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Condensed Tannin Content in Four Landraces of Bambara groundnut *(Vigna subterreanea* (L.) Verdc)

J. O. Amarteifio* and E. Moichubedi

Abstract

Keywords: **bambara groundnuts, condensed tannin, Botswana.**

Condensed tannins of four landraces grown in Botswana were determined using the acidified vanillin method (PRICE *et al.*1980). Botswana cream and Diphiri cream landraces had equal amount of tannin, 0.05 percent; while Zimbabwe red and Botswana red had 0.10 percent. There was a significant difference ($P < 0.05$) between the tannin content of the cream and red landraces. The quantity of tannin determined was low and might not adversely affect the digestion of proteins.

1 Introduction

Tannins are generally defined as naturally occurring polyphenolic compounds of high molecular mass between 500 and 3000 which form complexes with proteins (BATE-SMITH, 1962). They inhibit the digestive enzymes, trypsin, chymotrypsin and amylase (FAUJDAR *et al.* 1993). When ingested, tannins might reduce the nutritive value of food by forming indigestible complexes with dietary proteins. The consumption of feeds or foods containing tannins reduces nutrient use, feed efficiency and animal productivity. At high levels of intake animals sometimes die (MAKKAR, 1995). There are two classes of tannins: condensed and hydrolysable tannins. Condensed tannins occur in herbaceous legumes (SARKAR *et al.* 1976) such as bambara groundnuts (*Vigna subterranea*), cowpeas (*Vigna unguiculata*), and pigeon peas (*Cajanus cajan*).

The Government of Botswana is encouraging crop diversification, as it is assumed that this would positively contribute towards its goal of achieving food security. Besides traditional crops, for example, maize, sorghum and cowpeas, farmers can increase the production of bambara groundnuts. The latter is a drought resistant crop and it has a good potential in a drought stricken country such as Botswana.

To promote this crop as a food crop its nutritional value and the antinutritional factors should be evaluated. The nutritional value of the four landraces used in this study was reported (AMARTEIFIO *et al,* in press). The protein content varied from 16.6 ± 0.1 to 18.2

* Dr. J Amarteifio, Basic Sciences Department, Botswana College of Agriculture, Private Bag 0027, Gaborone, Botswana.

± 0.1g /100g dried samples. The protein may be unavailable for digestion depending on the amount of tannin in the bambara groundnuts. Data on the quantity of tannin in bambara groundnuts grown in Botswana are unavailable, therefore, this study was undertaken. This paper discusses the results of the estimation of condensed tannins in four landraces of bambara groundnuts grown in Botswana.

2 Materials and Method

The acidified vanillin method was used (PRICE *et al.* 1978) for tannin determination. The four landraces studied were Diphiri cream (DC), Botswana cream (BC), Botswana red (BR), and the Zimbabwe red (ZR). The seeds were grown on sandy-loamy soils at the Botswana College of Agriculture farm. The sorted seeds were milled in a Thomas Wiley Laboratory Mill to pass through a one mm screen and then dried at 80°C to constant weight.

The tannin was determined relative to catechin. The standard curve was prepared using catechin (98%) manufactured by the Aldrich Chemical Company in the United States of America. For each sample there were three replicates. The transmittance at 500nm for each replicate was measured using a Shimadzu Ultra violet-visible spectrophotometer and the mean calculated. The catechin equivalent was then determined from the standard curve and the percentage tannin calculated. It was assumed that 10mg catechin is equivalent to 1% tannin (BURNS *et al.* 1971). The analysis of variance method was used to find out if the tannin content of the different landraces were significantly different.

3 Results and Discussion

Table 1 gives the mean transmittance readings and the percentage tannin measured in the four landraces studied. The Botswana cream and Diphiri cream contained the same amount of tannin, 0.05%, and the Botswana red and Zimbabwe red contained 0.10% tannin respectively. The red coloured seeds contained twice as much tannin than the cream coloured seeds. This observation is in line with previous studies (POULTER, 1981 and OBIZOBA *et al.*1992). They reported that the cream coloured seeds have less tannin than the brown/red seeds. Poulter (1981) found that the amount of tannins in eight Ghanaian cultivars of bambara groundnuts ranged from 0.36% to 0.94%. Also Obizoba *et al.* (1992) reported that the quantity of tannins in five varieties of bambara groundnut grown in Nigeria varied from 0.3% to 1.1%. They also observed that fermentation and germination reduced the tannin content of the bambara groundnut. The values obtained by Poulter (1981) and Obizoba *et al.* (1992) are higher than those obtained in this investigation. This may be because the cultivars are different and they were not cultivated under similar conditions. In this study the tannin content for the four landraces ranged from 0.05% to 0.10%. This value does not exceed the maximum of 0.10% (% catechin equivalent) recommended for the weaning food *TSABANA* produced in Botswana (OHIOKPEHAI *et al.* 1994). Price *et al.* (1980) reported that the tannin content of different

varieties of cowpeas ranged from 0% to 0.7%. They concluded that tannin content of 0.7% may be nutritionally harmful to humans.

From the statistical analysis the tannin content of the Diphiri cream and Botswana cream landraces were significantly different ($P < 0.05$) from those of the Zimbabwe red and Botswana red.

Table 1: The tannin content of the four landraces studied.

Landrace	Mean transmittance % (500nm)	Catechin (mg) from standard curve	Tannin (g per 100g dried sample)
Botswana cream	99.6 ± 0.14	0.50	0.05
Diphiri cream	99.6 ± 0.14	0.50	0.05
Zimbabwe red	98.6 ± 0.19	0.98	0.10
Botswana red	98.6 ± 0.17	0.98	0.10

4 Conclusion and recommendations

The results of this study show that the tannin content of Botswana cream and Diphiri cream is low (0.05%) and they are significantly different from those of Botswana red and Zimbabwe red landraces(0.10%). The tannins determined are within the allowed limit of 0.10%, therefore it can be concluded that it may not adversely affect the digestion of protein. The increased cultivation and consumption of this crop are recommended. These would contribute positively towards achieving food and nutrition security in Botswana. It is also recommended that the possibility of using bambara groundnuts as a component of weaning foods be explored.

Tanningehalt in vier Bambara Erdnuß Landsorten

Zusammenfassung

In vier Bambara Erdnuß Landsorten, angebaut in Botswana wurden die kondensierten Tannine mit der acidified vanillin Methode bestimmt. Die Sorten Botswana cream und Diphiri cream hatten den gleichen Anteil an Tannin, 0,05 %, während Zimbabwe red und Botswan red ebenfalls gleich 0,10 %, eine signifikante Differenz ($P < 0.05$) zwischen cream und red Sorten. Der bestimmte Gehalt an Tanninen war niedrig und dürfte sich nicht nachteilig auf die Verdaulichkeit von Proteinen auswirken.

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6 References

1. AMARTEIFIO, J. O, SAWULA, G. and GIBBONS, M., (In press, Tropical Science), Composition of bambara groundnuts (*Vigna subterranea)* grown in Botswana.
2. BATE-SMITH, E. C., 1973, Tannins of herbaceous legumes, Phytochemistry 12: 1809-1812.
3. BURNS, R. E., 1971, Method for estimation of tannin in grain sorghum, Agronomy Journal 63: 511-512.
4. FAUJDAR, S. and DIWAKAR, B., 1993, Nutritive value and uses of pigeon pea and groundnut, Skills development series no. 14. International Crops Research Institute for the Semi-arid Tropics, Andra Pradesh 502 324, India.
5. MAKKAR, H. P. S., 1995, Quantification of tannins a laboratory manual, second edition. International Centre for Agricultural Research in the dry areas, P.O.Box 5466, Aleppo, Syria.
6. OBIZOBA, I .C. and EGBUNA, H. I., 1992, Effect of germination and fermentation on the nutritional quality of bambara nut (*Voandzeia subterranea L. Thouars*) and its product (milk), Plant Foods for Human Nutrition 42:13-23.
7. OHIOKPEHAI, O., JAGOW, J., JAGWER J and MARUAPULA, S., 1994, TSBANA-Towards locally produced weaning foods in Botswana. Paper presented at a Nutrition and Food Security Workshop held in Gaborone, Botswana 28-30th November, 1994.
8. POULTER, N.H., 1981, Properties of some protein fractions from bambara groundnut (*Voandzeia subterranea (L.) Thouars)*, Journal of the Science of Food and Agriculture, 32:44-50.
9. PRICE, M.L., HAGERMAN, A.E. and BUTLER, L.G., 1980, Tannin content of cowpea, chickpea, pigeon peas and mung beans, Journal of Agriculture and Food Chemistry 28:459-461.
10. PRICE, M.L., VAN SCOYOC, S and BUTLER, L.G., 1978, A critical evaluation of the vanillin reaction as an assay for tannin in sorghum grain, Journal of Agriculture and Food Chemistry 26: 1214-1218.
11. SAKAR, K.S., HOWARTH, R.E and GOPLEN, B. P., 1976, Condensed Tannins in herbaceous legumes. *Crop Science* 16:543-546.