



STUDY OF SPROUTED HULLLESS BARLEY GRAINS AND THEIR USES FOR THE DEVELOPMENT OF FUNCTIONAL SWEET SNACKS

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The significant advantage of ‘Kornelija’ is that it has both high protein content and β -glucans content, also grain *threshability* for this cultivar is high corresponding requirements of food barley.

Along with grains vegetables and fruits is part of the healthy daily diet. They are rich sources of vitamins, minerals, dietary fiber, as well as plant sterols, flavonoids and other antioxidants.

There is often a lack of time to enjoy a complete diet, a large part of the society uses snacks. The demand for snacks and consumption of confectionery continues to grow.



The aim of study was to evaluate the benefits of sprouted hullless barley grains and the possibilities of using them in the barley-fruit-vegetable snacks production.



The sprouting of hulless barley 'Kornelija'.

- The grains were rinsed and soaked in water in a ratio of 1:2 at 22±2°C for 24±1h.
- placed for sprouting in a climatic chamber at a temperature 35±1°C and relative air humidity (RH) 95±5% in darkness for 36±1 h.
- dried at +60±2°C for 7±1 h UF160 (Memmert) (Rakcejeva., 2008)



Description of snacks preparation:

- Beets, carrots: cooked raw materials used. Peeled, grated, dried, powdered;
- Plums, dates: dried, chopped raw materials used;
- Japanese quince syrup with Sukrin: made from quince juice with the addition of the sweetener Sukrin;
Japanese quince syrup: made from quince juice with added sugar;
Japanese quince concentrate: evaporated quince juice.
- Blackcurrants: frozen blackcurrants, dried, ground;
- Sprouted grain bars – **1vG; 2vG; 3vG; 4vG**,
- Bars with barley flour – **1vF; 2vF; 3vF; 4vF**.



The chemical analyses

- **Protein** content - Kjeldahl method (conversion factor 6.25)
- **Fat** content- by the Soxhlet extraction method.
- Content of **β-glucans** - CC Standard Method No. 168 using Megazyme Assay Kits.
- Content of **starch** determined by LVS EN ISO 10520:2001 .
- **Total dietary fibre (TDF)**, by AOAC 991.43:1994 method
- **Tannins** –photometric method (Paaver *et al.*, 2010)
- **Antioxidant activity** - using radical DPPH * (Heimler *et al.* 2006)
- **Phenolic** compounds- photometric method (Singleton *et al.*, 1999),
- **Total flavonoids** - photometric method (López-Perea *et al.*, 2019)
- **Sugar** profile by PB79/HPLC edV18.05,
- **Gluten, Gliadine** by RUK 5.04-ed.II (ELISA-RIDASCREEN GLIADIN)



Chemical composition of untreated and sprouted hulless barley 'Kornelija' grains

Samples	Protein,	β -glucans,	Fat	Starch	Total sugars	TDF	Gliadin	Gluten
	g100g ⁻¹						ppm	
F -untreated flour	13.5±0.4	4.4±0.3	2.4 ±0.4	62.28±0.6	0.95±0.4	26.3±0.4	82.0	164.1
G - sprouted grains	14.3±0.4	4.1±0.3	2.3±0.4	55.94±0.5	3.20±0.3 ↑	13.0±2.6 ↓	48.4 ↓	96.9 ↓
							< 100	

Samples	Total phenol (GAE mg100g ⁻¹)	Total flavonoid, (QE mg100g ⁻¹)	Antioxidant activity, (mmol TE 100g ⁻¹)	Total tannin, (mg TA 100 g ⁻¹)
	mean±SD			
F -untreated flour	273.14±7.93	290.25±7.17	493.15±5.21	1.25±0.03
G - sprouted grains	258.98 ±11.12	256.19±14.17	528.36±13.2 ↑	2.08±0.11 ↑



Recepies with sprouted hulless barley 'Kornelija' grains

Raw material / samples abbreviation	1vG	2vG	3vG	4vG
	Amount, g			
<i>'Kornelija', chopped</i>	48.4	27.5	30.0	29.4
<i>Red beets</i>	6.5	-	5.0	4.9
<i>Plums (dried)</i>	17.7	-	-	-
<i>Japanese quince syrup</i>	22.6	18.0	-	-
<i>Japanese quince syrup + Sukrin</i>	-	-	34.0	33.3
<i>Green buckwheat</i>	4.8	18.0	-	-
<i>Carrots</i>	-	9.2	10.0	9.8
<i>Honey</i>	-	9.1	-	-
<i>Dates</i>	-	18.2	-	-
<i>Black currant</i>	-	-	6.0	5.9
<i>Oat flakes</i>	-	-	15.0	14.7
<i>Japanese quince concentrates</i>	-	-	-	2.0
Total	100.0	100.0	100.0	100.0



Nutritional value of snacks with sprouted grains

Sample	1vG	2vG	3vG	4vG
Energy, kcal	314.0	330.0	218	248
Moisture	10.2	11.3	8.6	8.8
Protein, g	9.64	8.65	10.54	10.85
β -glucans, g	1.57	0.77	2.19	2.11
Carbohydrate, g	57.67	66.80	43.82	43.85
Fiber, g	15.99	12.92	13.25	13.32
Fat, g	1.40	1.20	1.33	1.84
Salts, g	0.14	0.14	0.16	0.16



In many sensory evaluation questionnaires, a comment was made that 3vG and 4vG bars should be added with chocolate because their taste was too strong and too sour.

CONCLUSIONS

- The highest evaluation (7.4) was received bars made with sprouted hulless barley grain, which were prepared according to the 2vG recipe with nutrition value 330 Kcal.
- Hedonic evaluation showed that in all 4 variants of bars grains were preferred to flour.
- Sprouted grains has significantly higher content of total sugars, total tannins and antioxidant activity, significantly lower content of allergens gliadin and gluten, unfortunately total dietary fibre also is significantly lower.

