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Protein of the Sweet Potato

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The sweet potato ranks sixth in average yearly production among the world's major food crops. The crude protein content ranges from 1.3% to > 10% (dry weight basis). Significant potential exists for increasing the protein content by breeding/selection and optimization of production practices. From 60-85% of the nitrogenous material is protein, and the remainder is mostly amino and amide nitrogen. Humans have been maintained in nitrogen balance using sweet potato as the major source of nitrogen. The protein efficiency ratio (PER) for isolated sweet potato protein is equal to that of casein. Heat processing lowers lysine bioavailability, dependent upon the severity of the heat treatment and the amount of reducing sugar present during heating.

The sweet potato (Ipomoea batatas L.) is an important contributor to human nutrition in many parts of the world. Sweet potato ranks sixth in annual world production at 137 million metric tons (1975-1977) (1) behind wheat, rice, maize, potato, and barley. Although starchy roots are generally considered to provide only calories to the diet, the sweet potato provides 73% of the required protein per calorie (2, 3) for an adult male. The average yield for sweet potatoes for 1975-1977 (1) was 9,621 kg/ha, making it second only to white potatoes among the ten leading crops produced worldwide. There is significant potential for increased yields, provided production practices are optimized and high yielding cultivars are grown. In the United States, for example, the mean yield in 1980 was 13,108 kg/ha (4). High yields and a 110-130 day growing season make the sweet potato an attractive source of calories and other nutrients for tropical regions of the world. It is noteworthy that the majority of the countries with an annual income of less than $500 (US) per capita are located in the tropics. Thus, the sweet potato is potentially

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an outstanding candidate for increased production in this area. Although not an important source of protein in the United States, the sweet potato is consumed extensively in New Guinea, and in parts of that country, provides up to 40% of the crude protein in the diet (5).

Data are not available for protein production worldwide. However, an estimate of the protein contribution provided by sweet potatoes can be made if we assume a mean dry matter content of 28% and a mean protein content of 5%. Based on these assumptions, the sweet potato provides 1.92 million metric tons of protein worldwide. The yield of protein would be 134 kg/ha using worldwide yield values or 184 kg/ha using US production values.

Sweet Potato Protein

The diet must provide those amino acids which the body cannot synthesize (essential amino acids, EAA) and nitrogen in the form of nonessential amino acids (NEA). Both EAA and NEA are required for biosynthesis of proteins and other nitrogen-containing compounds necessary for homeostasis or growth. Thus, the total nitrogen content of a specific food must be considered to be nutritionally significant.

For those sweet potato cultivars studied, the crude protein (N x 6.25) contains both protein and nonprotein nitrogen (NPN). The NPN content has been demonstrated to range from 15 to 37% at harvest (6, 7). The only published report of the composition showed the NPN fraction to be nutritionally unbalanced, containing mostly amino acids and amides (6). The major components were asparagine, 61%; aspartic acid, 11%; glutamic acid, 4%; serine, 4%; and threonine, 3%. Eighty-eight percent of the NPN fraction was accounted for by amino acids and amides. During the early part of storage, the NPN fraction decreased, then increased (8). The nonlinear nature of the change in NPN, coupled with the fact that nitrogen content decreased during storage, indicated that this fraction is part of a metabolically active nitrogen pool (9) and that the appreciable amount of nitrogen stored as asparagine is available for metabolic demands of the root. Although the NPN fraction of sweet potato is available to satisfy nitrogen requirements, only small amounts of EAA are present in this fraction.

The initial report on the nature of sweet potato protein indicated that most of the protein was a globulin "ipomoein" (10). The authors also stated that upon storage of the root, ipomoein was partially converted into a polypeptide which was considerably different from the parent material both in its chemical composition and its physical properties. Later workers using modern techniques reported the major soluble protein was a 25 k Da molecule (11). Only small amounts of this protein were found in roots stored for 1 year, suggesting that this protein is readily metabolized and is probably the storage protein. In addition, a second major protein identified as beta amylase was also shown to be minimally present in roots stored for 1 year.

Sweet potato protein is unequally distributed within the

root. The crude protein content is slightly greater in the stem end than the root end. The only region which has been shown to contain much higher protein levels is the outer layer adjacent to the skin corresponding to precambial tissue (12, 13). Scraping the roots removed ⩾2.5% of the fresh weight (FW) and decreased the root protein content by 4.4%, while a more drastic peeling which removed ⩾8.5% of the FW lowered the protein content by 12% (13). The tissue removed with the scrapings constituted 2.5% of the total weight and contained 87% more protein per unit weight than did the remaining tissue. The tissue removed by the deep peeling treatment contained 47% more protein per unit weight than did the tissue remaining after peeling. The above data indicate that although the surface layers of tissue are significantly higher in protein content than the underlying tissue, the absolute amount of protein-rich material is small. Consequently, it is not feasible to increase the protein content by selective removal of tissue.

A protein concentrate can be obtained from sweet potato roots (14). The laboratory method involved grinding with three parts of water, screening to remove coarse fibrous material, settling the starch, coagulating the chromoplasts, and precipitating the protein. Sweet potatoes have been used as a commercial source of starch and are still being used as such in Japan (15). Commercial production of starch involves the first three steps, i.e., grinding, screening and settling the starch. It would appear that commercial quantities of sweet potato protein might be readily available as a by-product of the starch industry. The laboratory concentrates were bland, light-colored powders containing 80-88% protein.

Crude Protein Variability

The sweet potato is a perennial, propagated vegetatively as an annual for agricultural purposes. The plant is heterozygous and is a hexaploid with a somatic chromosome number of 90. As would be expected, genetic potential for variation in protein content is great. Various workers have reported a protein range of from 1.3% to >10% (dry weight basis) (16, 17, 18), depending upon the cultivar. There appears to be potential for increasing the protein content by breeding, since the sweet potato has responded quite well to selection for other traits when genetic variability is present. Increase in protein content by selection is especially important because many parts of the tropics, which are in need of additional protein sources, consistently produce sweet potatoes with low (< 4%) protein content (dry basis). Li (19) demonstrated that a mass selection technique was effective in increasing crude protein content and maintaining a high yield. A later study (7) showed that NPN percent and trypsin inhibitor activity did not increase as the sweet potato protein content increased. There appeared to be some deterioration in the protein nutritional quality with an apparent decline in relative amounts of valine, aromatic amino acids and sulfur-containing amino acids. It should be noted, however, that sample to sample variability among amino acids is very great, and thus, more research is needed in this area before a definite relationship can be determined.

Within cultivar variation of sweet potato crude protein is high. Purcell et al. (20) reported a 13% coefficient of variability between roots from a single hill and a 13% coefficient of variability between hills in a single field. Field to field variability was very great with Jewel cultivar, ranging from 3.99 to 8.81% protein (dry basis), depending upon the field location. In a carefully controlled study, Collins and Walter (21) reported that for six sweet potato genotypes grown at six locations for 3 years (18 environments), protein content varied in a statistically significant manner ($P \leqslant 0.01$) by genotype, environment and the environment-genotype interaction.

Another study (22) of genotype-environment interaction for sweet potatoes grown in the southern highlands province of Papua, New Guinea, reinforced the finding of Collins and Walter (21) with regard to the variability in crude protein content. The data of Bradbury et al. (22) for 10 cultivars from 5 environments showed a mean crude protein content of 1.51% (fresh weight) with a standard deviation of 0.54%, a coefficient of variability of 35.8% (Table I). The gradient referred to in Table I was obtained by plotting the mean crude protein content for the 5 environments (bottom row, Table I) against the crude protein content for each cultivar in each environment. The gradient or slope of the resulting line provided a measure of the response of a given cultivar to varying environments. The greater the gradient or slope, the more the cultivar is affected by environment. From Table I, it is apparent that the cultivar 'Simbul Sowar' is least responsive to environment and still is high in crude protein content. On the other hand, cultivar 'Takion' has the highest mean crude protein content but much more environmental instability. This type analysis is a valuable tool for improvement of the crude protein content through cultivar selection.

Cultural practices also can affect sweet potato protein content. Purcell et al. (23) reported that increasing amounts of nitrogen fertilization up to 112 kg/ha caused an increase in protein content but no change in the NPN. Neither sulfur nor potassium influenced the protein content. Similarly, Constantin et al. (24) found that nitrogen fertilization up to 67.3 kg/ha linearly increased crude protein content. Kimber (25) reported that when available nitrogen no longer affects yields, protein content of the roots continues to increase. Other workers have demonstrated that crude sweet potato protein content can be increased through cultural management practices (26, 27). Length of the growing season also has an effect on crude protein content. Purcell et al. (28) found that the protein content decreased 0.0067% per day between 102 and 165 days. Concomitantly, dry matter decreased linearly at 0.233% per day. In addition to nitrogen fertilization rate and length of growing season, high rates of irrigation caused decreases in both dry matter and protein content (29). The results reported by Dickey et al. (7) and Bradbury et al. (22) reinforce the concept that protein content is not a reciprocal function of dry matter content. It appears then that natural genotypic variability in crude protein content provides a promising avenue to improve protein levels

Table I. Crude Protein Content (% Fresh Sweet Potato) of Ten Cultivars From Upper Mendi Grown in Different Environments

Name of Cultivar	Growth Conditions: Kiburu, 1982 Season[a]		Erave, 1982 Season[b]		Upper Mendi, 1981 Season[c]	Upper Mendi, 1983 Season	Upper Mendi, 1983 Season Gypsum Added[d]	Mean	SD	Gradient (See Text)
Hopomehene (HO)	1.87	1.97	2.31	2.34	0.50	1.19	1.06	1.41	0.74	1.61
	2.06		2.37							
Takion (TA)	2.37	2.69	1.87	2.06	2.06	1.00	1.25	1.81	0.68	1.14
	3.00		2.25							
Soii (SO)	1.12	1.28	2.56	1.97	1.38	0.88	1.13	1.33	0.41	0.93
	1.44		1.37							
Sapel (SA)	1.81	1.88	1.69	1.38	0.75	1.06	1.69	1.35	0.46	0.31
	1.94		1.06							
Kariap (KA)	1.62	1.50	1.94	1.91	2.00	0.81	0.88	1.42	0.56	0.94
	1.37		1.87							
Pulupuri (PU)	1.12	1.34	2.12	1.97	1.00	1.31	0.81	1.29	0.45	1.00
	1.56		1.81							
Kariko (KO)	0.94	0.91	2.19	2.32	1.63	0.94	1.06	1.37	0.60	1.10
	0.87		2.44							
Simbul Sowar (SI)	1.69	1.60	1.87	1.94	1.69	1.31	1.50	1.61	0.23	0.51
	1.50		2.00							
Wanmun (WA)	2.37	2.22	2.31		0.88	1.94	1.19	1.71	0.64	1.12
	2.06									
Tomun (TO)	1.44	1.48	2.81		1.56	1.56	1.31	1.76	0.60	1.33
	1.69									
	1.31									
Mean	1.60		2.10		1.35	1.20	1.19	1.51	0.45	

[a]Two (or three) roots from same plant and mean. [b]Roots from two different plants and mean. [c]From Bradbury et al. (13). [d]Gypsum added to soil at a rate of 500 kg/ha. From Bradbury et al. (22).

via selection. Selection for high protein cultivars which are relatively insensitive to environmental differences and optimization of cultural practices are also attractive research areas for increasing protein content.

Nutritional Value

Feeding Studies. Although sweet potatoes are a significant source of calories in many parts of the world, very little information is available concerning the nutritional quality of sweet potato protein as determined by controlled feeding studies in humans. This is in striking contrast to numerous reported studies on the feeding of white potatoes to humans (30). An early study in which the sweet potato was used as the sole source of nitrogen in the diet of humans was that of Adolph and Liu (31). They reported that nitrogen balance could be maintained with sweet potato nitrogen provided sufficient amounts were consumed. Research by other workers (32, 33) also suggested the sweet potato protein is readily utilized by humans.

Large amounts of sweet potato must be eaten to provide enough nitrogen. Oomen (34) reported that in New Guinea, where 80-90% of the total calories were obtained from sweet potato, the subjects studied were usually in significant negative nitrogen balance. Since negative nitrogen status means continuous breakdown of body protein leading to serious malnutrition, Oomen (34) was puzzled because the subjects seemed to be in good health. As a result, he suggested that eating large amounts of sweet potato might induce an intestinal microflora which was able to fix gaseous nitrogen so that it could be utilized to synthesize amino acids. Obviously, if such were the case, much of the knowledge of protein nutrition would be in doubt since the validity of nitrogen balance studies upon which most of this knowledge is based would be in doubt. A later study (35) using carefully controlled conditions indicated that both adolescent and young adult males maintained in slightly negative nitrogen balance through use of sweet potato as the major nitrogen source developed clinical symptoms of mild protein malnutrition. These included abnormal plasma free amino acid patterns and a decrease in physical stamina. In addition, no evidence of *in vivo* nitrogen fixation could be detected in fecal material, indicating that the microflora induced by long-term consumption of sweet potatoes are not capable of fixing nitrogen. The report that habitual sweet potato eaters are somewhat independent of dietary nitrogen appears to have no basis in fact.

Results reported by Huang et al. (35) indicated that with teenagers a positive nitrogen balance could be maintained with an intake of 0.67 to 0.71 g protein/kg body weight, where the sweet potato furnished most of the protein. The energy requirement for this level of protein consumption was 54 k cal/kg body weight. The apparent protein digestibility was found to be 66%, which was very close to a previously reported value of 67% (36). The above reports, although limited in number, indicate that sweet potato protein is of good nutritional quality but the quantity is low in the cultivars used. The cultivar Tainon 57 used by

Huang et al. (35) had a crude protein content of from 0.8 to 1.3% (fresh weight).

A report by Bressani et al. (37), which evaluated the nutritional value of diets based on starchy foods and beans, indicated that for the rat, sweet potato protein was of poor nutritional quality. When methionine was added to all diets to raise sulfur amino acids, sweet potato still required the largest amount of supplementation with bean flour to maintain animal weight (Table II).

Sweet potato flour contained 3.8% protein, the second highest amount of protein among starchy foods, and yet the protein appeared to be the poorest in nutritional quality. However, it should be noted that the sweet potatoes used in this study were dried at 60°C but were not cooked. Uncooked sweet potato starch is not completely digestable by rodents. As a consequence, maintenance requirements would increase. This is the most likely explanation for the increased requirement for bean flour, but there also may have been interference with digestion from protease inhibitors present in uncooked sweet potatoes.

Walter et al. (38) measured the protein efficiency ratio (PER) of flour prepared from sweet potatoes which were cooked in a drying oven. Because the PER is determined on the basis of a diet containing 10% protein, the 'Jewel' and 'Centennial' sweet potatoes used in this study were stored until sufficient starch had metabolized to increase crude protein content to 11.25% (dry basis). When the flour was fed to Sprague-Dawley strain rats, the corrected PER values were 2.22 and 2.00 for 'Centennial' and 'Jewel' cultivars, respectively, compared to 2.50 for casein. 'Centennial' had the highest PER value of the two cultivars because its NPN content was lower. The net effect of increased NPN content is to lower the amount of essential amino acids as a percentage of the total nitrogen and thus decrease the PER value.

Anti-nutritional Factors

It has been recognized since 1954 (39) that sweet potato contains trypsin inhibitors. Trypsin inhibitors (TI) have an anti-nutritional effect by inhibiting proteolytic action of trypsin during digestion. Since the initial report, TI activity in sweet potatoes has been the subject of several reports. Dickey and Collins (40) reported the presence of 7 TI bands in the 4 cultivars examined, the intensity of the bands being cultivar dependent. Heat inactivation of TI also was cultivar dependent, but heating the tissue to 94°C, followed by cooling to room temperature destroyed 93-97% of the activity in all cultivars. Consequently, cooking of sweet potatoes should eliminate most of the anti-nutritional effect.

Enteritis necrotians (EN), a spontaneous form of enteric gangrene endemic to the highlands of Papua, New Guinea, is caused by toxins produced when Clostridium perfringens of the gut enter a rapid growth phase (41). It has been postulated that the disease occurs in populations which consume a low protein diet, e.g., sweet potato as the staple food combined with TI activity which

Table II. Effect of Supplementation of Starchy Foods With Common Beans on Weight Maintenance[a]

Flours	% Crude Protein	% Bean Flour[b] Required for Nitrogen Balance
Cassava	1.4	14.5
Plantain	3.1	20.1
Potato	9.5	14.6
Sweet Potato	3.8	29.3
Bean	22.8	10.1[c]

[a]From Bressani et al. (37). Wistar rats were test animal.
[b]Supplemented with methionine.
[c]Cornstarch used as starchy food with bean flour.

effectively reduces the proteolytic capacity of the digestive system to such a degree that it cannot destroy the proteinaceous toxin by hydrolysis. A report by Bradbury et al. (13) indicated that there was no correlation between the incidence of EN in a given region and the amount of TI activity in the sweet potato cultivars consumed in that region. Unless the populations involved consume large amounts of raw sweet potatoes, it is highly unlikely that the TI is obtained from this source since cooking has been shown to inactivate the inhibitor (40, 42).

Amino Acid Composition

In recent years, a number of workers have published amino acid analyses of the sweet potato (38, 43, 13, 22, 18). The overall picture is that the sweet potato amino acid pattern is of good nutritional quality but that the variability of individual amino acids both within the same cultivar and across cultivars is very high. For example, Walter et al. (44) reported that with the exception of aromatic amino acids, every essential amino acid has a score of less than 100 in one or more cultivars. The amino acid score is defined as the g of amino acid in 100 g of test protein divided by the number of g of that amino acid in the FAO/WHO reference pattern times 100. Bradbury et al. (22) showed that, for the same cultivar, environmental effects on the amino acid patterns is significant. For three cultivars, they found a mean percent standard deviation for all amino acids of 24.2, 23.4 and 20.6 over 5 environments. From their results, Bradbury (22) concluded that in the highlands of Papua, New Guinea, the EAA most likely to be limiting in decreasing order of probability were lysine, leucine and sulfur amino acids. These workers suggested that a part of the large difference reported worldwide in the relative amount of sulfur amino acids may be due in part to difficulties in the analysis of these compounds.

Concentrates and Isolates

The literature on concentrated sweet potato protein is sparse. Amino acid patterns for sweet potato protein isolates have been reported by three groups (16, 45, 46). One report showed that when compared to the FAO standard (47), no amino acids were limiting. The other reports showed total sulfur amino acids and lysine to be limiting (Table III). The patterns indicate a nutritionally well balanced protein. The improvement in nutritional quality, when compared to amino acid patterns from whole sweet potato, is due to the fact that whole sweet potatoes contain substantial amounts of NPN, which consists mainly of nonessential amino acids. This effectively dilutes the EAA and lowers the amino acid score.

Feeding studies with the rat as the test animal verified the high nutritional quality indicated by the amino acid pattern (45). Using isolates and concentrates prepared from 'Jewel' and 'Centennial' cultivars, PER values were equal to that of casein (milk protein) (Table IV). Examination of the amino acid patterns of sweet potato protein and casein revealed that both contained

Table III. Amino Acid Composition of Protein Isolates (g of Amino Acid Per 100 g of Protein)

	Walter and Catignani (45)	Purcell et al. (16)[a]	Nagase (46)[b]	FAO/WHO (47)
Essential				
Threonine	6.4	5.5	4.6	4.0
Valine	7.9	6.8	7.9	5.0
Methionine	2.0	2.6	2.5	
Total Sulfur	3.1	3.0	4.1	3.5
Isoleucine	5.6	5.3	5.3	4.0
Leucine	7.4	7.8	8.7	7.0
Tyrosine	6.9	5.2	3.6	
Phenylalanine	8.2	6.7	6.0	
Lysine	5.2	6.8[c]	6.5[c]	5.5
Tryptophan	1.2[c]	1.1[c]	1.8[c]	1.0
Amino Acid Score[d,e]				
Total Sulfur	88	86	100	
Lysine	95	100	100	
Nonessential				
Aspartic Acid	18.9	14.4	13.1	
Serine	6.6	5.1	5.5	
Glutamic Acid	9.6	8.6	11.8	
Proline	4.2	5.4	4.3	
Glycine	5.3	4.3	2.6	
Alanine	5.4	4.6	6.1	
Histidine	2.7	2.4	4.2	
NH_3	1.6	-[f]	-[f]	
Arginine	5.9	6.0	6.4	

[a] 'Jewel' cultivar.
[b] Cultivar unknown.
[c] Tryptophan content measured colorimetrically on enzyme-hydrolyzed material.
[d] g of amino acid in 100 g of test protein/g of amino acid in FAO/WHO reference pattern x 100.
[e] All other essential amino acids exceeded FAO/WHO values.
[f] NH_3 not reported.
From Walter et al. (44).

Table IV. Protein Efficiency Ratio (PER)[a] for Protein Fractions From Sweet Potatoes

Protein Fractions	PER	Corrected PER	Wt. Gained, g	Food Consumed, g	Initial Group wt., g
White					
Casein	2.81 ± 0.11	2.50 ± 0.09	134.3 ± 11.7	477.9 ± 37.7	78.3 ± 3.1
'Jewel'	2.91 ± 0.10	2.64 ± 0.09	138.9 ± 11.7	477.1 ± 29.0	78.3 ± 3.3
'Centennial'	2.96 ± 0.07	2.63 ± 0.07	140.3 ± 12.4	472.6 ± 35.3	78.4 ± 3.2
Chromoplast					
Casein	2.78 ± 0.10	2.50 ± 0.09	109.5 ± 7.8	394.0 ± 25.3	71.6 ± 2.9
'Jewel'	2.73 ± 0.09	2.47 ± 0.09	117.6 ± 11.3	431.1 ± 39.5	71.1 ± 2.7
'Centennial'	2.78 ± 0.10	2.50 ± 0.10	122.2 ± 14.9	437.9 ± 44.5	71.3 ± 2.7

[a]Mean and standard deviation calculated from data from 10 rats per diet group.
[b]Corrected by adjusting test diets to 2.50 for casein (AOAC).
From Walter and Catignani (45).

less sulfur amino acids than required for rat growth. In addition, sweet potato contained less lysine, while casein contained less threonine than is required for rat growth. Apparently the overall deficiencies limited rat growth about the same amount. The end result was that rats fed either protein grew at about the same rate.

Horigome et al. (15) reported a PER of 1.9 for protein recovered from an industrial sweet potato starch facility. They were able to increase the PER to 2.5 by supplementing the diets with lysine and methionine. A portion of these amino acids were either destroyed or made biologically nonavailable by the processing operation. The possibility also exists that these amino acids were limiting in the cultivars studied.

Effect of Processing on Nutritional Quality

Heat processing of sweet potatoes can have deleterious effects on protein nutritional quality. Purcell and Walter (48) found that the intensity of the heat processing conditions had a direct bearing on nutritional quality of the protein. In this study lysine was destroyed, presumably via irreversible reaction with reducing sugars (40). Both sucrose syrup-canned sweet potatoes and drum-dried sweet potato flakes contained 26% less lysine than did baked sweet potatoes. In addition, syrup-canned sweet potatoes contained 25% less total nitrogen than did either baked or drum-dried sweet potatoes. This loss of nitrogen was apparently due to solution of the NPN fraction in the syrup. Other reports on canned sweet potatoes reveal similar changes. Canned sweet potatoes from various locations were found to contain 3.8 to 4.2% (dry basis) crude protein (50), rather than the expected 4.5-7.0%. Although no mention was made of the lower-than-expected crude protein values, these were probably due to dissolution of part of the NPN fraction in the syrup. Similarly, Meredith and Dull (43) reported that canned-in-syrup sweet potatoes contained ca. 45% less amino acids than did the roots before processing. Since syrup is discarded before the canned roots are eaten, this results in a serious loss of nitrogen.

The severity of heat treatment during dehydration has a significant effect on protein nutritional quality. Cooked sweet potatoes dehydrated in a forced-draft oven at 60°C had a PER of 2.2, while a second lot of cooked sweet potatoes dehydrated on a steam-heated drum dryer had a PER of 1.3 (38). The lysine content measured by acid hydrolysis-ion exchange chromatography was somewhat lower in the drum dehydrated flour but not sufficiently low to account for the difference in PER values. Further study using an assay for available lysine (51) showed that a large part of the lysine was not available. Thus, acid hydrolysis can liberate biologically nonavailable lysine which is subsequently quantified along with available lysine, causing an overestimation of the nutritional quality of the food. This is most likely to happen when high levels of reducing sugars are present in the food and lysine is limiting, as is the case with sweet potatoes.

Summary and Conclusions

The sweet potato ranks sixth in average production among the major food crops of the world. There is significant potential for increasing the protein content of this crop by a combination of breeding/selection and optimization of production practices. According to present knowledge, most of the nitrogen of the sweet potato is in a form suitable to satisfy human nitrogen requirements. The protein component comprises from 60-85% of the nitrogen with the remainder consisting of amino or amide nitrogen. The amino acid pattern of the sweet potato is highly variable. Isolated sweet potato protein is of sufficient nutritional quality to support growth of laboratory rats to the same extent as casein. Humans have been maintained in nitrogen balance using sweet potato as the major source of protein. Processing of sweet potatoes can have adverse effects on the protein nutritional value. Canning sweet potatoes in a liquid medium causes leaching of soluble nitrogenous compounds into the liquid, thereby lowering the nitrogen content. Heat processing of the sweet potato causes a decrease in the biological availability of lysine. The extent of the decrease in lysine availability is dependent upon the severity of the heat treatment and the amount of reducing sugars present during heating.

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