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PEPTAIDE™

人工智能识别的植物基活性肽 — 新一代运动营养成分

珠海，中国

2019年10月19日

PeptAide, 用于运动营养的新一代植物基免疫活性肽

市场和消费者需求

人工智能识别的多肽

从AI到初步临床证据

PEPTAIDE™的广泛应用

Let the consumer talk 倾听消费者的声音

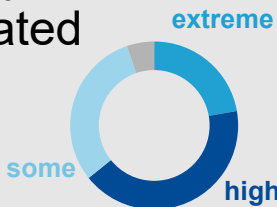
69%

exercise
3x a week
and more

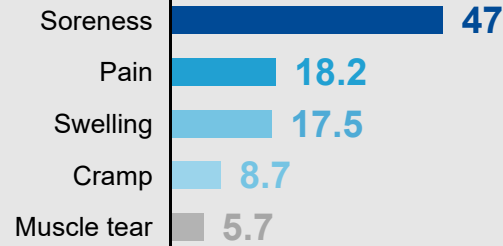


64%

are extremely /
highly motivated
to do sports



Perceive inflammation as



67%

use a dietary
supplement for
the workout



62%

agree that recovery is
extremely important
after workout



49%

prefer a plant
based product as
it is cleaner and
healthier



55%

Would pay a
premium price



Source: BASF AYTM consumer survey, 2017

The Issue: Extensive exercise induces inflammation in tissues

问题：大量锻炼引发组织炎症反应

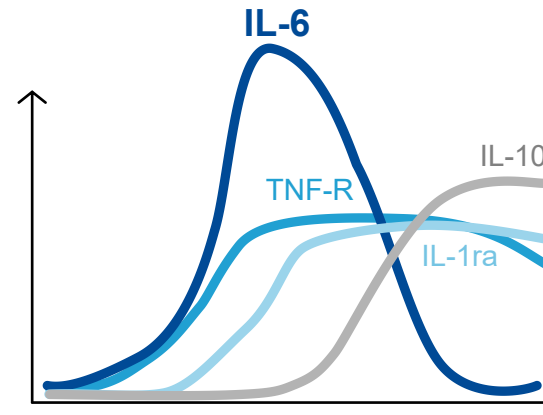
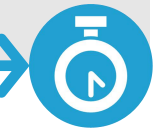
Exercise induced inflammation

1. Oxidative stress
2. Intramuscular injury

Activation of cytokines (IL-6, TNF- α , IP-10 and their receptors)

Recovery strategies

1. Rest and physical regeneration
2. Nutritional modulation of inflammation



Faster recovery through modulation of cytokines

PEPTAIDE™ addresses the need for nutritional modulation of inflammation

* Pedersen & Toft 2000, Br J Sports Med 34:246; Petersen & Pedersen 2005, J Appl Physiol 98:1154

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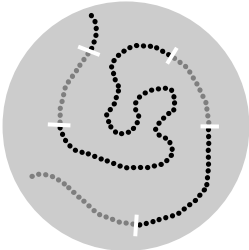
PEPTAIDE™的广泛应用

Complementary know-how of BASF & Nunitas to advance our customers' products 巴斯夫和Nunitas知识互补推动客户产品升级

NURITAS
Life-changing Discoveries



Artificial Intelligence predicts & identifies anti-inflammatory peptides



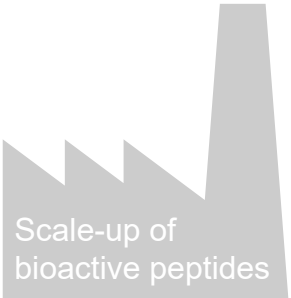
Liberation of bioactive peptides from rice



In vitro proof points; clinical validation



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High reliability, quality (raw material to product), trust, regulatory expertise

Prototype



Commercial samples, production at scale

PEPTAIDE™ designed by nature, discovered by Nunitas, commercialized by BASF

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PEPTAIDE™

The Nuritas way is faster and more accurate than traditional target screening – that means speed to market! 更快更精准

Traditional Approach



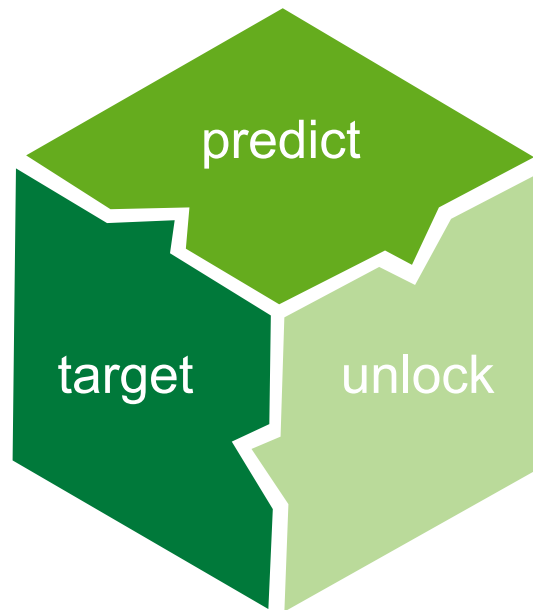
Random Screening
Haphazard 偶然的



Time Consuming
7 – 10 years



Inefficient
0.1% Chance



Nuritas Approach



Predicted discovery
Targeted 瞄准的



More efficient
10x faster



More accurate
>600x more

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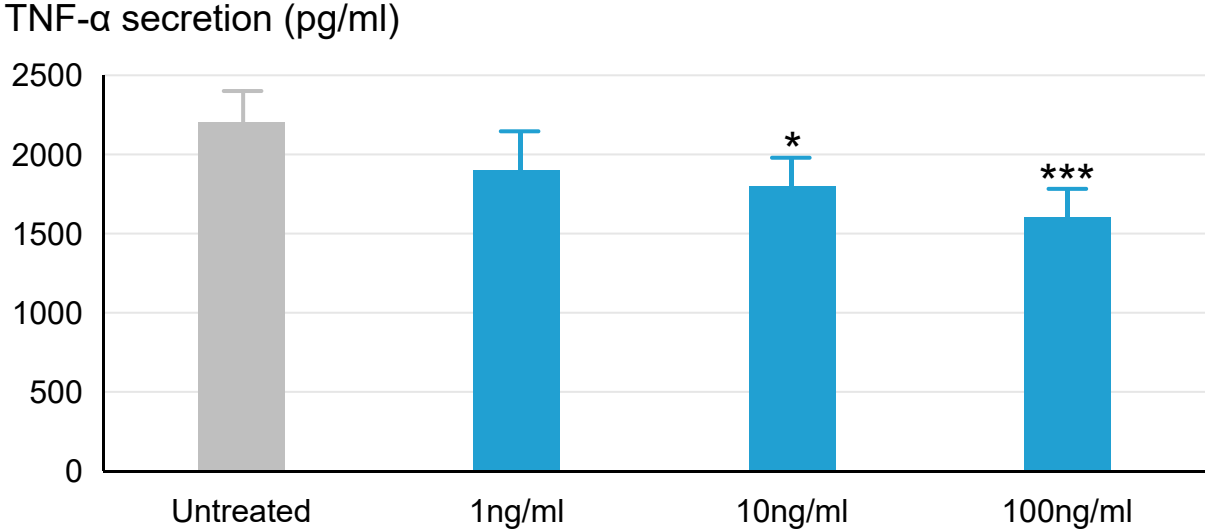
Macrophage culture: Suppression in stimulated macrophage immune assays 受刺激巨噬细胞免疫试验中的抑制作用

Proposed mechanism

- TNF-α and cytokines transmits inflammatory signaling 传递炎症信号
- Peptides within PEPTAIDE™ bind TNF-α or TNF-receptors 结合TNF-α 或TNF-受体



Cell model with immune cells



Effect of an exemplary peptide derived from PeptAide™ on TNF-α secretion in THP-1 differentiated macrophages. Differentiated macrophages were treated with peptide (1, 10 and 100 ng/mL) for 24 hours before treatment with 10 ng/mL of LPS for 5 hours. (*p<0.05, ***p<0,001)

PEPTAIDE™ modulates inflammatory response through TNF-α 调节炎症反应

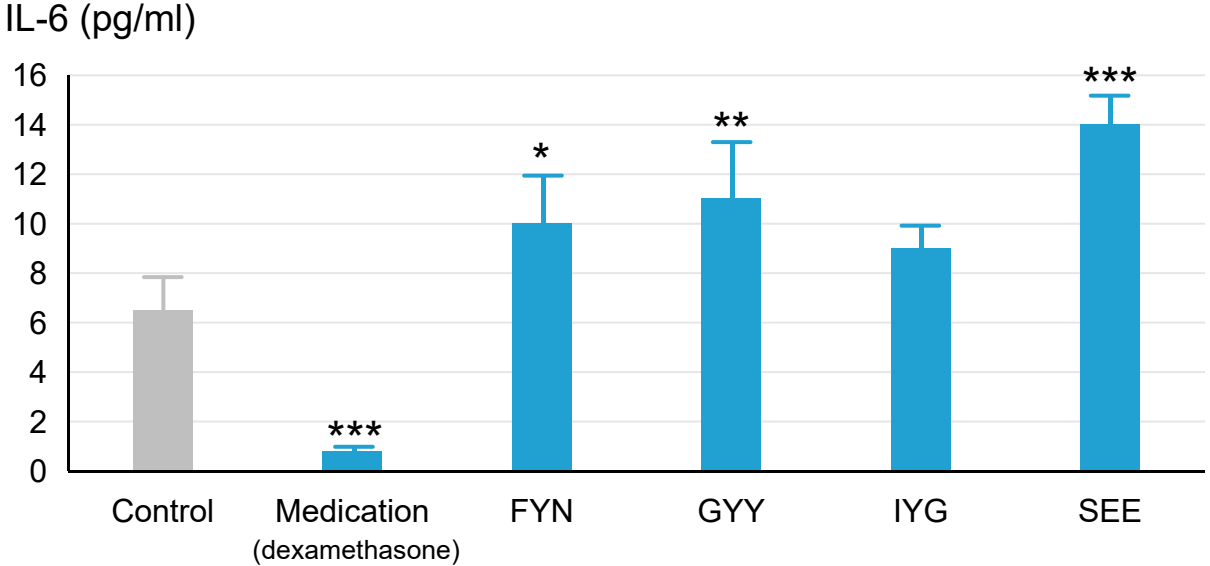
Fibroblast culture: Stimulation in primary human fibroblast assays

原代人纤维母细胞试验中的刺激作用

Proposed mechanism

- Primary human fibroblasts synthesize extra cellular matrix and collagen 合成细胞外基质和胶原蛋白
- Interaction with interleukin(IL)-6 independent of outside stimulation 与IL-6的相互作用独立于外部刺激

Cell model with fibroblast cells



Interleukin-6 concentrations 27 hours after supplementation with 10 or 100 ng/mL of respective peptide. * Values are given as mean +/- SD of n=6 independent runs. Significance tested using one-way ANOVA and Dunett's Post-hoc test, ***p<0.001, **p<0.01, *p<0.05.

PEPTAIDE™ raised IL-6 in human fibroblasts
 indicate stimulated activity 受刺激的活性

AI Identified Peptides Modulate Inflammation in Healthy Adults

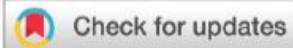
人工智能识别的多肽在健康成人中调节炎症免疫反应

Food & Function



PAPER

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[View Journal](#)



Cite this: DOI: 10.1039/c9fo01398a

Artificial intelligence identified peptides modulate inflammation in healthy adults†

Dietrich Rein, ¹ Philipp Ternes, ² Rodion Demin, ² Jürgen Gierke, ³ Thrandur Helgason ³ and Christiane Schön ⁴

Food & Function

| Year | IF |
|-----------|-------|
| 2018/2019 | 3.241 |
| 2017 | 3.289 |
| 2016 | 3.247 |

Dietary bioactive peptides have been, among many functionalities, associated with immune modulation and thereby may improve resolution of inflammation. The goals of this research were to assess (1) whether specific peptides with immune-modulating activity consumed as part of a rice protein hydrolysate could be absorbed into blood and (2) whether they modulate inflammation markers. Artificial intelligence algorithms were applied to target, predict and unlock inflammation-modulating peptides from rice protein. A food application was developed containing four bioactive peptides. Protein docking simulation studies revealed high binding energies of these peptides with inflammation markers. In a small kinetic study 10 healthy subjects consumed the peptides with a single bolus of 20 g protein hydrolysate. Although absorption of the four predicted peptides at plasma concentrations deemed biologically relevant could not be confirmed (quantitative LC-MS/MS), several cytokines responded (ELISA kits). The 24-hour kinetic study revealed a slight suppression of pro-inflammatory TNF- α , IP-10 and NOx, whereas IL-6 increased temporarily (timepoints 2–12 hours). These markers returned to the baseline after 24 hours whereas others were not affected significantly (IL-10, hs-CRP, IL-8, and MCP-1). Consumption of a single dose protein hydrolysate containing immune modulatory peptides induced a mild temporary response most likely through intestinal signaling. Forthcoming studies will examine dietary supplementation in situations of stress.

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rsc.li/food-function

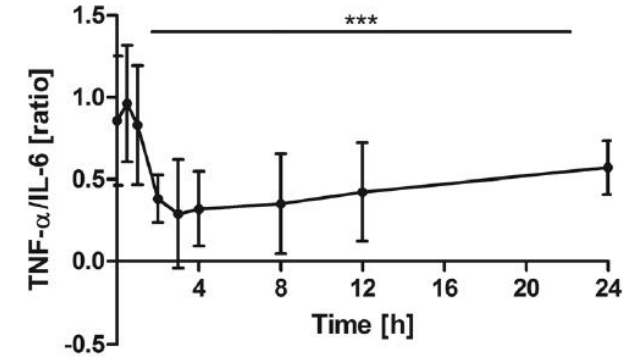


Fig. 5 Distribution of TNF- α /IL-6 [ratio] at the baseline and after the intake of rice peptides (mean \pm 95% CI); *** P < 0.0001.

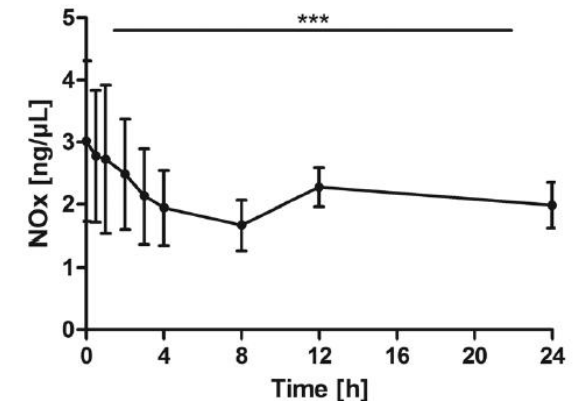


Fig. 7 Distribution of NOx [ng μ L⁻¹] at the baseline, and after the intake of rice peptides (mean \pm 95% CI); *** P < 0.0001.

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PeptAlde Concepts – Peanut chocolate protein bar



Peanut chocolate protein bar with PeptAlde™

A BASF solution for sports nutrition



PEPTAIDE™

Peanut chocolate protein bar with PeptAlde™

A BASF solution for sports nutrition

Concept Facts

What is the market need?

- The sports nutrition market is growing rapidly, matching the trending active and healthy consumer lifestyles
- Consumers are looking for natural-sourced, convenient and functional solutions to help achieve their fitness/health goals

What does PeptAlde™ do for you?

- Enables you to create new products with a unique set of plant based peptides identified using artificial intelligence that specifically help modulate inflammation¹
- Play in the post-workout sub-segment with a functional offering
- Connect with your target consumers via modern technology, convenience and great taste!

¹supported by *in silico*, *in vitro* and clinical evidence

Note: No health claims are authorized for PeptAlde™ in the EU

Nutrition Facts

| Typical values | per 50 g serving (1 bar) | per 100 g |
|----------------------|--------------------------|---------------------|
| Energy | 216 kcal 920 kJ | 432 kcal 1840 kJ |
| Fat | 8.0 g | 16.0 g |
| of which saturated | 1.8 g | 3.6 g |
| Carbohydrates | 25.3 g | 50.6 g |
| of which sugars | 10.7 g | 21.4 g |
| Protein | 12.0 g | 24.0 g |
| Salt | 0.2 g | 0.4 g |
| PeptAlde™ | 10.0 g | 20.0 g |

Ingredients: **peanut cream** (roasted **peanuts**, sugar, palm oil, salt), brown rice syrup, PeptAlde™ (hydrolyzed rice protein), rice cereal, chocolate (sugar, cocoa mass, emulsifier: soy lecithin, flavor: vanilla), **oats**, humectant: glycerin, skimmed **milk powder**, emulsifier: **soy lecithin**, salt, flavor: vanilla, Covi-ox T-70 EU (antioxidant: tocopherol-rich extract; sunflower oil)

Recommended daily dose is 1–2 servings

PEPTAIDE™



A market launch is subject to local regulatory requirements.
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PeptAlde Concepts – Post-workout cocoa squeeze



Post-workout cocoa squeeze with PeptAlde™
A BASF solution for sports nutrition

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Cocoa squeeze with PeptAlde™ A BASF solution for sports nutrition

Concept Facts

What is the market need?

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What does PeptAlde™ do for you?

- Enables you to create new products with a unique set of plant based peptides identified using artificial intelligence that specifically help modulate inflammation¹
- Differentiate your portfolio with a plant based product
- Play in the post-work sub-segment with a functional offering
- Connect with your target consumers via modern technology, convenience and great taste!

¹supported by *in silico*, *in vitro* and clinical evidence

Note: No health claims are authorized for PeptAlde™ in the EU

Nutrition Facts

| Typical values | per 69 g serving | per 100 g |
|--------------------------|--------------------|--------------------|
| Energy | 116 kcal 479 kJ | 168 kcal 694 kJ |
| Fat | 2.2 g | 3.2 g |
| of which saturated | 0.4 g | 0.6 g |
| of which polyunsaturated | 0.4 g | 0.6 g |
| Carbohydrates | 14.4 g | 20.1 g |
| of which sugars | 0.8 g | 1.1 g |
| Protein | 8.4 g | 10.9 g |
| Salt | 0.5 g | 0.7 g |
| PeptAlde™ | 10.0 g | 14.5 g |

Ingredients: Water, PeptAlde™ (hydrolyzed rice protein), maltodextrin, honey, emulsifier: soy lecithin, cocoa powder
Recommended daily dose is 1–2 servings

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消费者测试结果*：75%的受试者运动后恢复更快，超过70%有不同情况的肌肉痛感减轻；绝大多数愿意为此类产品付出一定比例的溢价

72%

notice less muscle soreness during usual workout



78%

feel less muscle soreness on the same day after usual workout

72%

notice less muscle soreness during daily activities



75%

recover faster from typical workouts

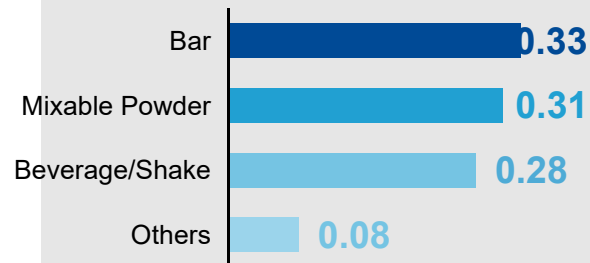


64%

can perform exercise routine at a higher intensity

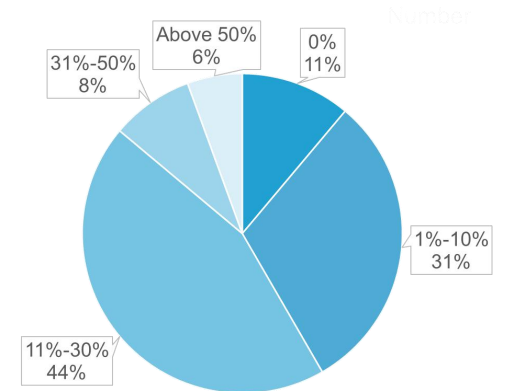


Prefer product form as



89%

Would pay a premium price



*: N = 36, at the end of week 3;



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