



## Technical Information: TEFF BAKE APPTLICATIONS

Teff is a high valuable ancient grain with amazing nutritional qualities. It is well applied in baked products, batters and beverages. Teff's most important properties at a glance:

***Vitality and better life style: Teff keeps you healthy, fit und energetic - thanks to its outstanding composition of essential amino acids, vitamins, trace elements und special carbohydrates.***

### Bread and Baked Goods

Teff boosts the taste and the nutritional qualities of industrial and hand-crafted wheat based bake products. Consumers all over the world start to understand that the ancient grains can help them to stay fit for life. They request tasty products with optimum nutritional qualities, improving wellness, vitality and wholesomeness.

Furthermore, Teff is most suitable for the nutrition for babies and children as well as for those consumers searching for non allergenic products. At least, Teff is used in a broad range of products for sportive nutrition, like bars, drinks and breakfast cereals.

### Nutritional information per 100 g

Nutrients	range	typ. value	units	100 g Teff/rdi <sup>1</sup>
calories		288	kcal	
calories from fat		21	kcal	
<b>water</b>	<b>10,0 - 13,8</b>	<b>12,0</b>	g	
protein	10,0 - 13,1	11,7	g	16 %
carbohydrates <sup>2</sup>	55,3 - 58,8	55,3	g	18 %
fast energy starch		8,8	g	
low energy starch		26,4	g	
pre-biotic starch		20,1	g	56 %
dietary fiber	15,2 - 27,3	26,2	g	
soluble fiber	12,5 - 22,8	20,1	g	56 %

Grain is the most important source of energy<sup>3</sup> for our body. Today's baking products are made out of modern wheat flour, which mainly delivers **one kind of energy**: fast energy<sup>4</sup>, strongly increasing blood sugars.

<sup>1</sup> RDI - recommended daily intake.

<sup>2</sup> The estimated glycemic load of Teff is 101. The energy of Teff is slowly released.

<sup>3</sup> The grain starches are degraded by the digestive system (enzymes in the mouth, gastric, intestines, colon flora).

<sup>4</sup> Fast starch works similar as sugars. As a consequence, consumers start to understand that baked products from purely wheat may structurally endanger their health instead of keeping them fit for life.



The body though needs three types of energy: a limited quantity of **fast (available) energy**, lots of **slow energy** and last but not least the **pre-biotic type of energy**.

One of the most appealing qualities of Teff is that it delivers all three different kind of energy to the organism. In today's bakery products the pre-biotic starches are missing. But the pre-biotic starches exactly are needed to supply the proper kind of energy (made by the colon flora) for our organs, including the brains.

Fast energy starches out of modern cereal flours behave far too aggressive to the human organism. It's like fuelling your engine with the wrong kind of energy: eventually it will break down. And that's exactly what scientists started proving and educated consumers now understand. That's why they are looking for better food that will keep them **fit for life**.

### Proteins in Teff

The major function of the protein in our nutrition is to grow and maintain tissues, bones, muscles and organs. If requested, our body can degrade protein to fuel but that is not the reason why we need proteins in our modern nutrition. Thus, we'd better consume the right kind of proteins.

Our body as well reduces proteins to its amino acids. And the amino acids profile of Teff proteins is unique. It is commonly regarded as the best existing for plant proteins and reckoned as favorable as egg protein. Additionally: **the proteins in Teff are not allergenic**<sup>5 6 7 8</sup>.

Scientists at the Universities of Napoli (Italy) and Leiden found that Teff shows amazingly many different proteins. Both universities found Teff to be fully free from gluten protein.



Amino acids	range	typ. value	units	100 g Teff/rdi
isoleucine	420 - 500	411	mg	59 %
leucine	880 - 1050	940	mg	90 %
lysine	310 - 340	331	mg	37 %
methionine	377 - 460	377	mg	60 %
cystine	208 - 220	208	mg	
phenylalanine	560 - 670	614	mg	97 %
tyrosine	403 - 560	403	mg	
threonine	430 - 490	449	mg	85 %
tryptophan	100 - 140	116	mg	44 %
valine	560 - 680	604	mg	80 %

<sup>5</sup> Teff grain is in accordance with EEC food and USDA regulations.

<sup>6</sup> I.U.I.S. Allergen nomenclature Sub-Committee of the International Union of Immunological Societies.

<sup>7</sup> The Codex Committee on Food Labeling allergen list, June 1997.

<sup>8</sup> Directive 2007/68/EC.



## Vitamins, Minerals, Trace Elements

Teff is an extremely valuable source for vitamins, minerals and trace elements, amongst them many anti-oxidants.

Anti-oxidants	typ. value	units
beta-carotene	5	mcg
lutein + zeaxanthin	66	mcg
copper	0,81	mg
manganese	9	mg
alpha-tocopherol	4	mcg
zinc	4	mg

Each day, our body needs to be fed with vitamins, minerals and trace elements. But today's wheat based baking products can supply only very limited quantities of essential minerals<sup>9</sup>.

Nutrient	range	typ. value	units	100 g Teff/rdi
vitamin A - IU		8,00	IU	1%
vitamin B1 - thiamin	0,10 - 0,77	0,55	mg	55%
vitamin B2 - riboflavin	< 0,1	< 0,1	mg	7%
vitamin B3 - niacin	0,54 - 1,29	0,79	mg	6%
vitamin C	0,11 - 0,40	0,25	mg	< 1%
folate	< 0.02	< 0.02	mg	5%
calcium	140 - 180	171	mg	19%
iron	4,9 - 6,6	6,7	mg	56%
magnesium	150 - 210	171	mg	41%
phosphorus	370 - 400	355	mg	44%
potassium	430 - 480	420	mg	12%
sodium	< 10	12	mg	3%
zinc	3,2 - 6,3	4,0	mg	27%
ashes	2,1 - 2,3	2	g	
phytic acid	100 - 500	160	mg	

<sup>9</sup> The absorption is blocked by phytic acid; if the dough rises for many hours most phytic acid is decomposed, but in today's bakery the dough preparation is too short for such degradation.



The minerals found in Teff are important for our body, and the **absorption of minerals** from Teff, like Calcium, Iron, and Magnesium, is considered high<sup>10</sup>.

1. You find the same minerals as part of the body, like iron for the blood regeneration and calcium in the bones<sup>11</sup>;
2. The minerals stimulate all kind of processes like the energy transformation in cells, building of tissue, and many others (catalytic)<sup>12</sup>;
3. The minerals are part of the information transport system (nerves & brains);
4. The minerals cool down our body (sweating) and have to be continuously replenished;

In the past, baked products like bread have always been a vital source for the daily absorption of minerals and trace elements, a merit that should prevail the same way in the future!

**Vitamins** are considered to adjust correctly our body functions. Some of them, like the B-complex vitamins, we get out of baked products. Wholemeal flour contains those vitamins. Teff only is offered flour or flakes from full grain and contains the essential vitamins.

Furthermore, Teff contains **trace elements**, which in combination with other nutritional aspects of Teff, support the body in fighting infections or adjusting malfunctioning cells (which may cause cancer if not corrected).

Thanks to its essential and valuable composition, Teff supports many functions of the human organism to improve and maintain wholesomeness and vitality (mens sana...).

Wheat has been modified through thousands of years by cultivation to have it easy digestible, comfortable to use and more and more efficient considering costs and processing speed. Increasing life expectancy and raised susceptibility now change our notion about healthy nutrition and sustainable sourcing and processing. We learn and understand how significantly healthy food influences the quality of life.

That's where ancient grains fit in. Of course: **Teff the best grain ever:**

Content/Effect	Function	Wheat	Teff	Performance
minerals absorption	essentiell every day	low	excellent	superior
calcium	bones, muscles	34	171	5x more
iron	blood formation	4	7	double
magnesium	cell tension	138	171	1,6x more
gluten	none	8 %	0 %	allergen-free
fast energy	like sugar: makes fat	97 %	20 %	5x less
lasting energy	energy for many hours	3 %	50 %	17x more
prebiotic starch	stomach, gut, organs	0 %	30 %	superb

<sup>10</sup> Teff contains only a low amount of phytic acid. In combination with the present vitamin C, Teff provides optimum conditions of enhancing minerals absorption to the human system.

<sup>11</sup> The combination of Strontium (Teff contains 0,8 mg Sr/100g) and Calcium is recognized vital for strong bone structures.

<sup>12</sup> As an example: not many people know this but Magnesium interacts with 350 different enzymes in our body.



## Baking with Teff as an ingredient

Baking with Teff is not that difficult. There are some golden rules:

The addition of Teff to wheat products means to enrich the taste experience. Best taste is achieved by replacing 20 to 30 % wheat flour by **Teff flakes**. Teff is a natural conditioner to improve freshness and shelf-life, important enough for mainstream products and even more for organic goods.

Please note that the best results are achieved by adding some fibers (as recommended) to capture any water that is released by the Teff shortly after baking<sup>13</sup>. The addition of ca. 3 % **apple fiber or oat fiber** (on flour) is recommended.

As a result of the absence of gluten, Teff might negatively influence the bake behavior of wheat doughs. The finer the size of the Teff flour is, the more it will affect the bake properties.

By experience, **Teff flakes** are most suggested to use in addition to wheat flour or other gluten containing flours. The reason is, that Teff flakes don't interact much with the gluten, where the application of fine Teff flour is more sensitive. Also, the lack of gluten can be compensated by adding eggs or oil (lecithine) to the dough.

Doughs containing a desirable amount of Teff produce high amounts of energy during the first phase of the baking process. Baking bread in solid pans helps to control the energy.

**Puffed Teff** is an excellent topping and makes products more tasty and appealing. Also do **Teff seeds** provide a sensational kind of pleasant taste experience when eating the bread.

## Biscuits and Cookies with Teff

Teff can be used in any recipe for baking products. Simply replace up to 20% of the flour in the recipe by Teff flakes and compensate the loss of gluten by adding some eggs or oil.

Fine bakery products, like cakes and cookies can be made out of 100% Teff. Though slightly different in taste from regular products, those are very tasteful.

## Baking with Teff in a gluten free environment

Teff is free from gluten and other allergenic ingredients, thus designed for manufacturing products suitable for allergen suffering persons and celiacs<sup>14</sup>.

<sup>13</sup> The starches of Teff retrograde extremely fast after baking. As a result, the water is released by the starch molecules while the product cools down after baking. Appealing advantage of this process: The Teff-starches stay stable, no later retrograding occurs. To avoid vanishing caused by the released water, it should be instantly absorbed in the baked product.

<sup>14</sup> Latest evaluations show that 4,3 % of the Swedish population should consume gluten free products. Worldwide, the percentage of celiac population is less than 0,5 %.



Milled to finest specification (85 % below 100  $\mu$ ), Teff provides taste, texture and mouthfeel to gluten free bake products. Thus it is advised, to use **finely milled Teff flour** for the manufacture of gluten free products. Suggested is an addition of 10 to 30% Teff flour in combination with rice, corn or other gluten-free flours. Again, the use of fibers (like apple fiber or oat fiber), xanthan or guar gum may substantially help to improve the result.

Finely milled Teff flour takes up lots and lots of water. As a result, the dough is rather fluid, similar to a typical pancake dough. It is advised to add sufficient water to the industrial oven during baking in order to obtain best texture and mouthfeel.

### Teff in the Nutrition for Babies and Infants

**Teff flakes** are not only gluten-free but also have a very low microbiological plate count. As a result, Teff flakes are designed for the use in nutrition for babies<sup>15</sup>, infants and children. The nutritional and physiological qualities of Teff are appealing. If you start to find out the proper qualities a grain should have for this kind of nutrition you likely end up by the ancient grain Teff.

Teffs typical combination of minerals, amino acid specification and trace elements are precisely what children need to grow wholesome and healthy.

### Non GMO Statement

Teff is 100% natural and no modification has taken place<sup>16</sup>. The varieties used are all the originals, existing for Thousands of years. Of course, our Teff products are not produced from genetically modified material nor cultivation, nor are genetically modifying treatment or genetically modified additives applied during processing, warehousing or shipping.

Our Teff products are free from GMO and must not be declared according to the regulations EEC 1829/2003 and 1830/2003.

### Availability

- ✓ Teff is available as **seeds**, fine **flour** (corresponding to the baby food regulations) and as **flakes**. All products are supplied in gluten-free quality (max 20 mg/kg)
- ✓ Conventional and Organic (from ecological cultivation, according to the regulations EEC 834/2007 and 889/2007)
- ✓ Puffed Teff and Crispies (extruded Teff).

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<sup>15</sup> Babies up to 1 year should not at all eat gluten and infants up to 3 years be careful with eating too much gluten.