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The Nutrition Compositional Analysis and Sensory evaluated Comparison between Chinese Naked Oats Flake and the Covered Oats Flakes from North American, Australia, and European

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Introduction

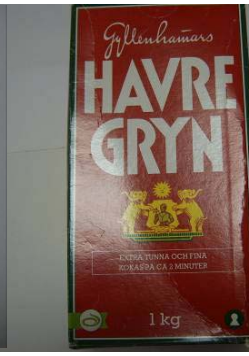
- ❖ Oat whole meal is the biggest commercialized oat products around the world, though each countries have their unique tradition oat products.
- ❖ Hot cereal is more welcomed than cold cereal in Chinese market.
- ❖ Some Chinese oat company imported covered oat from abroad, but most utilized for oat flake processing is naked oats.



Naked oats in China

- ❖ Naked oat (*Avena nuda*) has been planted in China for ~ 2100 ys and China is one of the original places of oat, 90% is naked oats.
- ❖ It is said that Genghis Khan and his troops could ride so far from Baltic Sea to Pacific Ocean, from Siberia to the Persian Gulf, all people ate oat and all horses were fed with oat. Eating oats make people and horses keep hunger away for a very long time.
- ❖ There were many folk proverbs in Chinese history, for examples,
 -  Eating oat keeps people away from hungry for one day, wheat only for half a day.
 -  Oat food can make people walk 30 km, but for wheat based food, the distance is only 20 km.
 -  Oat is the king of all cereals.

Samples from Chinese markets and foreign countries



Comparison of Consumption of oats in Western and China

In western

- ❖ **> 90% as horse feed**
- ❖ **~ 5% are processed into breakfast cereals and oat groats/flakes**
- ❖ **Less oat food diversity**

In China

- ❖ **Most of the oats are used as food for human**
- ❖ **Oats based products are traditional foods in some region of China**
- ❖ **Demand of oats based products is soaring**

Material and Methods

China-37
Sweden-5
Denmark-8
UK-7
USA-8
Canada-8
NZ-8
(Foreign 44,
Total 81)

Moisture, ash, β -Glucan, Protein, total crude fatty acid analysis were according to AACC. Energy test. Content of calcium, zinc, sodium, iron; Color analysis;

Water expansion ratio (WER) of oat flakes
Water absorption index (RTWAI, HTWAI) of oat flakes (Room Temperature, Hot water)

Sensory evaluation (Oat flakes before cooked-- Shape and size of flakes, Color of flakes) (Oat flakes after cooked-- Aroma, Color of flake supernatant, Mouth feel of supernatant, Mouth feel of cooked flakes, Flavor of cooked flakes)

Description sensory language for oat flakes

Term	Definition and score			Evaluation way
Oat flakes before cooked				
Shape and size of flakes (20)	Many broken flakes and with flours, the shape was not uniform, 5-10 score	The flakes were uniform and have bigger flakes, few broken and with few flours, 10-15	The flakes size was medium, shape like round or ellipse, and uniform, with fewer flours, 15-20	Test the shape and size when the oat flakes were put in the flat plates
Color of flakes (15)	Little dark without brightness, 1-5 score	White or grey with little brightness, 5-10 score	Lightly milk or yellow with brightness, 10-15 score	Test the shape and size when the oat flakes were put in the flat plates
Oat flakes after cooked				
Aroma (10)	Non-fresh smell, or some other flavor without nature roasted oat aroma, 1-4 s	Smell nice and with light roasted oat aroma, 4-7 score	With rich and pure roasted oat aroma, fresh, 7-10 score	Smell the aroma when the oat flakes were warm
Color of flake supernatant (10 score)	Little dark without brightness, 1-4 score	White or grey with little brightness, 4-7 score	Lightly milk or yellow with brightness, 7-10 score	Watch the supernatant without touch the flakes
Mouth feel of supernatant (20 score)	Low viscosity, blank mouth feel, 5-10 score	Medium viscosity, slipperiness mouth feel, 15-20 score	High viscosity, slipperiness and thickness mouth feel, 15-20 score	With the scoop into the mouth, feel the taste and slipperiness of the supernatant
Mouth feel of cooked flakes (15 score)	Adherence to teeth, coarseness, without chewingness, 1-5 score	tender and slipperiness mouth feel, 15-20 score	No adherence to teeth, rich chewingness, tender and slipperiness mouth feel, 10-15	With the scoop into the mouth, chewing, feel the texture of flakes
Flavor of cooked flakes (10 score)	Less oat flavor or with non-fresh flavor, 1-4	Blank oat flakes, but non other different flavor, 4-7 score	Rich oat flakes smell and endurable, 7-10 score	the supernatant and cooked flakes with the scoop into the mouth, chewing and swallowing, feel the taste

Comparison of several mineral constitutes between NOF and COF

items	NOF			COF		
	average	range	SV	average	range	SV
Ca (mg·kg ⁻¹)	484.00	272.0-830.95	46.40	511.82	347-801.00	170.94
Na (mg·kg ⁻¹)	200.52	28.1-457.73	72.94	47.09	24.65-76.69	23.21
Zn (mg·kg ⁻¹)	32.06	12.85-50.57	25.82	27.22	20.00-37.00	14.75
Fe (mg·kg ⁻¹)	29.52	12.2-55.35	31.91	40.05	25.60-62.50	17.81
Ash content (g·100g ⁻¹)	1.71	1.31-3.82	23.91	1.93	1.56-4.15	30.40

protein content, lipid content, beta glucan content and energy value

items	NOF			COF		
	average	range	SV	average	range	SV
Protein/ (g·100g ⁻¹)	13.04	10.57-15.29	11.47	12.74	10.11-14.81	1.18
crude lipid (g·100g ⁻¹)	7.68	1.42-11.52	25.56	5.06	2.93-8.32	15.09
β -glucan/ (g·100g ⁻¹)	3.76	3.10-4.99	13.01	3.88	3.16-4.44	12.81
Calorie/ (kcal·100g ⁻¹)	426.06	351.6-455.8	5.10	434.05	421.9-445.0	2.01

Soluble and insoluble glucan

Oat β -glucan accounts for at least 78% of the total soluble fibre (Miller and Fulcher 1994).

	Hull-less oats	Hulled oats
Soluble β -glucan	3.91~7.47 %	1.97~4.09 %
Insoluble β -glucan	5.15~10.80 %	13.79 ~33.7 %

(Gajdošová et al. 2007)

Flakes whiteness and moisture between different countries

	L	a	b	Moisture
Chinese	97.46	0.36	2.29	7.60
American	85.16	-0.38	8.91	8.98
Canada	85.28	-0.36	8.80	9.44
Sweden, Denmark	85.39	-0.51	8.18	9.58
NZ	85.38	-0.42	8.18	9.95
UK	84.52	-0.58	9.32	10.06
Foreign Ave	85.15	-0.45	8.68	9.60

Flakes water absorption ability between different countries

	Water expansion ratio (WER)	Water absorption index (RTWAI) at room temp.	Water absorption index (HTWAI) at high temp.
Chinese	240.56	188.73	322.01
American	234.26	165.69	338.30
Canada	226.97	168.29	327.14
Sweden, Denmark	228.49	185.04	350.76
UK	222.64	177.03	344.12
NZ	223.92	143.67	289.75
Foreign Ave	227.26	167.94	330.01

Comparison of the sensory evaluation value between NOF and COF

items	NOF		COF	
	average	range	average	range
Oat flakes before cooked				
Shape and size of flakes (20)	13.13	9.4-17.1	12.54	7.2-17.0
Color of flakes (15)	10.83	7.1-13.7	9.99	8.2-12.4
Oat flakes after cooked				
Aroma (10)	5.52	4.6-7.0	7.32	5.6-8.8
Color of flake supernatant (20)	5.71	3.6-7.5	7.63	5.2-8.8
Mouth feel of supernatant (20)	9.72	6.8-13.3	13.63	7.4-17.4
Mouth feel of cooked flakes (15)	8.83	6.4-10.9	11.00	5.4-13.2
Flavor of cooked flakes (10)	5.56	4.2-6.5	6.98	4.4-8.2
Overview evaluation	59.3	51.7-65.9	69.09	56.6-76.8

Comparison of the sensory evaluation value between different countries

	Shape and size	Color	Aroma	Color of supernatant	Mouth feel of supernatant	Mouth feel of cooked flakes	Flavor of cooked flakes	Total evaluation scores
Chinese	13.1	10.8	5.5	5.7	9.7	8.8	5.6	59.3
American	11.9	9.7	7.0	7.5	12.9	10.2	6.6	65.7
Canada	13.2	10.3	8.0	7.8	13.8	11.2	7.1	71.4
Sweden, Denmark	12.4	10.0	7.5	7.9	14.6	12.0	7.4	71.9
UK	12.5	10.0	7.3	7.6	13.6	11.0	7.0	69.0
New Zealand	12.8	10.0	6.9	7.3	12.7	10.1	6.6	66.2
Foreign Average	12.56	10	7.34	7.62	13.52	10.9	6.94	68.84

Recap

1. The naked oat flakes was higher in protein content, lipid content, Na and whiteness, but lower in beta-glucan content and Fe, the mineral substances such as Zn, Ca and total ash content have no significant difference.
2. The naked oat flakes was high in water expansion ratio and water absorption index at room temperature, high sensory evaluation score in the flakes before cooked, but low in water absorption index at high temperature.
3. The naked oats was rich in protein and lipid content but lower in soluble dietary fiber content, the covered oats flake was better in water expansion ratio, hot water absorption index and sensory evaluation.

Future plan



To study the soluble and insoluble beta glucan, molecular weight of naked oat flakes and covered oat flakes



To study the starch content, viscosity of naked oat flakes and covered oat flakes



To study the aroma characters and composition of naked oat flakes and covered oat flakes

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Thanks for your attention

