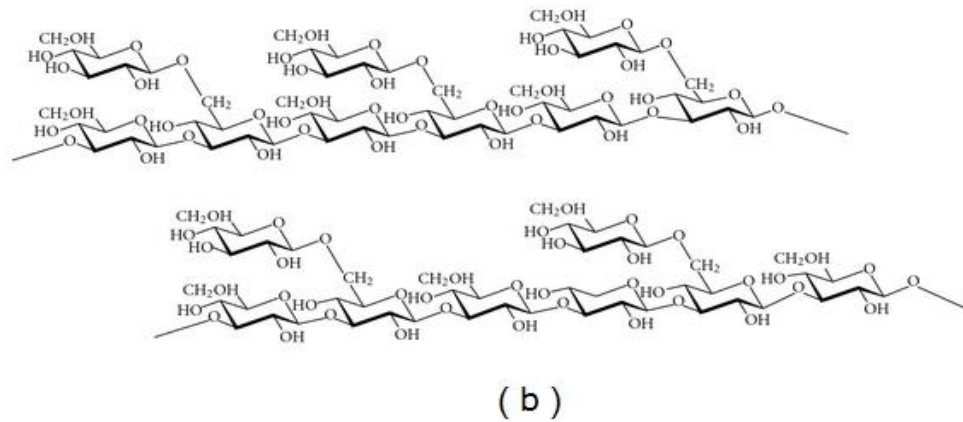
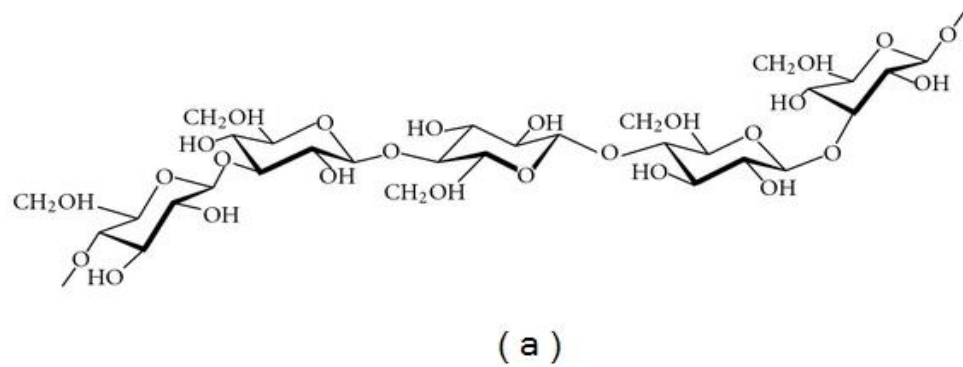
ημικυτταρίνες

κυτταρίνη



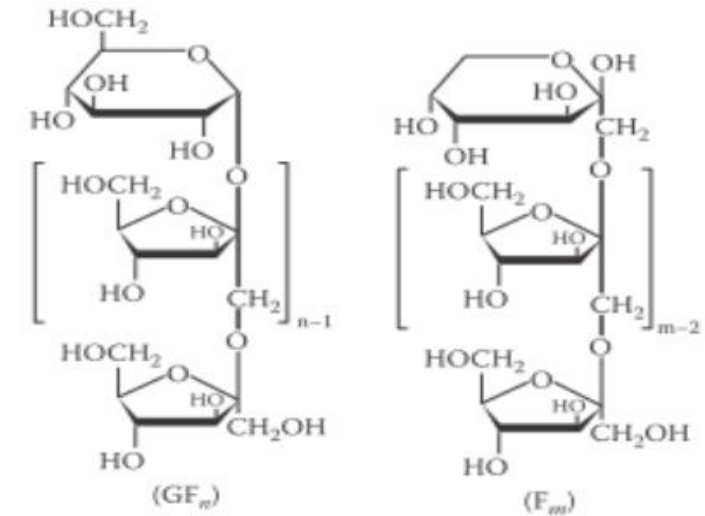
Λιγνίνη

Διαιτητικές Ίνες-Χημική δομή

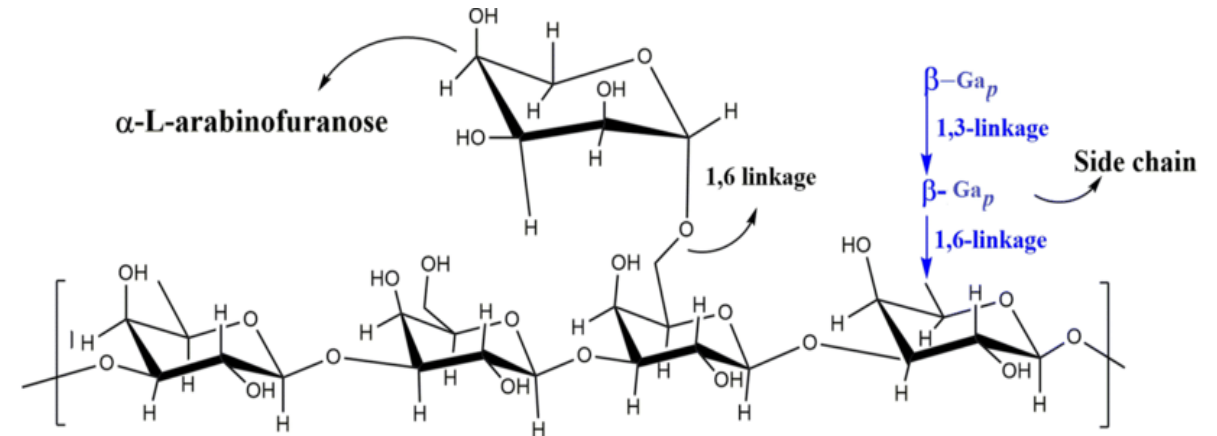


(a) β -(1,3-1,4)-D-γλυκάνη

(b) β -(1,3-1,6)-D-γλυκάνη

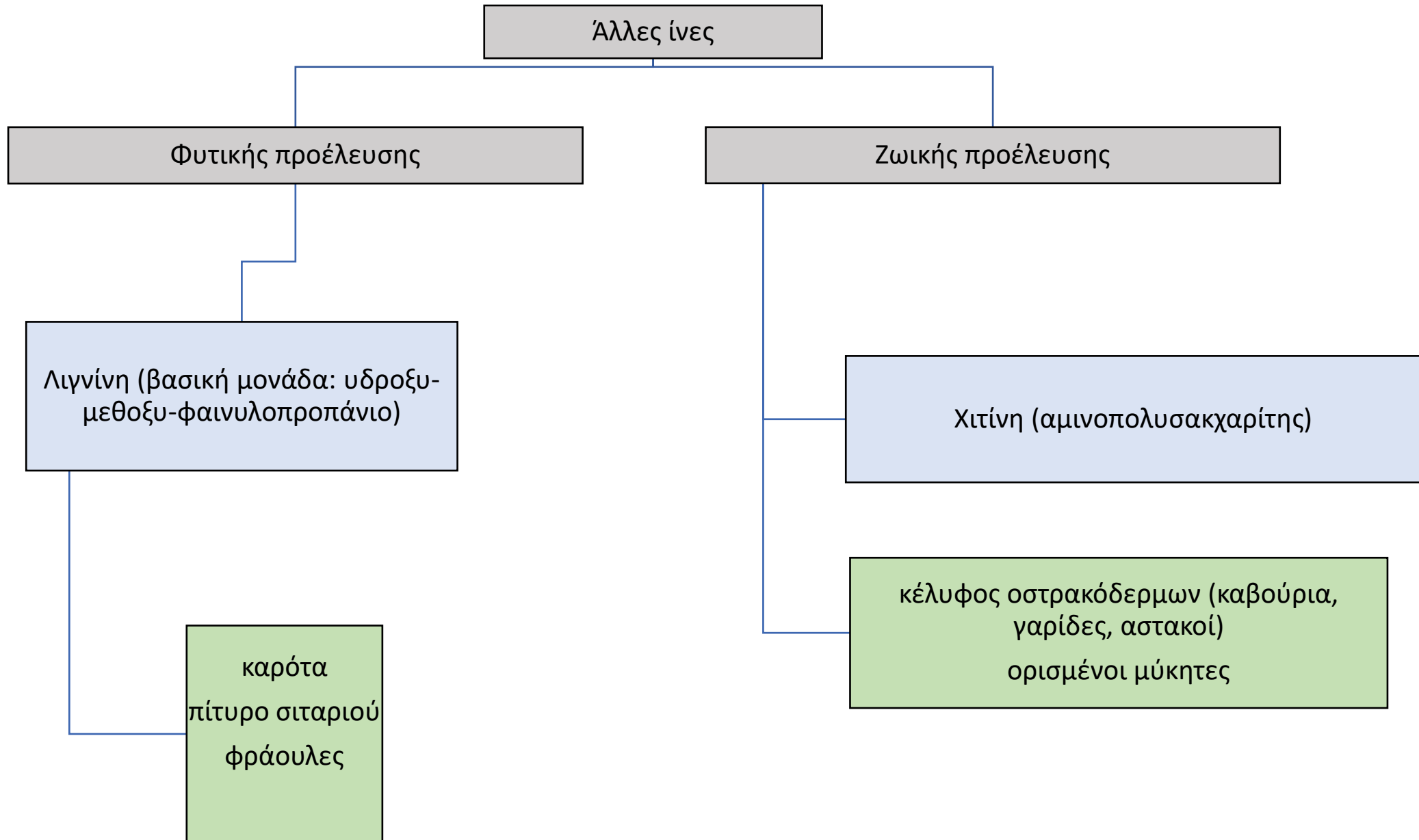


Δομή ινουλίνης ($n, m \geq 10$) και φρουκτο-ολιγοσακχαριτών ($n, m = 2-8$)

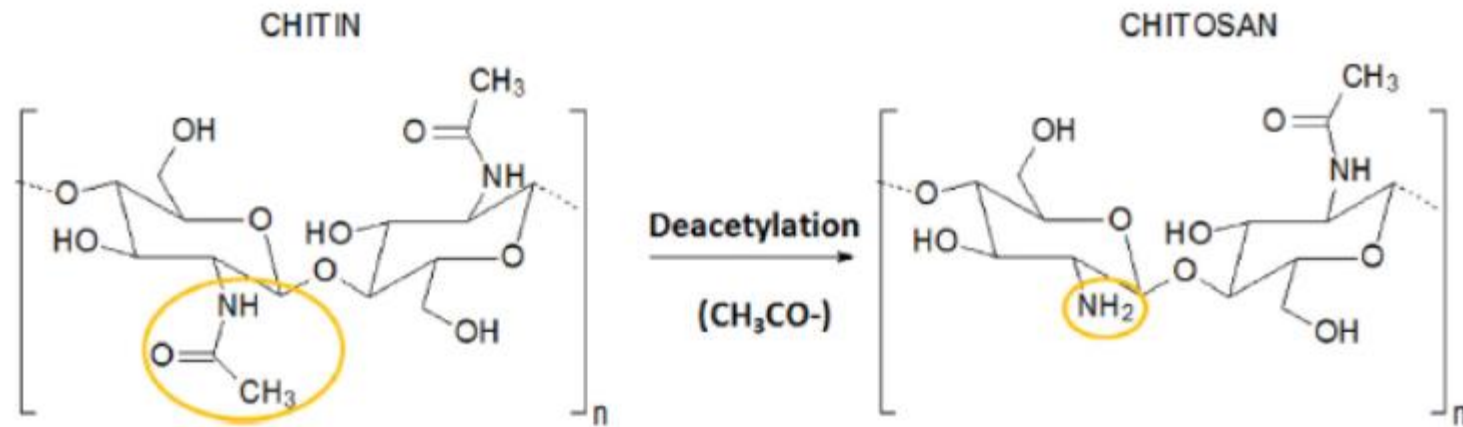


Chemical structure of Gum arabic: 1,3-linked β -D-Galactopyranose (main backbone)

Διαιτητικές Ίνες-Κατηγορίες και Πηγές



Διαιτητικές Ίνες-Χημική δομή



Χιτίνη και χιτοσάνη

Διαιτητικές Ίνες-Κατηγορίες και Πηγές

*Το σύνολο του αμύλου και των προϊόντων της αποικοδόμησής του που δεν απορροφώνται στο λεπτό έντερο

Ανθεκτικό άμυλο (RS)*

RS1 (φυσικά μη προσβάσιμο)

όσπρια
ολόκληροι ή μερικώς
αλεσμένοι σπόροι

RS2 (εγγενώς ανθεκτικό)

άμυλα υψηλής
περιεκτικότητας σε αμυλόζη

ωμές πατάτες
πράσινες μπανάνες
καλαμπόκι

RS3 (αναδιαμορφωμένο)

πατάτες και άλλα αμυλούχα
τρόφιμα που έχουν υποστεί
θέρμανση και ψύξη

RS4 (τροποποιημένο)

Διαιτητικές Ίνες-Αναλυτικές μέθοδοι

Table 7. Principal Association of Official Analytical Chemists International (AOAC) methods for total dietary fibre (TDF) and specific dietary fibre analysis

Method	Fraction which is quantified	Comment
AOAC 985.29*	TDF	Quantifies most of the resistant starch
AOAC 991.42*	Insoluble dietary fibre	Quantifies most of the resistant starch
AOAC 993.19*	Soluble dietary fibre	
AOAC 991.43*	Total, insoluble, and soluble dietary fibre	≈985-29 or 991-42 +993-19 Quantifies most of the resistant starch
AOAC 995.16	β-Glucans	
AOAC 997.08	Fructans (inulin, FOS)	
AOAC 2001.03	TDF including resistant maltodextrins	
AOAC 2001.02	Galacto-oligosaccharides	
AOAC 2000.11	Polydextrose	
AOAC 2006.08	Modified celluloses	
AOAC 2002.02*	Resistant starch	
AOAC 2009.01*	TDF (Codex definition)	=991-43 + 2001-03 + 997-08 + 200-11 + 2001-02

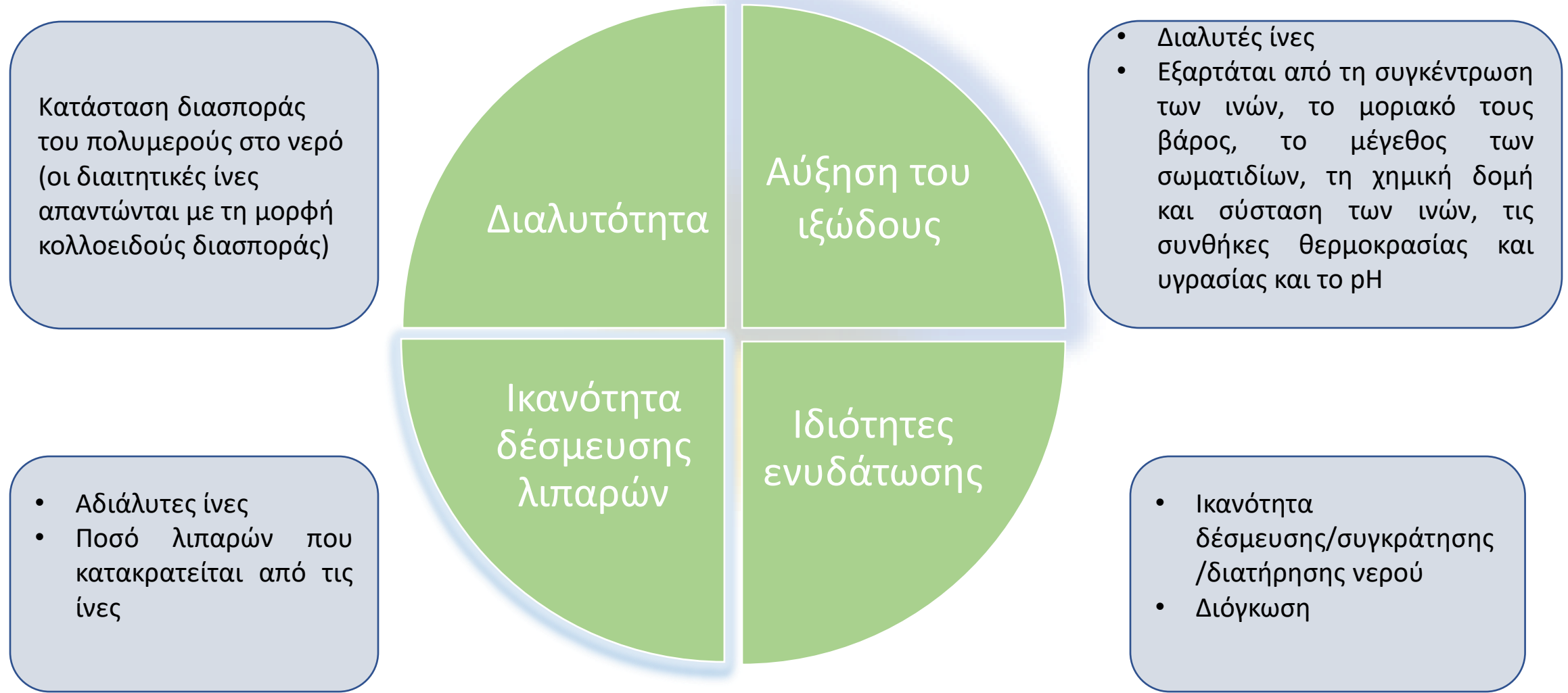
FOS, fructo-oligosaccharides.

* Cited by McCleary *et al.*⁽¹⁰⁾.

AOAC 985.29	AOAC 2001.03	AOAC 2009.01
Enzymic digestion of starch		
α -Amylase 95°C, 15 min		α -Amylase 37°C, 16 h
Recovery and assay of DF		
Insoluble and soluble DF of high molecular weight (HMwDF)		
(1)		
Resistant starch*	Resistant starch*	Resistant starch†
(2)	(2)	(2)
	Low-molecular-weight soluble DF	
	(3)	
TDF = (1) + (2)	TDF = (1) + (2) + (3)	TDF = (1) + (2) + (3)

} HMwDF

Διαιτητικές Ίνες-Φυσικοχημικές ιδιότητες



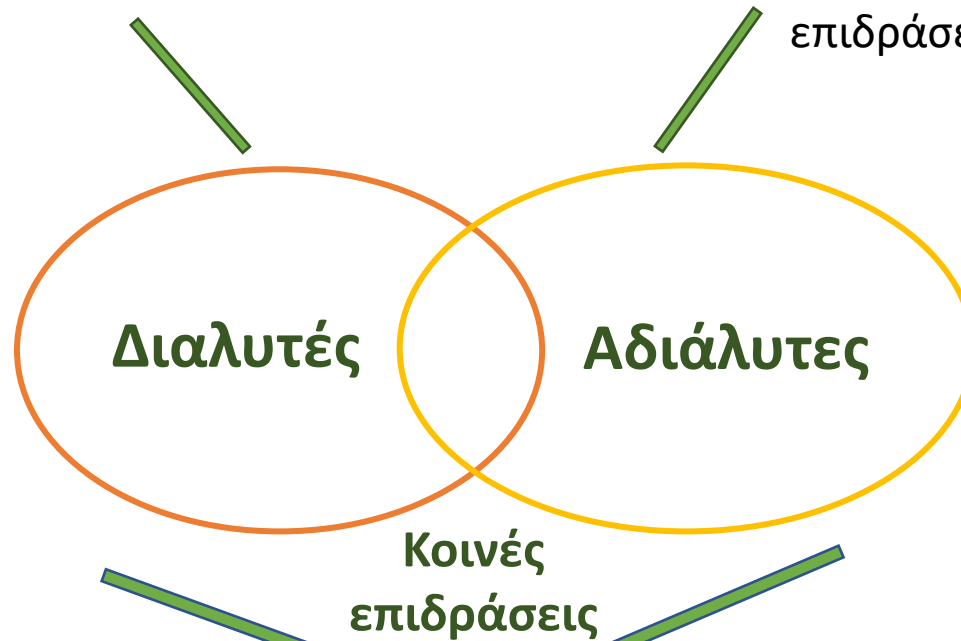
Μεταβολικές Επιδράσεις Διαιτητικών Ινών

- Ιξώδεις
- Ικανότητα σχηματισμού πηκτών
- Υφίστανται ζύμωση-παραγωγή SCFA (οξικό, προπιονικό και βουτυρικό)
- Επιδράσεις στη μικροβιακή χλωρίδα

- Μη-ιξώδεις
- Δεν έχουν την ικανότητα σχηματισμού πηκτών
- Υφίστανται μικρού βαθμού ζύμωση (στην καλύτερη περίπτωση)-δεν υπάρχουν επιδράσεις στα SCFA

Επιδράσεις-κλειδιά

- ↓ Απορρόφηση θρεπτικών συστατικών
- ↓ Μεταγευματική γλυκαιμική απόκριση (γλυκαιμικός δείκτης)
- ↓ Ολική και LDL-χοληστερόλη
- ↓ Γαστρική κένωση



- ↓ Ενεργειακή πυκνότητα
- ↑ Όγκος κοπράνων
- ↑ Πληρότητα
- ↓ Αύξηση σωματικού βάρους

- ↑↓ Επίδραση στις γαστρεντερικές ορμόνες
- ↓ Φλεγμονή

Επιδράσεις-κλειδιά

- ↓ Χρόνος παραμονής στο γαστρεντερικό σωλήνα
- ↓ Απορρόφηση διαιτητικών πρωτεϊνών
- ↓ Αντίσταση στην ινσουλίνη



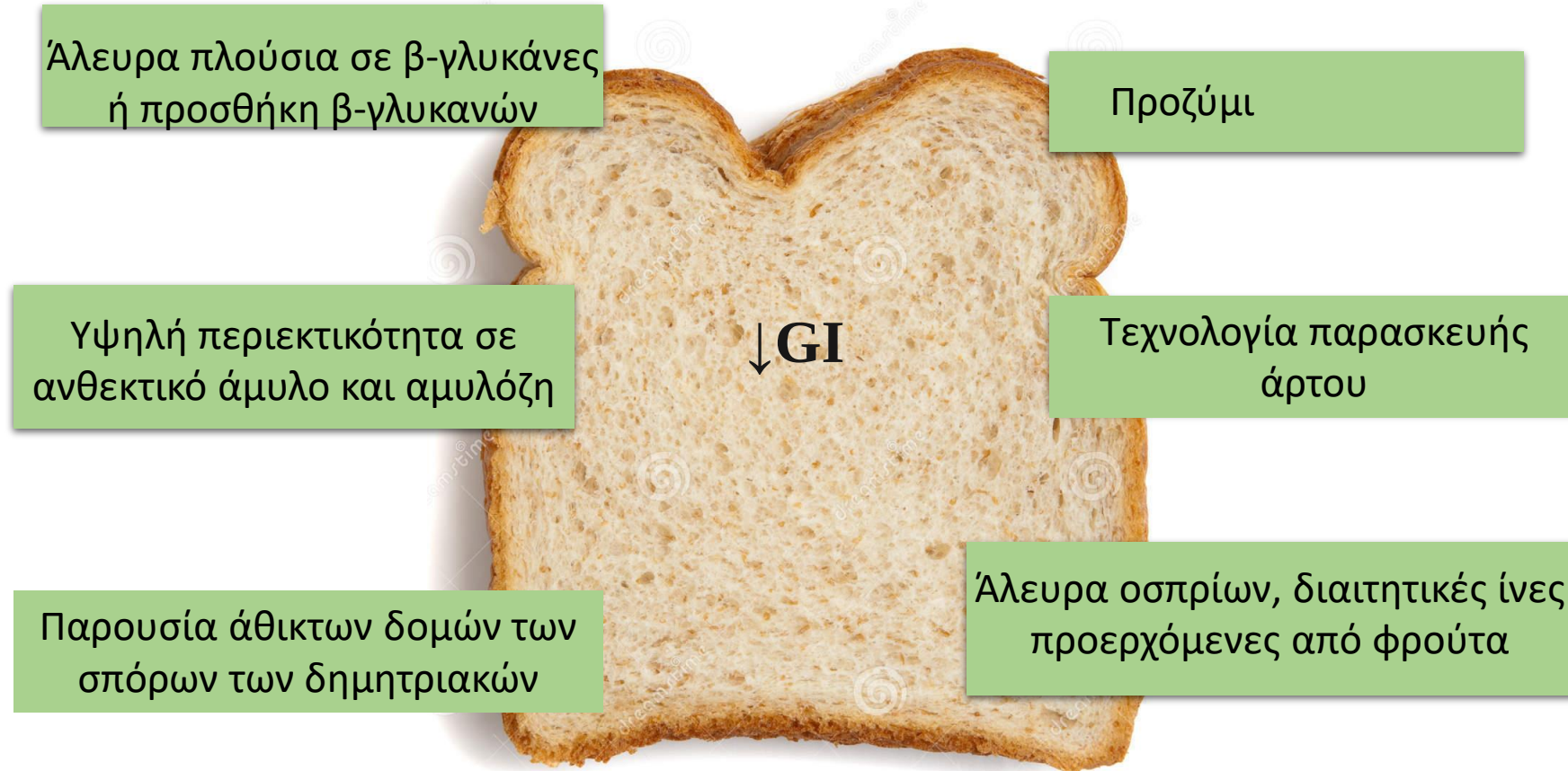
Διαιτητικές Ίνες-Ισχυρισμοί Υγείας

Country	Subject of the claim	Claim	Conditions of use	Remarks	Reference
Article 13(1) EU	α -Cyclodextrin and reduction of postprandial glycaemic responses	Consumption of α -cyclodextrin as part of a starch-containing meal contributes to the reduction of the blood glucose rise after that meal	The claim may be used for food which contains at least 5 g of α -cyclodextrin per 50 g of starch in a quantified portion as part of the meal	Information shall be given to the consumer that the beneficial effect is obtained by consuming the α -cyclodextrin as part of the meal	EU Commission ⁽¹²⁴⁾ EFSA ^(125,126)
EU	Arabinoxylan produced from wheat endosperm and reduction of postprandial glycaemic responses	Consumption of arabinoxylan as part of a meal contributes to a reduction of the blood glucose rise after that meal	The claim may be used only for food which contains at least 8 g of arabinoxylan-rich fibre produced from wheat endosperm (at least 60 % arabinoxylan by weight) per 100 g of available carbohydrates in a quantified portion as part of the meal	Information shall be given to the consumer that the beneficial effect is obtained by consuming the arabinoxylan-rich fibre produced from wheat endosperm as part of the meal	EU Commission ⁽¹²⁷⁾ EFSA ⁽¹²⁸⁾
EU	Barley grain fibre and increase in faecal bulk	Barley grain fibre contributes to an increase in faecal bulk	The claim may be used only for food which is high in that fibre ⁶ as referred to in the claim HIGH FIBRE as listed in the Annex to Regulation (EC) No 1924/2006		EU Commission ⁽¹²⁷⁾ EFSA ⁽¹²⁹⁾
EU	β -Glucans and maintenance of normal blood cholesterol concentrations	β -Glucans contribute to the maintenance of normal blood cholesterol levels	The claim may be used only for food which contains at least 1 g of β -glucans from oats, oat bran, barley, barley bran, or from mixtures of these sources per quantified portion	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 3 g of β -glucans from oats, oat bran, barley, barley bran, or from mixtures of these β -glucans	EU Commission ⁽¹²⁷⁾ EFSA ^(129,130)
EU	β -Glucans from oats and barley and reduction of postprandial glycaemic responses	Consumption of β -glucans from oats or barley as part of a meal contributes to the reduction of the blood glucose rise after that meal	The claim may be used only for food which contains at least 4 g of β -glucans from oats or barley for each 30 g of available carbohydrates in a quantified portion as part of the meal	Information shall be given to the consumer that the beneficial effect is obtained by consuming the β -glucans from oats or barley as part of the meal	EU Commission ⁽¹²⁷⁾ EFSA ⁽¹²⁹⁾
EU	Chitosan and maintenance of normal blood LDL-cholesterol concentrations	Chitosan contributes to the maintenance of normal blood cholesterol levels	The claim may be used only for food which provides a daily intake of 3 g of chitosan	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 3 g of chitosan	EU Commission ⁽¹²⁷⁾ EFSA ⁽¹³¹⁾
EU	Glucomannan (konjac mannan) and maintenance of normal blood cholesterol concentrations	Glucomannan contributes to the maintenance of normal blood cholesterol levels	The claim may be used only for food which provides a daily intake of 4 g of glucomannan	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 4 g of glucomannan. Warning of choking to be given for individuals with swallowing difficulties or when ingesting with inadequate fluid intake – advice on taking with plenty of water to ensure substance reaches stomach	EU Commission ⁽¹²⁷⁾ EFSA ^(86,132)
EU	Glucomannan (konjac mannan) and reduction of body weight	Glucomannan in the context of an energy-restricted diet contributes to weight loss	The claim may be used only for food which contains 1 g of glucomannan per quantified portion	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 3 g of glucomannan in three doses of 1 g each, together with 1–2 glasses of water, before meals and in the context of an energy-restricted diet	EU Commission ⁽¹²⁷⁾ EFSA ⁽⁸⁶⁾
EU	Guar gum and maintenance of normal blood cholesterol concentrations	Guar gum contributes to the maintenance of normal blood cholesterol levels	The claim may be used only for food which provides a daily intake of 10 g of guar gum	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 10 g of guar gum. Warning of choking to be given for individuals with swallowing difficulties or when ingesting with inadequate fluid intake – advice on taking with plenty of water to ensure substance reaches stomach	EU Commission ⁽¹²⁷⁾ EFSA ⁽¹²⁵⁾
EU	Oat grain fibre and increase in faecal bulk	Oat grain fibre contributes to an increase in faecal bulk	The claim may be used only for food which is high in that fibre ⁶ as referred to in the claim HIGH FIBRE as listed in the Annex to Regulation (EC) No 1924/2006		EU Commission ⁽¹²⁷⁾ EFSA ⁽¹²⁸⁾

Διαιτητικές Ίνες-Ισχυρισμοί Υγείας

Country	Subject of the claim	Claim	Conditions of use	Remarks	Reference
EU	Pectins and reduction of postprandial glycaemic responses	Consumption of pectins with a meal contributes to the reduction of the blood glucose rise after that meal	The claim may be used only for food which contains 10 g of pectins per quantified portion	Information shall be given to the consumer that the beneficial effect is obtained by consuming 10 g of pectins as part of the meal. Warning of choking to be given for individuals with swallowing difficulties or when ingesting with inadequate fluid intake – advice on taking with plenty of water to ensure substance reaches stomach	EU Commission ⁽¹²⁷⁾ EFSA ⁽⁸⁶⁾
EU	Pectins and maintenance of normal blood cholesterol concentrations	Pectins contribute to the maintenance of normal blood cholesterol levels	The claim may be used only for food which provides a daily intake of 6 g of pectins	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 6 g of pectins. Warning of choking to be given for individuals with swallowing difficulties or when ingesting with inadequate fluid intake – advice on taking with plenty of water to ensure substance reaches stomach	EU Commission ⁽¹²⁷⁾ EFSA ^(86,129)
EU	Resistant starch and reduction of postprandial glycaemic responses	Replacing digestible starches with resistant starch in a meal contributes to a reduction in the blood glucose rise after that meal	The claim may be used only for food in which digestible starch has been replaced by resistant starch so that the final content of resistant starch is at least 14 % of total starch		EU Commission ⁽¹²⁷⁾ EFSA ⁽¹³³⁾
EU	Rye fibre and changes in bowel function	Rye fibre contributes to normal bowel function	The claim may be used only for food which is high in that fibre ⁶ as referred to in the claim HIGH FIBRE as listed in the Annex to Regulation (EC) No 1924/2006		EU Commission ⁽¹²⁷⁾ EFSA ⁽¹³⁴⁾
EU	Wheat bran fibre and reduction in intestinal transit time	Wheat bran fibre contributes to an acceleration of intestinal transit	The claim may be used only for food which is high in that fibre ⁶ as referred to in the claim HIGH FIBRE as listed in the Annex to Regulation (EC) No 1924/2006	Information shall be given to the consumer that the claimed effect is obtained with a daily intake of at least 10 g of wheat bran fibre	EU Commission ⁽¹²⁷⁾ EFSA ⁽¹³⁵⁾
EU	Wheat bran fibre and increase in faecal bulk	Wheat bran fibre contributes to an increase in faecal bulk	The claim may be used only for food which is high in that fibre ⁶ as referred to in the claim HIGH FIBRE as listed in the Annex to Regulation (EC) No 1924/2006		EU Commission ⁽¹²⁷⁾ EFSA ⁽¹³⁶⁾
Article 13(5) EU	Sugarbeet fibre	Sugarbeet fibre and increasing faecal bulk	The claim may be used only for food which is high in that fibre ⁶ as referred to in the claim HIGH FIBRE as listed in the Annex to Regulation (EC) No 1924/2006		EU Commission ⁽¹³⁷⁾ EFSA ⁽¹³⁸⁾
Article 14 (1)(a) EU	Barley β-glucans and risk of (coronary) heart disease	Barley β-glucan has been shown to lower/ reduce blood cholesterol. High cholesterol is a risk factor in the development of CHD	The claim can be used for foods which provide at least 1 g of barley β-glucan per quantified portion	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 3 g of barley β-glucan	EU Commission ⁽¹³⁹⁾ EFSA ^(140,141)
EU	Oat β-glucan and risk of heart disease	Oat β-glucan has been shown to lower/ reduce blood cholesterol. High cholesterol is a risk factor in the development of CHD	The claim can be used for foods which provide at least 1 g of oat β glucan per quantified portion	Information shall be given to the consumer that the beneficial effect is obtained with a daily intake of 3 g of oat β-glucan	EU Commission ⁽¹⁴²⁾ EFSA ⁽¹⁴³⁾

Τρόποι μείωσης GI άρτου



Επίδραση β-γλυκανών και ανθεκτικού αμύλου στον GI του άρτου



RSB: Άρτος σίτου με
ανθεκτικό άμυλο

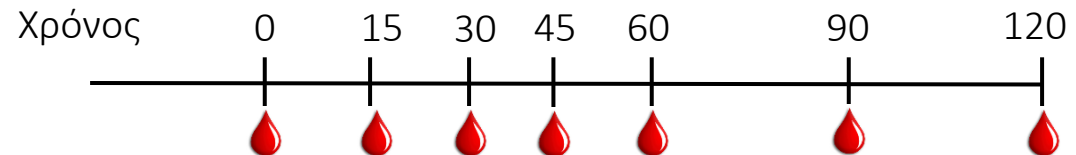


BGB: Άρτος σίτου
με β-γλυκάνες



GS: Διάλυμα
γλυκόζης, τρόφιμο
αναφοράς

Μετά από ολονύκτια νηστεία



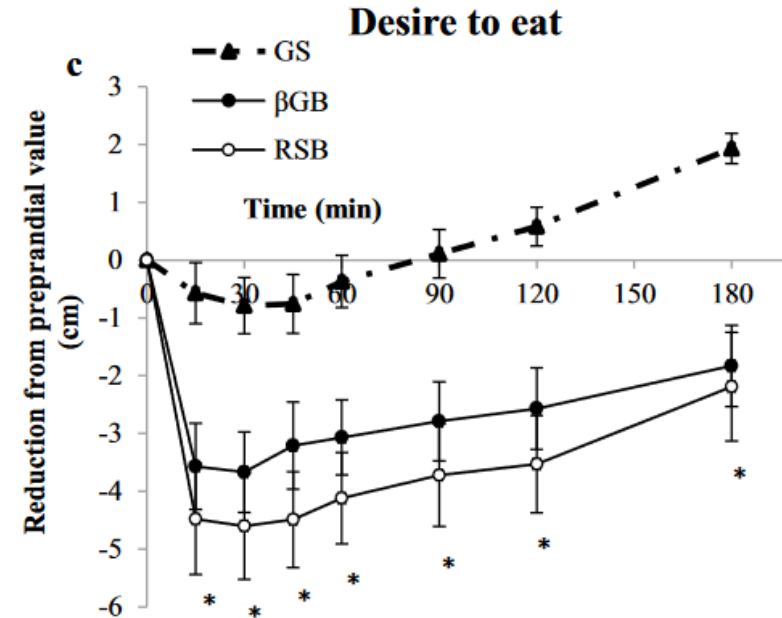
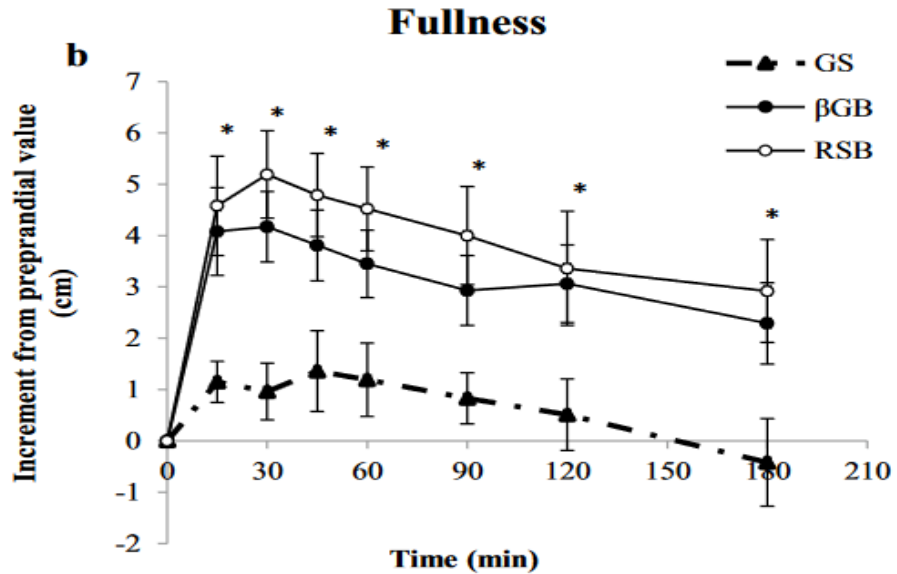
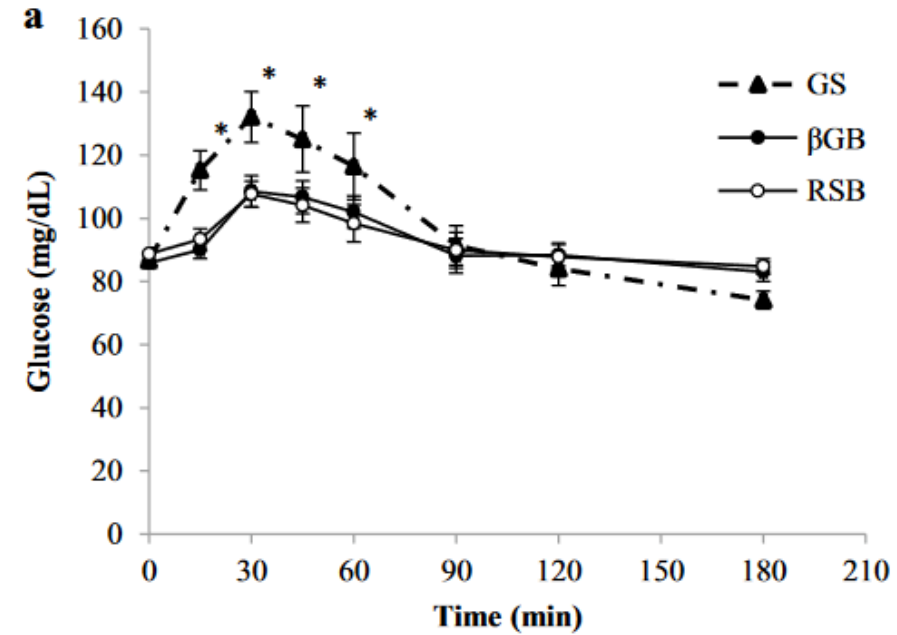
Συλλογή δειγμάτων αίματος
Γλυκόζη, ινσουλίνη, γκρελίνη



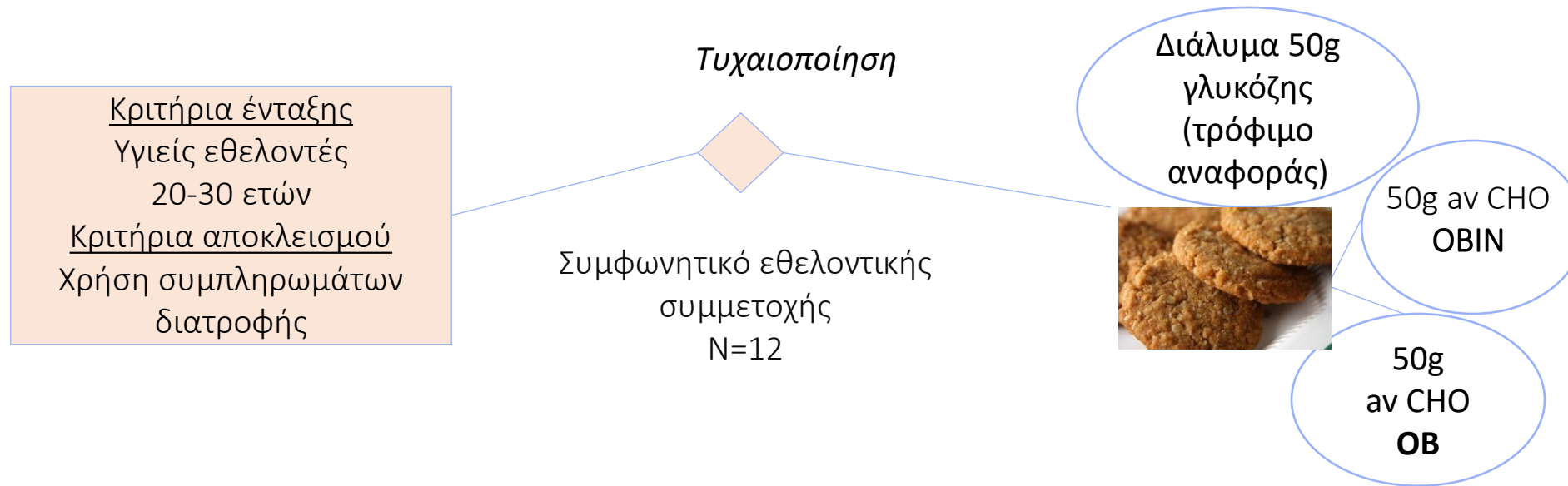


Enrichment of bread with beta-glucans or resistant starch induces similar glucose, insulin and appetite hormone responses in healthy adults

Panagiota Binou¹ · Amalia E. Yanni¹ · Athena Stergiou^{1,2} · Konstantinos Karavasilis³ · Panagiotis Konstantopoulos⁴ · Despoina Perrea⁴ · Nikolaos Tentolouris² · Vaios T. Karathanos¹



Μπισκότα βρώμης με ινουλίνη και επίδραση στη μεταγευματική απόκριση της γκρελίνης

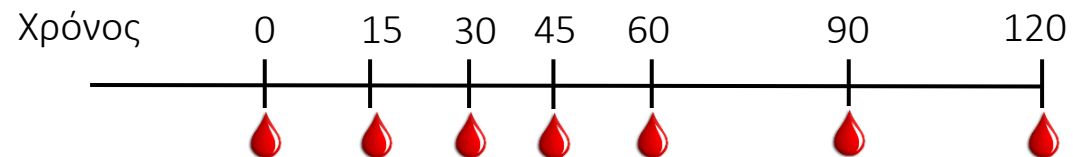


OB: Μπισκότο
βρώμης



OBIN: Μπισκότο
βρώμης με
ινουλίνη

Μετά από ολονύκτια νηστεία



Συλλογή δειγμάτων αίματος
Γλυκόζη, ινσουλίνη, γκρελίνη





Cite this: *Food Funct.*, 2016, 7, 3295

Evaluation of a high nutritional quality snack based on oat flakes and inulin: effects on postprandial glucose, insulin and ghrelin responses of healthy subjects

Nikoleta S. Stamataki,^a Eirini K. Nikolidaki,^a Amalia E. Yanni,^{*a} Maria Stoupaki,^c Panagiotis Konstantopoulos,^b Alexandros-Pantelis Tsigkas,^a Despoina Perrea,^b Nikolaos Tentolouris^c and Vaios T. Karathanos^a

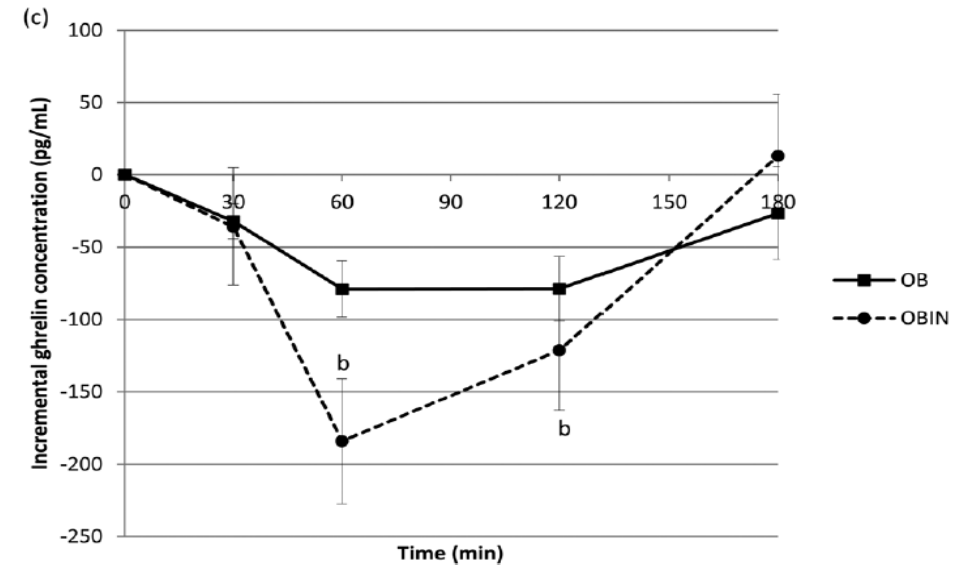
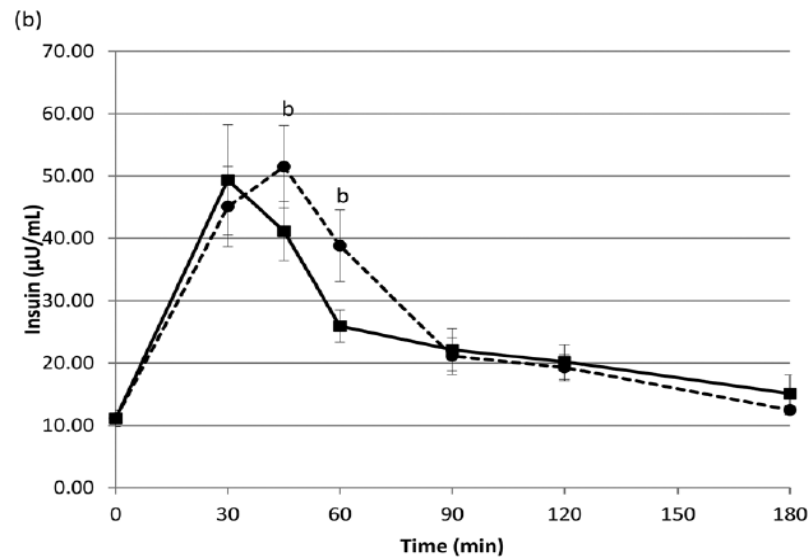
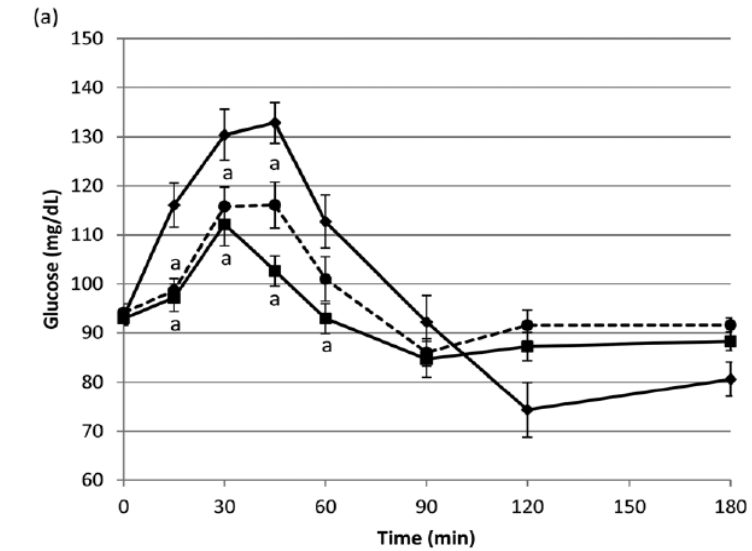


Fig. 1 Glucose (a), insulin (b) and ghrelin (c) responses 180 min after the consumption of the two biscuits. Values are expressed as mean $\pm$ SEM ($n = 11$). ^a $P < 0.05$ compared to GLU, ^b $P < 0.05$ compared to OB. GLU, glucose; OB, oat biscuit; OBIN, oat biscuit enriched with 4% inulin.





Ευχαριστώ!

Still Life with Vegetables and Fruit
Vincent van Gogh (1853 - 1890), Nuenen, Autumn 1884