



## *Nutritional properties of Fonio: health claims and evidence*

*“Fonio is one of the most nutritious of all grains” Lost Crops of Africa: Grains. Edited F. R. Ruskin*

### **Amino Acids (particularly methionine and cystine)**

Like other millets, fonio is widely reported to be rich in amino acids but particularly in the amino acids methionine and cystine<sup>1 2 3 4 5 6 7</sup> which supply sulfur and other compounds required by the body for normal metabolism and growth. Methionine is an essential amino acid, which the body needs for health but cannot synthesise; it can only obtain it from food. It helps the liver to process fat, and is also a methyl donor, capable of giving off a molecule needed for a wide variety of chemical and metabolic reactions inside our body, including the manufacture of the amino acid taurine. Cystine is a major constituent of the proteins that make up hair, nails and skin, and is involved in major detoxification processes in the body.

Methionine levels are higher than those found in sorghum and other millets<sup>8 9</sup> and the amino acid is reportedly deficient in other major cereals such as wheat, rice, barley and rye<sup>5 10</sup>. When tested, fonio also appeared to be richer than pearl and finger millets in phenylalanine, another essential amino acid<sup>8</sup>. The body needs phenylalanine to create various brain chemicals and thyroid hormones as well as tyrosine (another amino acid that it uses to make proteins).

<sup>1</sup> *Fonio: A treasure for West Africa* Briefing by the International Plant Genetic Resources Institute (West and Central Africa Sub-Office) and colleague organisations  
[www.underutilized-species.org/documents/PUBLICATIONS/rv.pdf](http://www.underutilized-species.org/documents/PUBLICATIONS/rv.pdf)

<sup>2</sup> Agricultural Products India A website dedicated to the Agriculture Industry with details on agriculture products, technology used in agriculture industry, African grains etc [www.agriculturalproductsindia.com/cereals-pulses/cereals-fonio.html](http://www.agriculturalproductsindia.com/cereals-pulses/cereals-fonio.html)

<sup>3</sup> *Pseudocereals and less common cereals: Grain Properties and Utilization Potential* P. S. Belton, John Reginald Nuttall 2002. Publisher Springer-Verlag Berlin Heidelberg. See page 201 for a table of amino acids in white and black fonio.

<sup>4</sup> *Lost Crops of Africa: Grains* Edited F. R. Ruskin p.64 National Academy Press, 1996

<sup>5</sup> *European Food Research and Technology* Volume 211, Number 2 / July, 2000 Publisher Springer Berlin / Heidelberg

<sup>6</sup> CIRAD [http://fonio.cirad.fr/en/the\\_grain/biochemical\\_composition](http://fonio.cirad.fr/en/the_grain/biochemical_composition)

<sup>7</sup> *The benefits of locally based food security* Article by Moumouni Ouattara (agronomist at Environnement et Developpement du Tiers Monde (ENDA)) *Pesticides News* No. 33

<sup>8</sup> *Organic production and use of alternative crops* Franc Bavec, Martina Bavec p.122 Publisher CRC Press 2006

<sup>9</sup> *Overview: Importance Of Millets In Africa* A B Obilana, The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) [www.afripro.org.uk/papers/Paper02Obilana.pdf](http://www.afripro.org.uk/papers/Paper02Obilana.pdf)

<sup>10</sup> *The potential of fonio (Digitaria exilis, Stapf) as feed for monogastric in Ghana* Paper by CIRAD <http://pigtrop.cirad.fr/sp/content/pdf/1038>

Tests have shown that the methionine level in fonio is twice that found in egg protein,<sup>3 4 7</sup> leading to suggestions that fonio might be used to complement standard diets<sup>3 11</sup>. It's also suggested that the high content of these sulphur amino acids would make fonio an excellent nutritional complement to legumes<sup>12 1</sup> as most legumes are low in methionine (but high in lysine, which is lacking in cereal grains).

## Low Glycaemic Index

The Glycaemic Index (GI) ranks foods based on their overall effect on blood glucose levels. Foods that are slowly absorbed produce only small fluctuations in our blood glucose and insulin and therefore have a low rating. Choosing low GI foods is important for those with diabetes because these foods can help even out blood glucose levels. They can also reduce the risk of heart disease.

A study by Sante Diabete Mali of the influence on glycaemia of different cereals and sauces consumed in Mali showed that fonio had a low GI of 56,95 +\_ 8,73 (compared to sorghum, corn & white rice which had intermediary GIs, and sorghum paste & corn paste which had elevated GIs).<sup>13</sup>

Research<sup>14</sup> funded by USDA/Institute of Food Science Technology Dakar also showed that fonio had an overall lower glycemic index (GI =66) than Sorghum (GI =72) and rice (GI = 95).

Similiarly, a Senegalese Project by The International Sorghum and Millet Collaborative Research Support Program conducted a glycemic study of sorghum comparing rice and fonio and found that a lower glycemic index was obtained with fonio, followed by sorghum.<sup>15</sup>

The research by Sante Diabete Mali concluded that food with low GI such as millet couscous and fonio couscous seem more appropriate for people with diabetes.<sup>9</sup>

In Nigeria Fonio (known as acha) sellers identify diabetic patients as their major customers<sup>16</sup> and it is also reported that doctors there are recommending fonio to diabetic patients.<sup>17</sup>

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<sup>11</sup> *Harnessing sorghum and millet biotechnology for food and health* M.M. O'Kennedy et al. *Journal of Cereal Science* 44 (2006) 224–235 "Fonio grains are unusually rich in methionine (4.8g / 100 g protein) (de Lumen et al., 1986) and may be suitable for supplementing low methionine diets."

<sup>12</sup> *Lost Crops of Africa: Grains* Edited F. R. Ruskin p.70 National Academy Press, 1996

<sup>13</sup> Nutritional Management of Diabetes in Africa  
[www.worlddiabetesfoundation.org/media%283846,1033%29/Nutritional\\_management\\_of\\_diabetes\\_in\\_Africa\\_BESAN\\_CON.pdf](http://www.worlddiabetesfoundation.org/media%283846,1033%29/Nutritional_management_of_diabetes_in_Africa_BESAN_CON.pdf)

<sup>14</sup> *Food forms and beta glucans contents in sorghum, fonio and rice can influence their glycemic indexes* Djibril Traore, A Ndoye, Bruce R. Hamaker, Barbara Stoecker, Nancy Betts and A. T. Guiro  
[www.fasebj.org/cgi/content/meeting\\_abstract/23/1\\_MeetingAbstracts/563.28](http://www.fasebj.org/cgi/content/meeting_abstract/23/1_MeetingAbstracts/563.28)

<sup>15</sup> *Food and Nutritional Quality and Processing of Sorghum and Millet* I. Nkama, M. Badau, S. Modu, A. Jato, C. Uga, J.U. Igwebuikwe, I.D. Mohamed, University of Maiduguri; I. Angarawai, LCRI; B. Hamaker, PU  
<http://www.ianr.unl.edu/INTSORMIL/SM2007anlrpt/2007HCPE.pdf> p.143  
Note that Glycemic index obtained using couscous was higher than with porridges.

<sup>16</sup> *Final report on: Promoting fonio production in West and Central Africa through germplasm management and improvement of post harvest technology* International Plant Genetic Resources Institute  
[www.underutilizedspecies.org/Documents/PUBLICATIONS/fonio\\_rapport\\_final\\_GTZ\\_project1.pdf](http://www.underutilizedspecies.org/Documents/PUBLICATIONS/fonio_rapport_final_GTZ_project1.pdf)

<sup>17</sup> *Fonio: West Africa's treasure* Bioversity International News Report 25 June 2008

## Minerals

Fonio is reputed to be richer in magnesium, zinc, and manganese than other cereals.<sup>8 18 19</sup> It is also significantly richer in thiamine (Vitamin B1), riboflavin (Vitamin B2), calcium and phosphorous than white rice.<sup>3 4</sup>

Levels of phosphorous, an essential mineral needed by all human cells for normal function, are high 20 and tests by the Laboratory of Food Technology and Animal Nutrition in Mali indicate that phosphorous and potassium are major minerals in fonio grains.<sup>13</sup> Phosphorous is found mainly in bones and is a constituent of many vital compounds in the body, including ATP, DNA, and phospholipids. Potassium is crucial to heart function and plays a key role in skeletal and smooth muscle contraction, making it important for normal digestive function, while it is also an important electrolyte.

Fonio also appears to have appreciable amounts of iron<sup>21</sup> and, compared to white rice, is significantly richer in this essential mineral.<sup>22</sup> In one study fonio which had been cleaned, steam cooked and drum dried contained 10.74mg iron /100g.<sup>23</sup> Compare this to brown rice which, in a separate study, contained  $1.1 \pm 0.1$  mg/100 g<sup>24</sup> - appreciably less than fonio. However, based on a study in Mali, while levels of zinc in fonio appear to be consistent across regions there is more variation for iron levels.<sup>25</sup>

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<sup>18</sup> SPORE Information for agricultural development in ACP countries Issue 126 Dec 2006  
<http://spore.cta.int/images/stories/pdf/old/spore126.pdf>

<sup>19</sup> "Fonio is.. richer in minerals such as zinc, manganese, and magnesium, as well as amino acids that are good for the heart and nerves." Mr. Modibo Goita, Coordinator of USC (an NGO which specializes in promoting African seed varieties)  
[http://www.farmradio.org/english/radio-scripts/82-6script\\_en.asp](http://www.farmradio.org/english/radio-scripts/82-6script_en.asp)

<sup>20</sup> *Pseudocereals and less common cereals: Grain Properties and Utilization Potential* P. S. Belton, John Reginald Nuttall 2002 p.199

<sup>21</sup> Letizia Saturni, specialista in Scienze dell'Alimentazione della Scuola di Specializzazione in Scienze dell'Alimentazione dell' Università Politecnica delle Marche <http://notonlyglutenfree.org/category/>

<sup>22</sup> *Lost Crops of Africa: Grains* Edited F. R. Ruskin. See Comparative table p.65

<sup>23</sup> *Potentials of Fonio (Digitaria iburua) for production of breakfast meal* Victoria Funmilayo Abioye and Grace Oluwakemi Babarinde. Abstract [www.ultrascientist.org/JUSPS/21\(2\)/index.htm](http://www.ultrascientist.org/JUSPS/21(2)/index.htm)

<sup>24</sup> *Iron absorption from brown rice/brown rice-based meal and milled rice/milled rice-based meal* Trinidad P. Trinidad<sup>1</sup> Aida C. Mallillin; Rosario S. Sagum; Dave P. Briones; Rosario R. Encabo; Bienvenido O. Juliano *International Journal of Food Sciences and Nutrition*, 1465-3478, Volume 60, Issue 8, 2009, Pages 688 – 693

**Fibre, Food & Beauty for Poverty Reduction** is a joint project of PAN Germany, PAN UK, OBEPAB from Benin and Enda Pronat from Senegal. It aims to raise awareness about the many different food crops grown by organic cotton farmers in Africa and help them to find better marketing options for these, in local or export markets.

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For more info on the Fibre Food & Beauty project, visit:

<http://www.pan-uk.org/food/fibre-food-beauty>