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BUCKWHEAT FROM A POLISH VIEW

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Buckwheat in Europe

Poland

Germany

Italy

Slovenia

Austria

Bialorus

Ukraine

Sweden

Russia

Finland

Norway

× Regions of cultivation and research on buckwheat

• Regions of temporary buckwheat cultivation

◦ Regions of buckwheat cultivation in the past

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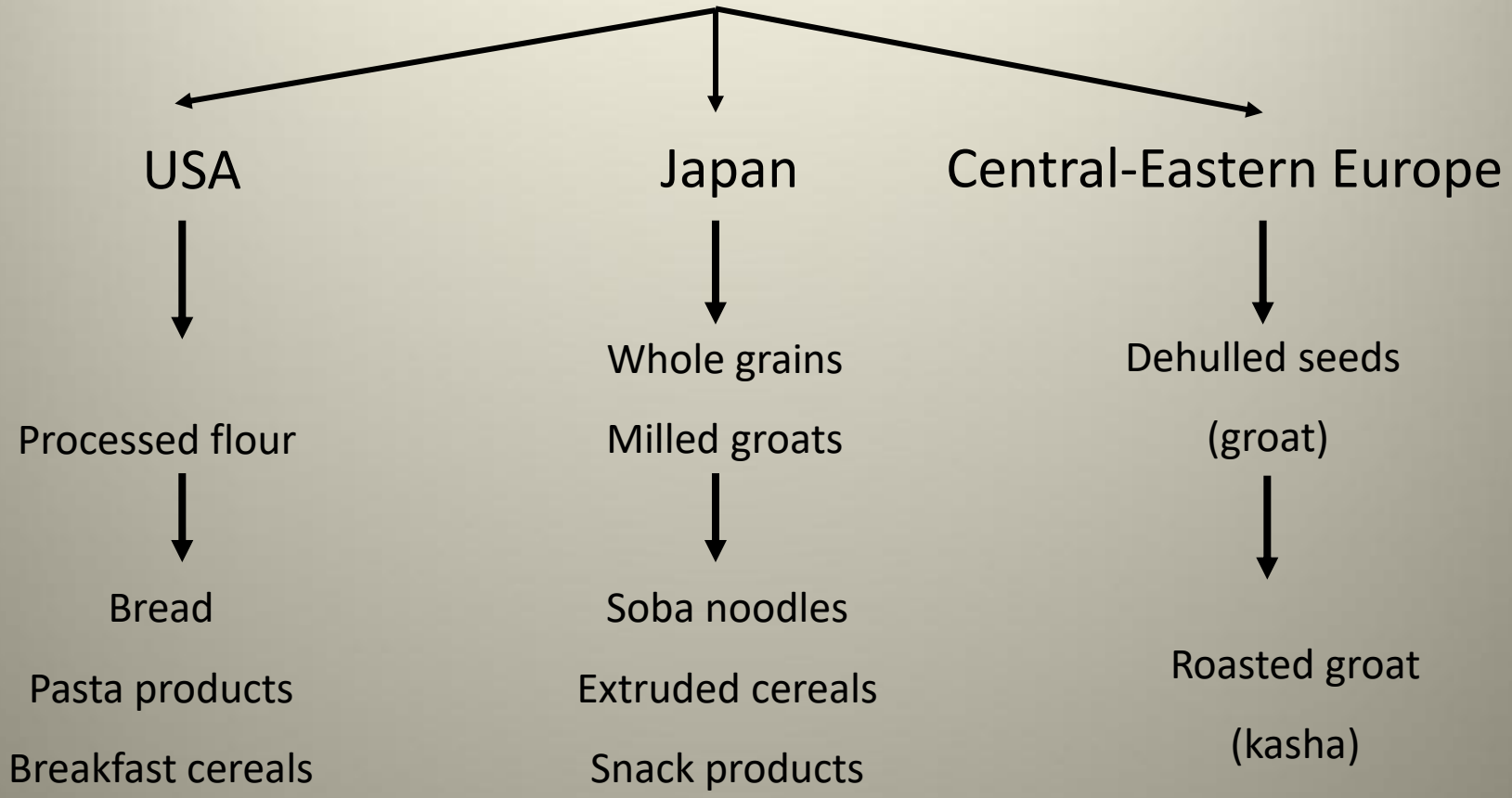
Use of buckwheat



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Buckwheat industry in Poland

Raw buckwheat → Typical milling products from unhusked and husked buckwheat

Steaming
Roasting

Dehulling → Hulls – waste byproduct

Roasted groat → 

Milling

Novel buckwheat flour from roasted groats

Typical milling products from unhusked and husked buckwheat → Wholegrain buckwheat flour

Typical milling products from unhusked and husked buckwheat → Flour from husked buckwheat

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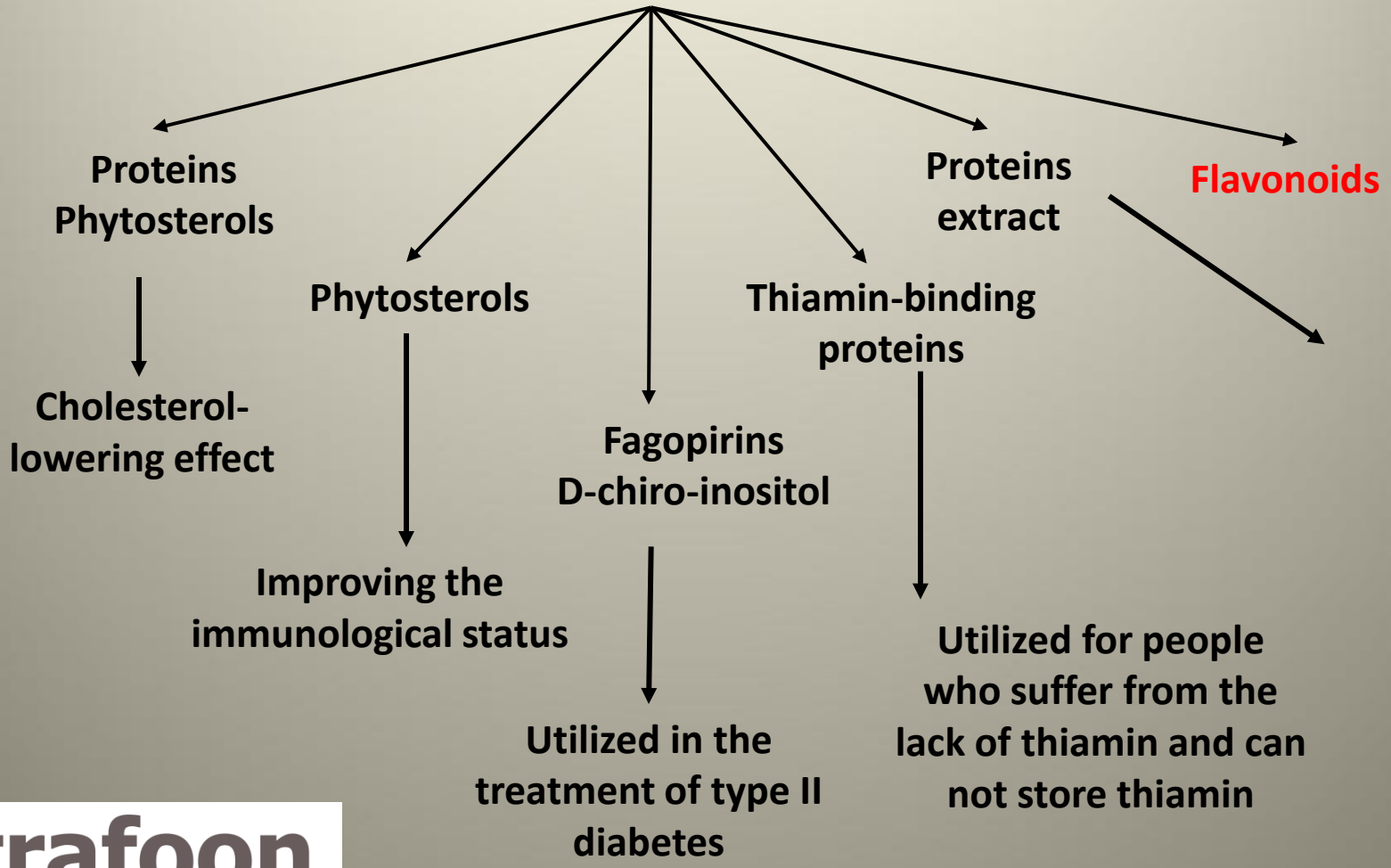
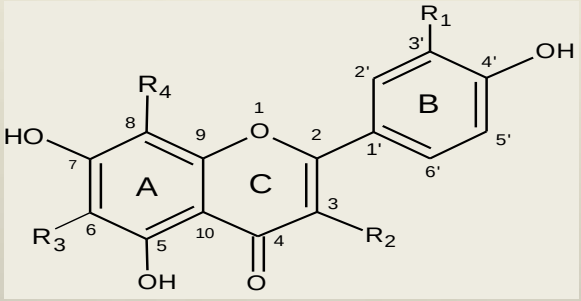
Biologically active compounds of buckwheat with beneficial action on consumer's organism



Buckwheat phytochemicals attracting attention due to their potential health beneficial action



Buckwheat flavonoids	R_1	R_2	R_3	R_4
rutin	OH	rutinose	H	H
quercetin	OH	OH	H	H
quercitrin	OH	ramnose	H	H
orientin	OH	H	H	glucose
homoorientin	OH	H	glucose	H
vitexin	H	H	H	glucose
isovitexin	H	H	glucose	H

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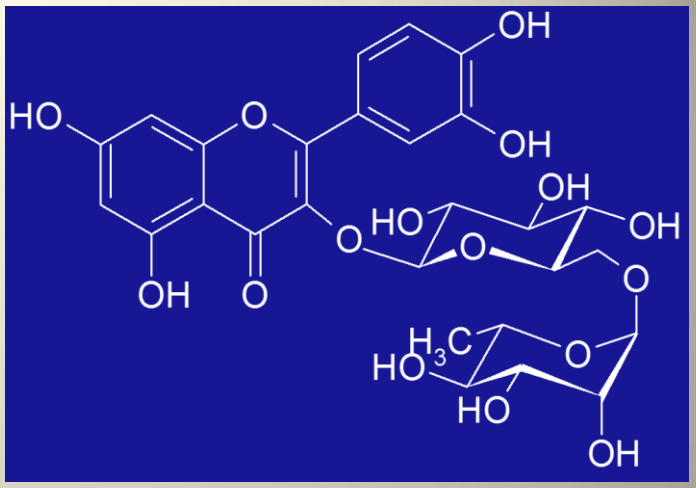
Rutin (quercetin-3-rutinoside)



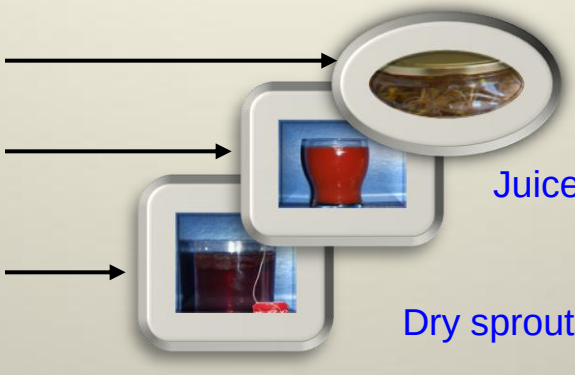
- anti-inflammatory and vasoactive properties
- capability to diminish capillary permeability
- reduce the risk of arteriosclerosis
- reducing coronary heart disease,
- diminishing of platelet aggregation
- inhibiting low-density lipoprotein (LDL) peroxidation
- protective effects against ethanol-induced gastric lesions
- against DNA damage
- protective agent against carcinogenesis
- **the most potent natural inhibitors of AGEs formation**
- hypocholesterolemic effect in humans after the intake of buckwheat products.

Orientin
Homoorientin
Isovitexin
Vitexin

- hypotensive properties
- anti-inflammatory
- antispasmodic
- antimicrobial
- radioprotective effects
- anti-glycation activity

Buckwheat sprouts – a new vegetable

Sprouted in the darkness

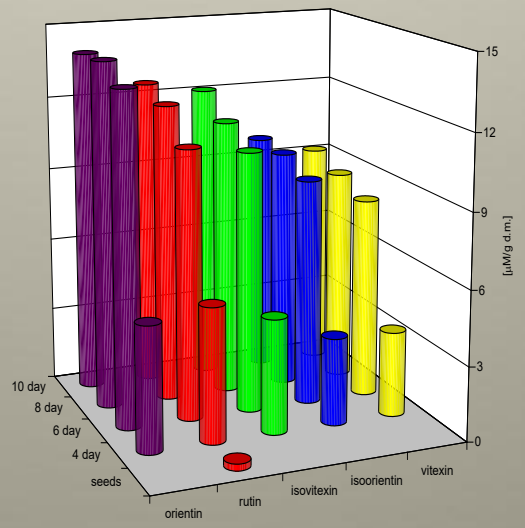


Pickled sprouts

Juice from sprouts

Dry sprouts as tea ingredient

Sprouted in the light



Rapid biosynthesis:
- flavonoids
- ascorbic acid
- α-tocopherol.

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Buckwheat food factory of the future – waste-free and energy saving

selection of buckwheat cultivar

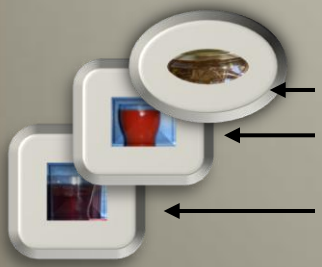
selection of high antioxidant material from aerial parts

Buckwheat flowers as ingredient in healthy food products

Buckwheat hull tea

Patent fuel

HP – shorter cooking time



HP

shorter cooking time

bakery products

Gluten-free bread
Buckwheat enriched wheat bread
Ginger cakes enriched in rutin

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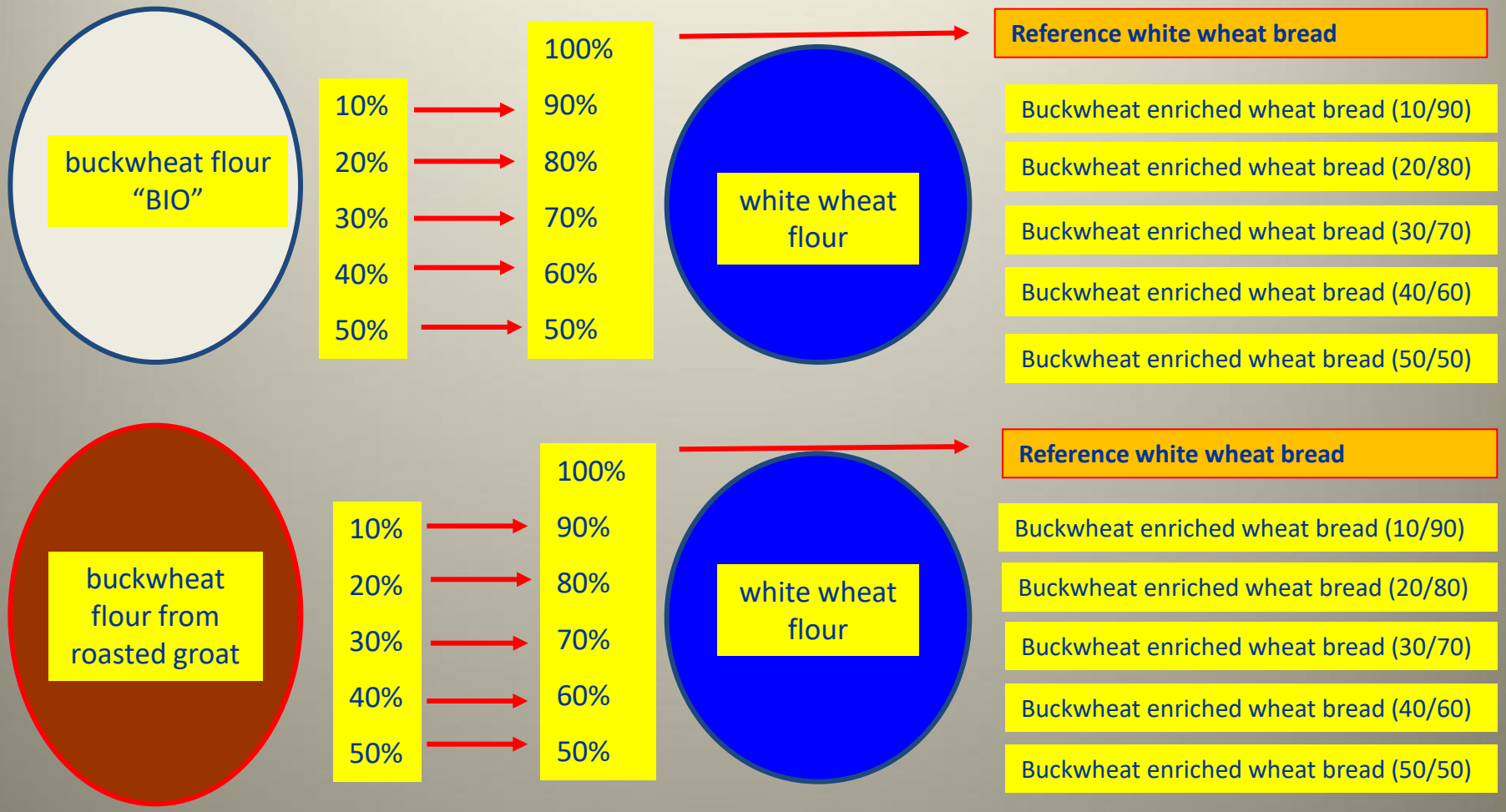
BUCKWHEAT ENHANCED WHEAT BREADS



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FORMULATION OF RYE-BUCKWHEAT GINGER CAKES WITH RUTIN

buckwheat honey	50 g
sugar	20 g
baking soda	3 g
butter	25 g
spice mix	2g

+ rye flour 100 g → **CONTROL**

buckwheat honey	50 g
sugar	20 g
baking soda	3 g
butter	25 g
spice mix	2g

+ rye flour 70 g + flour from roasted buckwheat groats 30 g

+ rye flour 70 g + flour from husked buckwheat 30 g

↓

Dough making

↓

Baking

180 °C 18 minutes

BITTER BUCKWHEAT TEA FROM UNHUSKED TARTARY BUCKWHEAT

2 g of tartary buckwheat groats

+

200 mL of boiled water

bitter buckwheat tea

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BUCKWHEAT HULL TEA INFUSION

2 g of buckwheat hulls

+

200 mL of boiled water

ready-to-drink tea

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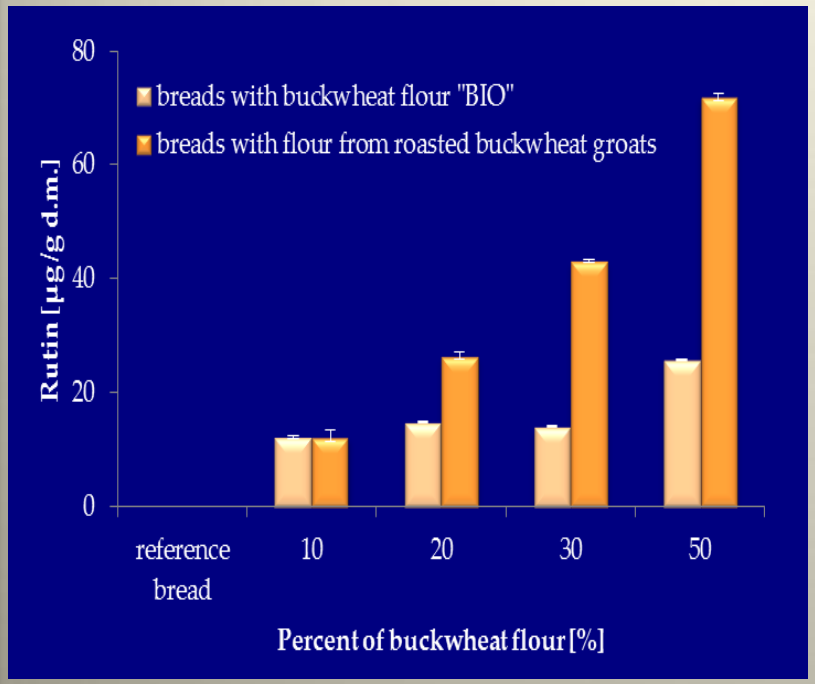
Rutin content

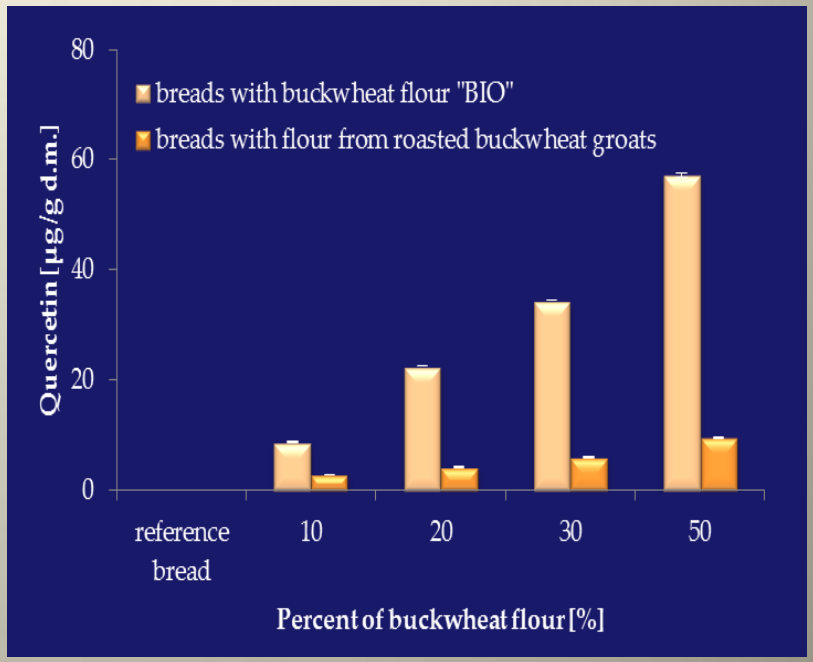


buckwheat flour “BIO”

white wheat flour

Ru and Q

Quercetin content



buckwheat flour from roasted groat

white wheat flour

Ru and Q

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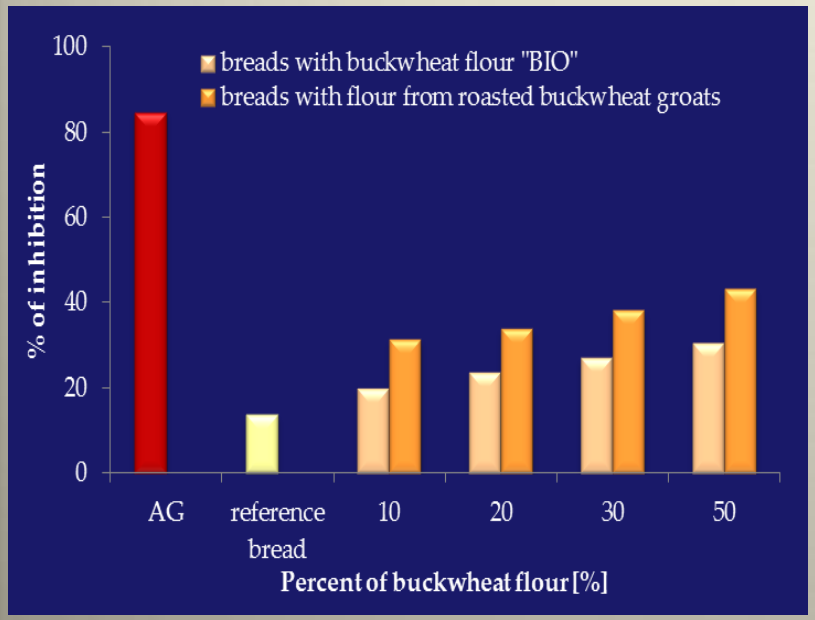
The inhibitory effect of buckwheat enhanced wheat bread extracts on the formation of AGEs

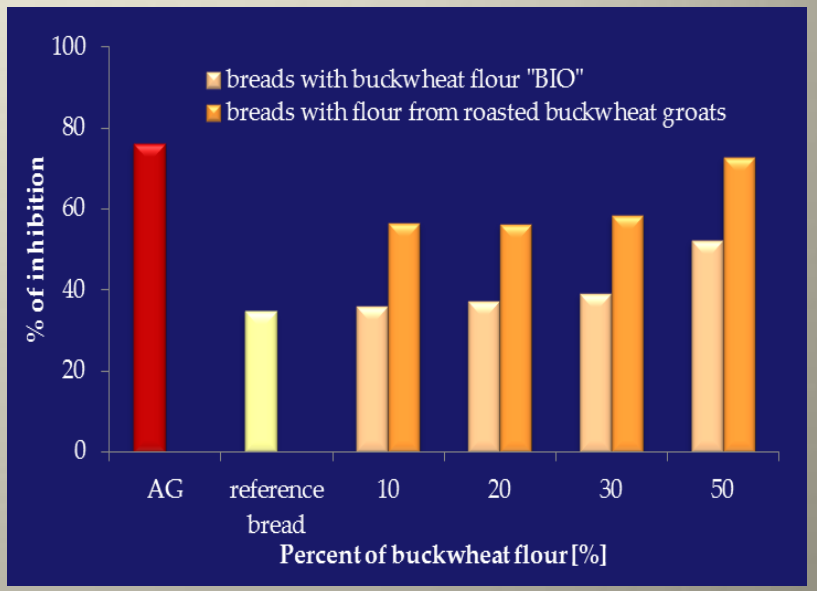
BSA-Glucose model system



Inhibition AGEs vs Ru r = 0.86 (BIO)

Inhibition AGEs vs Ru r = 0.89 (ROASTED)

BSA-MGO model system



Inhibition AGEs vs Ru r = 0.94 (BIO)

Inhibition AGEs vs Ru r = 0.88 (ROASTED)

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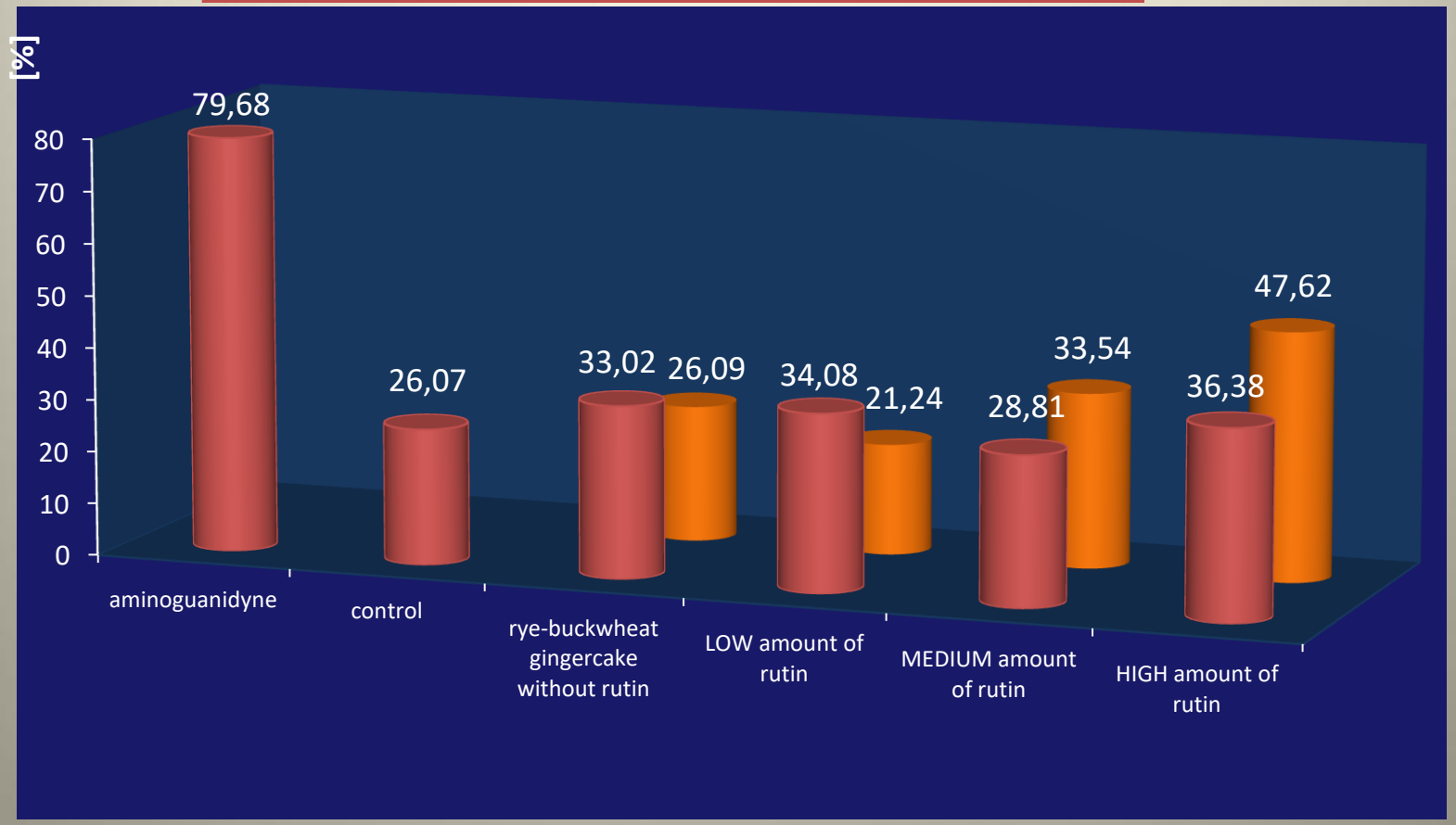
The inhibitory effect of buckwheat ginger cake extracts on the formation of AGEs

Bovine serum albumin -glucose system (BSA/glucose)



Ginger cakes based on flour from husked buckwheat

Rutin vs BSA /Glu r = 0.47

Ginger cakes formulated on flour from milled roasted buckwheat groats

Rutin vs BSA /Glu r = 0.93

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Antioxidative capacity of bitter buckwheat tea and green tea with mint

Type of tea	DPPH RSA (µmol Trolox/g d.m.)	TPC (mg catechin/g d.m.)	AC (µmol Trolox/g dm)
Bitter buckwheat tea	125.43 ± 0.63[a]	10.20 ± 0.47[a]	11.93 ± 0.86[a]
Green tea with mint	580.64 ± 29.16[b]	47.34 ± 1.61[b]	36.93 ± 1.39[b]

Compound	Extracted by 80% MeOH	After boiled water infusion [2]
Homoorientin (µg/g d.m.)	84.38 ± 0.42[a]	110.68 ± 0.73[b]
Orientin	59.14 ± 0.77[a]	73.94 ± 0.78[b]
Vitexin	45.86 ± 0.94[a]	80.90 ± 1.07[b]
Rutin	32855.29 ± 0.41[a]	10178.90 ± 0.41[b]
Isovitexin	36.50 ± 0.41[a]	92.35 ± 0.30[b]
Quercetin	2792.18 ± 1.94	nd
Total	35879.35[a]	10536.77[b]

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Total phenolic contents (TPC) and antioxidant capacity of buckwheat hull tea and green tea

Type of tea	TPC (mg catechin/g d.m.)	AC (µmol Trolox/g d.m.)	
		DPPH test	CV
Buckwheat hull tea	3.22 ± 0.05[a]	12.47 ± 0.21[a]	11.22 ± 0.39[a]
Green tea	87.20 ± 2.37[b]	530.55 ± 15.16[b]	47.12 ± 3.10[b]

Compound	Buckwheat hull (µg/g d.m.)	Buckwheat hull tea infusion (µg/g d.m.)
homoorientin	7.46 ± 0.47[a]	7.13 ± 0.39[a]
orientin	15.13 ± 0.28[a]	26.70 ± 0.65[b]
vitexin	51.66 ± 0.82[a]	64.70 ± 0.84[b]
rutin	58.46 ± 0.66[a]	62.78 ± 0.87[b]
isovitexin	18.87 ± 0.95[a]	10.05 ± 0.21[b]
quercetin	30.90 ± 0.91	nd
total	182.48 ± 0.68[a]	171.36 ± 0.59[b]

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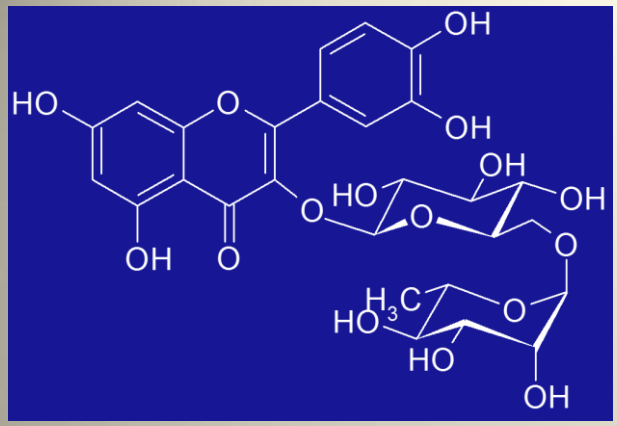
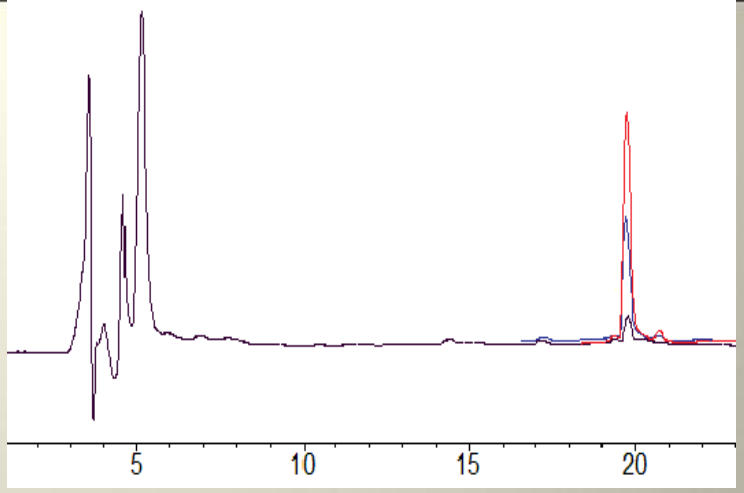
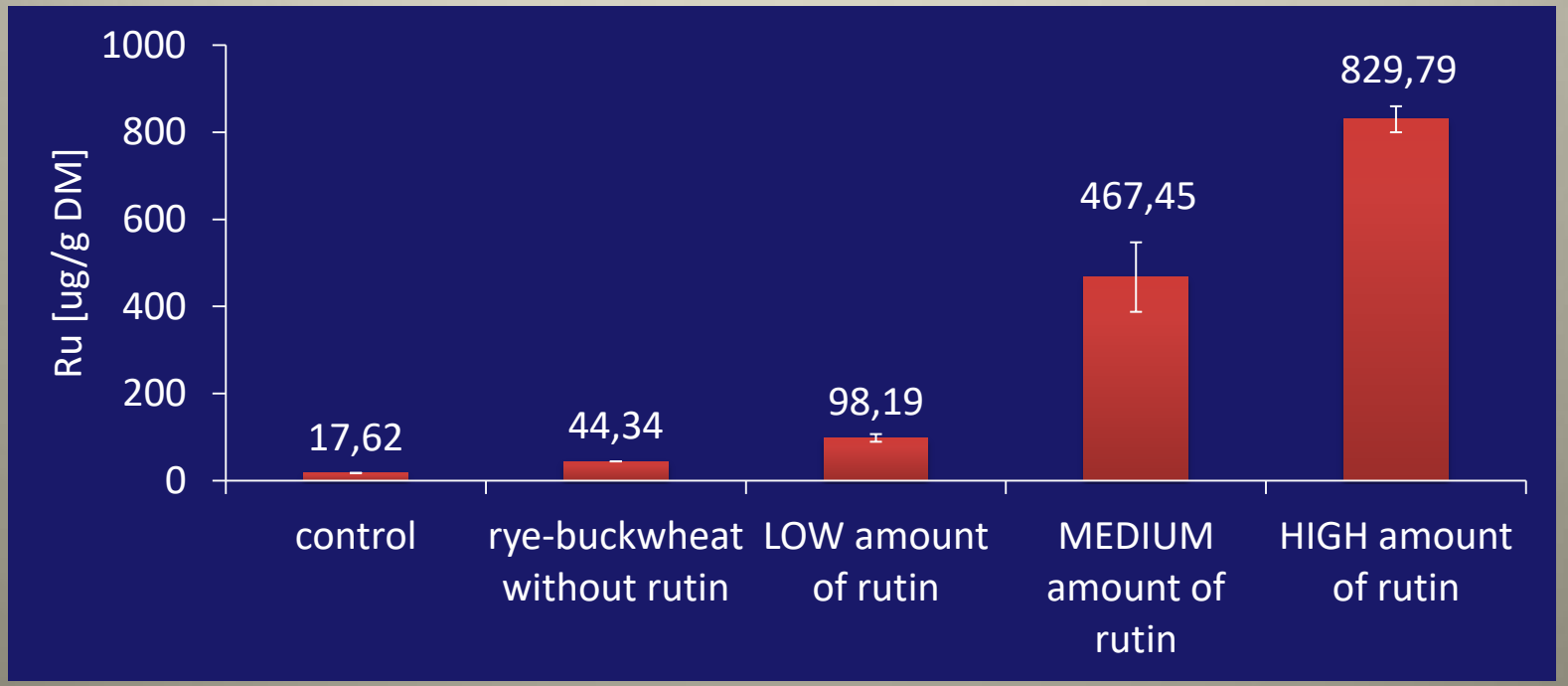




Ginger cakes based on flour from buckwheat flour



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THE IDEA

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weight: 50 g

6 pieces

1 tablet contains 25 mg of rutin

50 g of ginger cakes with high amount of rutin corresponds to one tablet of rutin

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RYE-BUCKWHEAT GINGER CAKES ENRICHED WITH RUTIN

flour from husked buckwheat

flour from roasted buckwheat groats

Rye-buckwheat ginger cakes with LOW addition of rutin
(2.5 mg of rutin in 50 g of product)

Rye-buckwheat ginger cakes with MEDIUM addition of rutin
(12.5 mg rutin in 50 g of product)

Rye-buckwheat ginger cakes with HIGH addition of rutin
(25 mg rutin in 50 g of product)

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The bitter buckwheat tea showed lower antioxidative capacity determined with the DPPH RSA and CV assays and a lower content of total phenolic compounds than the green tea with mint.

The bitter buckwheat tea contained mainly rutin and a small quantity of quercetin and flavone *C*-glucosides - flavonoids important from the dietary point of view.

The unhusked tartary buckwheat may be used for tea preparation as the main single tea ingredient or as a mixed component of other tisanes.

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CONCLUSIONS

Extracts from buckwheat enhanced wheat breads, formulated on white wheat flour and flour from roasted buckwheat groats showed higher inhibitory effects against AGEs formation than those formulated on white wheat flour and buckwheat flour “BIO”.

Rye-buckwheat ginger cakes with high rutin addition showed the highest inhibitory activity against AGEs formation as compared to ginger cakes with low and medium rutin supplementation.

The unhusked tartary buckwheat may be used for functional tea preparation as the main single tea ingredient or as a mixed component of other tisanes.

The buckwheat hull tea showed lower inhibitory activity against the formation of AGEs as compared to green tea.

This study showed possibility of formulation buckwheat derived bakery products and infusions with effective inhibition the formation of AGEs *in vitro*.

This further supports that buckwheat derived bakery products and infusions may be beneficial food choice for diabetics as AGEs have been implicated in the pathogenesis of various diabetic complications and other diseases.

The rich source of polyphenols such as buckwheat flours, buckwheat hull, tartary buckwheat groasts should be considered as a new ingredients in the innovative buckwheat derived products .

Antioxidants in thermally treated buckwheat groats. Mol. Nutr. Food Res., 2006, 50, 824-832.

Comparison of spectrophotometric and electrochemical methods for the evaluation of antioxidant capacity of buckwheat products after hydrothermal treatment. J. Agric. Food Chem., 2007, 55 (15), 6124-6131.

Changes in protein quality and antioxidant properties of buckwheat seeds and groats induced by roasting. J Agric Food Chem., 2009, 57, 4771-4776.

Determination of the antioxidant activity of rutin and its contribution to the antioxidant capacity of diversified buckwheat origin material by updated analytical strategies. Pol. J. Food Nutr. Sci., 2010, 60, 315-321.

Antioxidant activity of flavone C-glucosides determined by updated analytical strategies. Food Chemistry, 2011, 124, 672-678.

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Thank you for your attention

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