Research Application Summary

Effect of germination on the protein digestibility of some finger millet varieties grown in Kenya

Makokha, A.O.
Jomo Kenyatta University of Agriculture and Technology, Kenya, P.O. Box 62000-00200, Nairobi, Kenya
Corresponding author: anmakokha@yahoo.com

Abstract

The protein digestibility of seven ungerminated and germinated dried finger millet (*Eleusine coracana*) grain was determined in this study. All the finger millet varieties had low to medium tannin content, ranging from 0.1% Catechin equivalents (CE) in Dalle 1 to 0.6% CE in EKR 228. For raw ungerminated finger millet, the mean protein digestibility was 58.9%. It ranged from 40.5% in P224 to 86.3% in EKR 227. EKR 227 had significantly higher digestibility ($P<0.05$) than P224. Cooking drastically reduced the digestibility of ungerminated fingermillet. The protein digestibility of cooked finger millet ranged from 1.7% in Dalle 1 to 25% in EKR 227, with a mean of 9.0%. There were significant differences ($P<0.05$) in protein digestibility of cooked ungerminated finger millet grain. The mean protein digestibility of the raw germinated millet was 53.0%, ranging from a minimum of 16.9% in P224 to a maximum of 79.1% in EKR 227. The variety P224 had significantly lower protein digestibility ($P<0.05$) than P283 and EKR 227. The mean protein digestibility of the cooked germinated finger millet grain was 55.7%, and did not significantly differ ($P >0.05$) from that of the raw germinated grain.

Key words: Digestibility, fingermillet, protein

Résumé

La digestibilité des protéines de sept grains de millet *(Eleusinecoracana)* non germés et germés secs a été déterminée dans cette étude. Toutes les variétés d'éleusine avaient une teneur en tanin d'une valeur faible à une valeur moyenne, allant de 0,1% en équivalents catéchines (CE) dans Dalle1 à 0,6% en équivalents catéchines dans EKR 228. Pour le mil d'éleusine cru non germé, la digestibilité moyenne des protéines était de 58,9%. Elle variait de 40,5% dans P224 à 86,3% dans EKR 227. EKR 227 avait une digestibilité significativement plus élevée ($P <0,05$) que P224. La cuisson a considérablement réduit la digestibilité du millet non germé. La digestibilité des protéines du millet cuit a varié de 1,7% dans Dalle 1 à 25% dans EKR 227, avec une moyenne de 9,0%. Il y

avait des différences significatives (P <0,05) de la digestibilité des protéines dans les grains de millet cuits non germés. La digestibilité moyenne des protéines du millet germé cru était 53,0%, allant d'un minimum de 16,9% dans P224 à un maximum de 79,1% dans EKR 227. La variété P224 avait la digestibilité des protéines significativement plus faible (P <0,05) que P283 et EKR 227. La digestibilité moyenne des protéines du grain de millet germé cuit était de 55,7%, et ne différait pas significativement (P> 0,05) de celle du grain germé cru.

Mots clés: Digestibilité, éleusine, protéines

Background

Protein digestibility of millets is of immense interest, particularly to communities in Kenya and elsewhere in Africa who depend on these cereals as their staple foods. In such situations, these cereals are often also among the main sources of dietary protein. But even of more importance, thin porridge (*uji*), made from finger millet (*Eleusine coracana*) is widely used in Kenya as a complementary and a weaning food for babies, and may be the main source of protein for such babies. Controlled germination is one of the methods that have been reported to be effective in raising the protein digestibility in sorghum and millet grain. This study was done to determine the effect of germination on protein digestibility of some of the varieties of finger millet grain grown in Kenya.

Literature Summary

Finger millet grain is widely used in Kenya as a staple food. It is also used to make thin porridge called *uji,* which is commonly used as a complementary or weaning food (Oniang'o and Alnwick, 1988; Makokha, 1994). Germination enhances the activity of the amylase enzymes that facilitate the conversion of starch to fermentable sugars, and increasing the fluidity and nutritional density of the porridge (Palmer, 1992; Dahiya and Kapoor, 1994). This is beneficial, as the thin porridge has very low energy density and is a poor energy source for babies, contributing to protein energy malnutrition (WHO, 2004). Germinated finger millet grain is also widely used in the preparation of various traditional opaque beers. Generally such beers are much richer in essential nutrients, particularly the B vitamins, than the clear lager beers (Steinkraus, 1979; Eggum *et al.,* 1983). Elsewhere, both in vitro and in vivo studies have demonstrated wide variability in protein digestibility of millet varieties (Axtell *et al.,* 1981; Maclean *et al.,* 1981). However, there is very limited documented information on protein digestibility among the millet varieties grown in Kenya.

Study Description

This study was conducted at Jomo Kenyatta University of Agriculture and Technology. Six finger millet grain samples were obtained from Kenya Agriculture Research Institute (KARI), Alupe Research station. The varieties were Dalle 1, Gulu E, U15, P224, EKR 227 and EKR 228. The samples were kept at between 5^{o} C to avoid deterioration.

Determination of nitrogen (protein) in both the ungerminated and germinated finger millet grain was done using the micro-Kjedahl method (AOAC, 1984). A conversion factor of 6.31was used for conversion from nitrogen to protein (Greenfield and Southgate, 1992). Tannin content in the finger millet grain was determined using the Vanillin- Hydrochloric acid method (Burns, 1963; Price *et al*., 1978).

Controlled germination of the finger millet grain was done as described by Dewar *et al*. (1995) by steeping 200 g of grain for 24 hours, followed by germination in a humid incubator for 96 hours at 25^{o}C after removing the grain from the water. The germinated grain was then dried at 45 - 50^{o}C for 48 hours. The dried samples were then kept in air tight bottles at about 10^{o}C. Protein determination was determined using the method described by Mertz *et al.* (1984). The initial protein content of the samples was determined using the Micro-Kjedahl nitrogen determination method. The second stage involved digestion with buffered pepsin solution. The final protein content was then also determined by the Micro-Kjedahl method. The percentage protein digestibility was then calculated as the difference between the initial protein content and the protein content after digestion with pepsin.

Research Application

There were significant differences ($P<0.05$) in the protein digestibility of the finger millet varieties. Controlled germination increased the protein digestibility in both raw and cooked finger millet. Selection of more finger millet varieties with high protein digestibility can therefore be carried out for use as weaning or complementary foods. The protein digestibility can further be improved by controlled germination.

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