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EFFECT OF ALKALINE TREATMENTS IN LYE AND SLAKED LIME ON SOME NUTRIENTS, ANTINUTRIENTS AND *IN VITRO* PROTEIN DIGESTIBILITY OF EGYPTIAN RIVERHEMP *(SESBANIA SESBAN)* SEEDS

Shefiat O. Arekemase[1,5], Ibrahim Abdulwaliyu[2], Stanley I.R. Okoduwa[3,4*], Kola M. Anigo[5], Danladi A. Ameh[5]

[1]National Research Institute for Chemical Technology, Petrochemical and Allied Department, Zaria, Nigeria
[2]National Research Institute for Chemical Technology, Scientific and Industrial Research Department, Zaria, Nigeria
[3]Nigerian Institute of Leather and Science Technology, Directorate of Research and Development, Zaria, Nigeria
[4]Babcock University, School of Basic Medical Sciences, Department of Biochemistry, Ilishan-Remo, Nigeria
[5]Ahmadu Bello University, Department of Biochemistry, Zaria, Nigeria

Abstract: *Sesbania sesban* is widely distributed in different parts of Nigeria and is used as forage or green manure. However, the levels of antinutritional factors associated with the seed limit its use as an alternative feed for livestock. Therefore, this study determined the effect of alkaline treatments on some nutrient and antinutrient composition and *in vitro* protein digestibility of the seed of *S. sesban*. The seeds were treated by soaking (for 24 hours) and boiling (for 30 minutes) in slaked lime (calcium hydroxide) or lye. Afterwards, the boiled and soaked samples were properly dried at room temperature. The samples were then analysed using standard methods for proximate analysis, antinutrients, and *in vitro* protein digestibility. It was revealed that crude protein content was significantly ($p<0.05$) higher for samples boiled in slake lime (BSL) and in lye (BL) compared to unprocessed sample (RS), whereas carbohydrate content showed a significant ($p<0.05$) reduction in BSL compared to the RS. Regarding antinutrient content, the treatments caused a significant ($p<0.05$) reduction in tannins (37.1-76.5%) and trypsin inhibitors (34.2-68.0%), as compared to RS. The treatments were also effective in the reduction of saponins, oxalates, phytates and cyanogenic glycosides. *In vitro* protein digestibility was significantly higher in the treated seeds, following the order: boiling in lye>boiling in slaked lime> soaking in slaked lime>soaking in lye. The seeds of *S. sesban*, if properly processed using lye, could serve as a potential alternative compound for livestock feed. The results of this research confirmed that treatments with lye, which is much less costly and more available to rural communities are comparable to those based on slaked lime and can be used interchangeably.

Key words: *ash, calcium hydroxide, boiling, soaking, tannins, tripsin inhibitor*

INTRODUCTION

Sesbania sesban (Egyptian riverhemp) belongs to the family Fabaceae. It is a small perennial tree with woody stems, yellow flowers and linear pods. The origin of *S. sesban* is unclear but it is widely distributed and cultivated throughout tropical Africa and Asia (Veasey, Schammass, Vencovsky, Martins & Bandel, 1999). The plant is an excellent nitrogen fixer (Makatiani & Odee, 2007), capable of rapid growing in nitrogen-deficient soils, thus pos-

Corresponding author: Phone +234-803-295-5882
E-mail address: siroplc@gmail.com; okoduwas@babcock.edu.ng

sessing high utility in agroforestry as intercrop, cover crop, green manure, mulch and folder (Gopalakrishna & Joshi-Saha, 2007).

The seed has potential for use as animal feed because of its high crude protein, energy and other essential nutrients needed by livestock (Arekemase et al., 2013). As a good source of protein, the plant seed could replace soybean in the formulation of feeds for livestock. In India, the mature seeds of the plant have been reported to be consumed after cooking by tribal sets of Kharis and Ghondan (Siddhauraju, Vijayakumari & Janardhanan, 1995). Aside from the nutritional attributes, the plant seeds also possess some medicinal values. Seeds flour of *S. sesban* has been reported to be used in the treatment of ringworm, skin diseases and wounds (Duke, 1981), ulcers, fever, purgative demulcent, pain reliever and as an astringent (Yusuf, Choudhury, Wahab & Begum, 1994).

The prices of some foodstuffs (maize and soybean) used in the production of livestock feeds are increasing (Mengesha, 2012). Thus there is the need to replace these conventional foodstuffs with non-utilized plant seeds rich in nutrients. *S. sesban* is one of the non-utilized nutrients-rich plants. The major obstacle hindering its utilization is the presence of antinutrients. Previous studies have shown that antinutrients (especially tannins) can be reduced to a bearable level using calcium hydroxide (slaked lime) (Dakare, Ameh, Agbaji & Atawodi, 2011). However, the use of slaked lime to detoxify seeds of this plant may not be economically viable, especially to the people in the rural communities. Hence, there is a need to explore the use of other alternative processing methods, such as lye, which is readily available to rural communities. This study aimed at determining the effect of alkaline treatments using lye or slaked lime on nutrient composition, antinutrient reduction and *in vitro* protein digestibility of the treated seeds of *S. sesban*.

MATERIALS AND METHODS

Plant collection, identification and preparation

The mature pods of *Sesbania sesban* were harvested from Bassawa, Sabon Gari local government area of Zaria, Kaduna State, Nigeria. The identity of the plant was confirmed at the herbarium, Department of Botany, Ahmadu Bello University, Zaria, Kaduna State, Nigeria and voucher number 900112 was deposited. The pods were properly dried and threshed and the seeds obtained were dried at room temperature.

Ash production

Ash was produced by burning wood (*Gmelina aborea*) completely and the obtained ash was sieved using a mesh size of 0.400 mm to remove pieces of charcoal and other impurities.

Lye preparation

The lye was prepared using a traditional method. Exactly 100 g of ash was poured into a perforated container with a sieve cloth at the base of the container, and 1000 mL of distilled water was poured into the ash. The mixture was allowed to stay overnight to collect the lye as a droplet. Thereafter, 1000 mL of distilled water was poured into the mixture, followed by lye collection as a droplet. The process was repeated five times to achieve the desired quantity of lye, enough to be used for the treatment of the plant seeds.

Alkaline treatments

Boiling in slaked lime

A hundred grams of pulverized *S. sesban* seeds were boiled in a mixture of 1000 mL of distilled water and 100 g of slaked lime ($Ca(OH)_2$) at 100 $^{\circ}C$ for 30 minutes, and it was allowed to cool overnight. The supernatant was decanted and the residue was washed several times, sun-dried and labelled as BSL.

Boiling in lye

Exactly 100 g of the pulverized *S. sesban* seeds were boiled in 1000 mL of lye water for 30 minutes and it was allowed to cool overnight. The supernatant was decanted, and the residue was washed several times, sun-dried and labelled as BL.

Soaking in slaked lime

The pulverized seeds of *S. sesban* (100 g) were soaked in a mixture of 1000 mL distilled water and 100 g of slaked lime for 24 h at room temperature. The supernatant was decanted and the residue was washed several times, sun-dried and labelled as SSL.

Soaking in lye

The pulverized seeds of *S. sesban* (100 g) were soaked in 1000 mL of lye water for 24 h at room temperature with occasional stirring. The supernatant was washed several times, sun-dried and labelled as SL.

Proximate analysis

The methods described by AOAC (2003) were adopted for the determination of moisture (925.09), ash (923.03), crude fat (920.39C), and crude protein (979.09) contents of *S. sesban* seeds.

Determination of dietary fibre contents

The method described by AOAC (1992) was used for the determination of dietary fibre (AOAC 991.43) contents in the seeds of *S. sesban.* The method that entails determination of insoluble (AOAC, 991.42) and soluble dietary fibres (AOAC, 993.19) involves sequential enzymatic digestion of the sample by heat stable α-amylase, protease and amyloglucosidase.

Determination of carbohydrate contents

Carbohydrate content in the samples was determined using anthrone reagent following the method described by Prasad, Madhul, Venkateshwalu and Sabath (2012). In a hot acid, polysaccharides are hydrolysed into monosaccharides and reacts with anthrone reagent to form a green coloured complex which is quantified spectrophotometrically at 630 nm (Prasad et al. 2012).

Estimation of food energy value (FEV)

Atwater's conversion factors: 16.7 kJ/g (4 kcal/g) for protein, 37.4kJ/g (9 kcal/g) for lipids, and 16.7 kJ/g (4 kcal/g) for carbohydrates were used in estimating the energy value of the samples as revealed in study by Gemede, Haki, Beyene, Woldegiorgis and Rakshit (2016).

In vitro assay for protein digestibility

The *in vitro* protein digestibility was assayed according to the method of Mertz et al. (1984). *In vitro* protein digestibility entails a one-step digestion of the sample with pepsin for three hours, and the resultant indigestible nitrogen is subtracted from total nitrogen of the sample to obtain digestible nitrogen (Boisen, 2000).

Analyses of antinutrients (tannins, saponins, oxalates, phytic acid, cyanogenic glycoside, trypsin inhibitor)

The Folin – Denis spectrophotometric method was used as described by Pearson (1976) to determine tannin contents in triplicate for the treated and raw seeds of *S. sesban*. The gravimetric method of AOAC (1990) employing the use of a Soxhlet extractor and two different organic solvents were used for saponin determination. The titration method described by Day and Underwood (1986) was used to determine the oxalate content. Cyanogenic glycoside determination was performed as described by Onwuka (2005). Phytic acid was determined using the procedure described by Lolas and Markakis (1975). Trypsin inhibitor was determined by the method described by Onwuka (2005).

Statistical analysis

The data obtained were expressed as mean ± standard deviation (SD). Five samples of each treatment method were measured and analysed in triplicate (n=3). The data generated were analysed using ANOVA (SPSS version 20). Duncan's Multiple Range Test was used to determine the differences between the means. $P<0.05$ was considered statistically significant.

RESULTS

Effect of treatments on proximate composition of *S. sesban* seeds

The effect of alkaline treatments on the proximate composition of *S. sesban* seeds is shown in Table 1. Moisture content was significantly lower in both boiled samples, while it was significantly higher in both soaked samples in comparison to untreated (raw) samples (RS). Crude protein content showed a significant ($p<0.05$) reduction in SSL and SL compared to RS, BSL and BL. Ash content was significantly higher in RS in comparison to all treated samples, and the same was obtained for carbohydrate content, food energy value (FEV), as well as insoluble fibre content. On the other hand, the content of soluble fibre was highest in BSL sample.

Effect of alkaline treatments on antinutrient composition of *S. sesban* seeds

The effects of processing on the content of antinutrients present in *S. sesban* seeds are shown in Table 2. Generally, boiling and soaking treatments in lye and slaked lime caused a significant reduction in all the determined antinutrients that are naturally present in *S. sesban* seeds. The boiling treatments were more efficient than the soaking treatments in terms of reduction in tannins, saponins, cyanogenic glycoside and trypsin inhibitor content.

Table 1.
Effect of various alkaline treatments on proximate composition (g/kg DM) of *S. sesban* seed

Parameter	RS	BSL	BL	SSL	SL
Moisture	46.4±0.12[b]	41.1±0.08[a]	41.1±0.12[a]	51.2±0.05[c]	51.0±0.09[c]
Ash	26.6±0.10[c]	26.0±0.05[bc]	24.7±0.04[ab]	24.5±0.04[a]	25.1±0.07[ab]
Crude fat	61.8±0.12[ab]	61.6±0.05[ab]	63.4±0.09[c]	61.1±0.03[ab]	61.0±0.08[a]
Crude protein	256.6±0.52[b]	260.9±0.03[b]	261.4±0.06[b]	247.5±0.58[a]	247.7±0.60[a]
Soluble fibre	36.3±0.02[b]	38.1±0.04[c]	34.6±0.02[a]	47.2±0.05[d]	38.3±0.05[c]
Insoluble fibre	117.2±0.08[d]	105.0±0.20[c]	97.5±0.12[b]	98.4±0.09[b]	84.0±0.02[a]
Carbohydrates	595.1±0.29[d]	486.4±0.84[a]	524.4±0.40[bc]	533.3±0.41[c]	515.4±0.34[b]
FEV (kcal/kg)	3963.0±3.70[e]	3544.0±2.40[a]	3713.8±1.90[d]	3674.0±3.15[c]	3601.4±2.85[b]

Values are mean ± SD of five replicate determinations. Means denoted by a different letter indicate significant differences between treatments (p < 0.05). RS – raw sample, BSL – boiled in slaked lime, BL – boiled in lye, SSL – soaked in slaked lime, SL–soaked in lye, FEV–Food Energy Value, DM-dry matter

Table 2.
Effect of processing on antinutrients composition of *S. sesban* seed (magnitude of reduction (%) in comparison to the untreated sample in square brackets)

Antinutrient content	RS	BSL	BL	SSL	SL
Tannins (g/kg DM)	13.20±0.03[d]	3.30±0.02[a] *[75.0%]*	3.10±0.03[a] *[76.5%]*	5.90±0.03[b] *[55.3%]*	8.30±0.04[c] *[37.1%]*
Saponins (g/kg DM)	4.30±0.04[d]	1.80±0.02[a] *[58.1%]*	1.80±0.02[a] *[58.1%]*	3.30±0.05[b] *[23.3%]*	3.20±0.04[c] *[25.6%]*
Oxalate (mg/ kg DM)	42.40±0.08[e]	30.90±0.02[d] *[27.1%]*	21.0±0.01[a] *[50.5%]*	28.1±0.06[c] *[33.7%]*	27.90±0.11[b] *[34.2%]*
Phytate (mg/ kg DM)	12.90±0.09[d]	7.00±0.03[b] *[45.7%]*	7.50±0.05[c] *[41.9%]*	6.30±0.05[a] *[51.7%]*	6.40±0.08[a] *[50.4%]*
Cyanogenic glycoside (mg/kg)	12.81±0.08[c]	6.27±0.04[a] *[51.0%]*	6.24±0.24[a] *[51.3%]*	7.55±0.13[b] *[41.1%]*	7.62±0.03[b] *[40.5%]*
Trypsin inhibitor (TIU)	13.50±0.11[e]	4.72±0.10[b] *[65.0%]*	4.32±0.11[a] *[68.0%]*	7.29±0.12[c] *[46.0%]*	8.88±0.07[d] *[34.2%]*

Values are mean ± SD of five replicate determinations. Means denoted by a different letter indicate significant differences between treatments (p < 0.05). RS – untreated sample, BSL – boiled in slaked lime, BL – boiled in lye, SSL – soaked in slaked lime, SL – soaked in lye, DM-dry matter, TIU-Trypsin inhibitor unit

Effect of alkaline treatments on *in vitro* protein digestibility of *S. sesban* seeds

Protein digestibility of raw and treated samples, determined *in vitro,* is shown in Table 3. After alkaline treatments, protein digestibility significantly increased in comparison to the control (untreated sample).

Table 3.
Effect of processing on *in vitro* protein digestibility of *S. sesban* seed

Sample	*In vitro* protein digestibility (%)
RS	53.72 ± 0.12[a]
BSL	84.36 ± 0.11[e]
BL	89.23 ± 0.17[d]
SSL	80.66 ± 0.20[c]
SL	78.23 ± 0.16[b]

Values are mean ± SD of triplicate determinations. Means denoted by a different letter indicate signifucant differences between treatments (p < 0.05). RS – raw sample, BSL – boiled in slaked lime, BL – boiled in lye, SSL – soaked in slaked lime, SL – soak in lye

DISCUSSION

Many foods exist, but not all foods possess the ability to improve metabolic and physiologic processes, due to the presence of antinutritional factors (Bassaganya-Riera et al., 2021). Kiarie and Mills (2019) reported previously that the processing of feeds improves nutrient utilization for healthy growth and overall performance of the animal. In this study, low moisture content was observed in all the samples analysed. This result is comparable to the values obtained in a study by Arekemase et al. (2013). Low moisture content is necessary to retain the desired quality of food. The low ash contents obtained in this study suggest low mineral contents. The low content of crude fat is an indication that *S. sesban* seed is a poor source of lipids. Fat, like other macronutrients, is vital for good nutritional balancing and enhancing product performance in poultry (Centingul & Yardimci, 2008).

Irrespective of the processing methods, the content of carbohydrates was observed to be the highest in *S. sesban* seeds. The carbohydrate contents obtained in this study were higher than those reported by Ishola et al., (2018) for the raw and fermented seeds of *Sesbania spp*. (264 ± 0.02 and 249.3± 0.00 g/kg DM, respectively). Moreso, the carbohydrate content (486.4 ± 0.001 g/kg DM) revealed in a closely related *S. aculeate* (Nayak, Rath, Giri & Mohanta, 2018) was lower than the composition revealed in this study. Which by implication, buttressed that the carbohydrate contents obtained in this study, regardless of the processing methods, were significant for the consideration of the seeds of *S. sesban* as a good source of carbohydrates. The higher carbohydrate content in RS as compared to the contents found in the treated samples suggests that the carbohydrates of *S. sesban* are subject to changes following treatments with slaked lime and lye (boiling or soaking).

The crude protein contents in the unprocessed and processed samples were significant enough to consider the seeds of *S. sesban* as a good source of proteins. Since most animal feedstuffs are low in proteins, supplementing with seeds of *S. sesban* may contribute to the overall well-being of livestock. The content of crude proteins observed in this study (247.5-261.4 g/kg) was lower than the content reported for soybean (376.9 g/kg DM), a common source of protein ingredient for livestock (Etiosa, Chika & Benedicta, 2017).

The treated seeds of *S. sesban,* (except BL), showed a slight increase in the soluble fibre content as compared to the raw seeds (RS). This suggests that boiling with lye and calcium hydroxide may have contributed to decomposing part of the cell wall of the plant seed. This observation corroborates with the findings of Azizah and Zainon (1997) (although reported for different plant seeds) that boiling and soaking slightly increase soluble dietary fibres in soybean, mung bean and groundnut. The contrary observation was revealed in the case of insoluble fibres. The decrease in the level of insoluble fibre of processed seeds of *S. sesban* harmonizes with previous findings in the work of Joshua, Timothy and Suleiman (2012). They highlighted that processing methods such as boiling affected (reduced) the fibre content in plant-based food, and the reduction was a function of time.

The treatments employed in this study reduced the levels of antinutritional factors in the raw seeds. However, the reduction of the antinutrients in seeds of *S. sesban* varied depending on the used treatment. Soaking resulted in a better reduction of phytates while boiling proved better in the reduction of tannins, saponins, cyanogenic glycosides and trypsin inhibitors. Boiling of the raw seeds using slaked lime and lye revealed a significant reduction ($p<0.05$) in the levels of tannins as compared to the soaking method. Information on the effect of processing on raw seeds of *S. sesban* is relatively scarce. In comparison to other legumes, Mamiro et al. (2017) affirmed that the processing (cooking) of different varieties of beans (leguminous plants) significantly reduced the level of tannins. The content of saponins obtained in this study was comparable to that previously reported elsewhere (Arekemase et al., 2013). Just like tannins, saponins in feed samples, especially from leguminous plants, affect protein utilization (Abdulwaliyu et al., 2018).

The content of phytic acid revealed in the raw seed of *S. sesban*, as observed in this study is lower than the contents reported for *S. aculeate*, *S. rostata* and *S. cannabina*, (20.5, 15.4 and 19.1 mg/kg DM, respectively) (*Siddhuraju, Osoniyi, Makkar & Becker*, 2002). The difference in the phytic acid composition between the studies could be attributed to species differences (Abdulwaliyu et al., 2019). The various alkaline treatments - boiling (BL, BSL) and soaking with (SSL, SL) significantly reduced the phytic acid composition in the raw seeds of *S. sesban* (Table 2). Contrary to our observations, some studies reported that soaking and boiling did not affect the phytic acid content of *Sesbania* species (Duodu, Minnaqr & Taylor, 1999; Siddhuraju et al., 2002). Also, the phytic acid content reported in this study (irrespective of the treatments) was lower than those reported in the seeds of *S. sesban* (23.5 and 23.7 mg/kg DM), as reported by Hossain and Becker (2001). The differences may be attributed to the maturity stage of the plant seeds at the time they were harvested and/or their geographical zone of cultivation (Abdulwaliyu et al., 2019). Oxalate also exerts effects against optimal utilization of nutrients in feeds and foods. Observation in this study revealed that the raw seeds of *S. sesban* contain oxalate (give your value here), although not in an ample amount. Although the oxalate content present in the raw seeds was low, the employed alkaline treatments further reduced its content. This is in line with previous findings that boiling oxalate-rich plant material promotes the loss of soluble oxalate (Poeydomenge & Savage, 2007). Soaking of plant material has been also confirmed to induce a significant reduction in oxalate (Kumoro, Budiyati & Retnowati, 2014) and this was in agreement with the observations from our study.

This study revealed the presence of cyanogenic glycosides which is contrary to the previous report by Osman, Ahmed, Barda and Eltohami (2015). The difference may lie in the species of *Sesbania*. Our study revealed that raw seeds of *S. sesban* contained significant amounts (12.81±0.08, 6.27±0.04, 6.24±0.24, 7.55±0.13, 7.62±0.03 mg/kg DM) of cyanogenic glycolsides though, lower than that reported for corn (291.6 mg/kg DM) (Onojah & Odin, 2015).

Also, the values of cyanogenic glycoside as shown above are lower than the values (250±1.00 and 210±0.70 mg/kg) reported for corn and soybean (Nkafamiya, Osemeahon Andema & Akinterinwa, 2015). However, the processing methods employed in this study significantly reduced cyanide contents even though the absolute reduction was not achieved by all the processing methods.

This study showed that all boiling (BSL and BL) treatments were more effective ($p<0.05$) than soaking treatments (SSL and SL) in the reduction of reduced trypsin inhibitor contents.

But, soaking also exhibited a significant reduction of trypsin inhibitor in comparison to the untreated sample. This observation agrees with the previous report that soaking leguminous plant seeds promotes a significant reduction of trypsin inhibitors (Adeleke, Adiamo, Fawale & Olamiti, 2017).

The percentages of *in vitro* protein digestibility (78.23-89.23%) revealed in the processed samples of *S. sesban* were higher than that (65.82%) reported for *S. bispinosa* (Pugalenthi, Vadivel, Gurumoorth & Janardhanan, 2004). The percentage (84.36 ± 0.11%) *in vitro* protein digestibility found for BSL is comparable to that (85.89%) revealed for soybean meal fermented using *Aspergillus* sp., while the seeds processed with lye (BL) (89.23 ± 0.17%) were higher in the percentage of *in vitro* protein digestibility as compared to soybean meal (87.50%), soybean meal fermented with *Aspergillus* (85.89%) and soybean protein concentrate (87.63%) (Chen, Shih, Chiou & Yu, 2010). The high levels of *in vitro* protein digestibility observed in the processed samples suggest that processing of the raw seed of *S. sesban* may in part contribute to the protein quality of the plant seeds. Protein quality is determined by the digestibility of the protein, composition of the amino acids and their bioavailability (Gilani, Cockell & Sepehr, 2005). The high levels of antinutrients in the untreated sample may be a contributing factor to the lower *in vitro* protein digestibility revealed in RS (53.72 ± 0.12) as compared to the processed samples. A previous report affirmed that the presence of antinutritive factors found in some raw legumes influences protein digestibility (Gilani et al., 2005). Possible interaction between proteins and non-proteins may also contribute to poor protein utilization (Usman, Bolade & Hussein, 2018). A lower level of *in vitro* protein digestibility revealed in the untreated seeds may result in poor utilization of protein in *S. sesban* by any targeted animals.

CONCLUSIONS

Based on the findings from this study, it is concluded that proximate compositions showed that *S. sesban* seeds boiled in lye (BL) had higher levels of crude proteins, carbohydrates and food energy value compared to other processed samples. This study clearly reveals that boiling alkaline treatments (BSL and BL) exhibit significant reduction of tannins, saponins, cyanogenic glycosides and trypsin inhibitor as compared to soaking alkaline treatments (SSL and SL). The alkaline treatments, as demonstrated in this study, improved *in vitro* protein digestibility of *S. sesban* seeds, with boiling in lye being the most effective treatment. Therefore, this study suggests that seeds of *S. sesban*, if properly processed using lye which is readily available, could serve as an alternative feed for livestock. Further studies should focus on the effects of other processing methods such as fermentation, roasting, sprouting on the levels of nutrients, antinutrients and *in vitro* protein digestibility.

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EFEKAT ALKALNIH TRETMANA PRIMENOM CEĐI I HIDRATISANOG KREČA NA NEKE NUTRIJENTE, ANTINUTRIJENTE I *IN VITRO* SVARLJIVOST PROTEINA SEMENA *SESBANIA SESBAN*

Shefiat O. Arekemase [1,5], Ibrahim Abdulwaliyu [2], Stanley I.R. Okoduwa[3,4*], Kola M. Anigo[5], Danladi A. Ameh[5]

[1]Nacionalni istraživački institut za hemijsku tehnologiju, Departman za petrohemiju, Zaria, Nigerija
[2]Nacionalni istraživački institut za hemijsku tehnologiju, Departman za naučna i industrijska istraživanja, Zaria, Nigerija
[3]Nigerijski institut za kožu i naučnu tehnologiju, Direktorat za istraživanja i razvoj, Zaria, Nigerija
[4]Univerzitet Babkok, Škola za osnovne medicinske nauke, Departman za biohemiju, Ilišan-Remo, Nigerija
[5]Univerzitet Ahmadu Belo, Departman za biohemiju, Zaria, Nigerija

Sažetak: *Sesbania sesban* je višegodišnja žbunasta ili drvenasta biljka široko rasprostranjena u različitim delovima Nigerije koja se koristi kao krmno bilje. Međutim, sadržaj antinutrijenata u semenu biljke ograničava njihovu upotrebu kao komponente za stočnu hranu. Stoga je tema ovog rada ispitivanje uticaja različitih tretmana alkalnim sredstvima na sadržaj nutrijenata, antinutrijenata i svarljivost proteina u semenu *S. sesban*. Semena su tretirana potapanjem (tokom 24 h) ili kuvanjem (30 min) u ceđi (voda kuvana sa pepelom) ili hidratisanom tj. gašenom kreču (kalcijum-hidroksidu). Nakon tretmana, semena su dobro osušena na ambijentalnoj temperaturi. U tretiranim semenima ispitivan je hemijski sastav, sadržaj antinutrijenata i *in vitro* svarljivost proteina. Rezultati su pokazali da je sadržaj sirovih proteina statistički značajno ($p<0.05$) povišen u uzorcima kuvanim u ceđi (BL) i hidratisanom kreču (BSL), u poređenju sa netretiranim uzorkom semena sesbanije. Sadržaj ugljenih hidrata bio je značajno ($p<0.05$) manji nakon tretmana s hidratisanim krečom. Alkalni tretmani su značajno ($p<0.05$) smanjili sadržaj antinutrijenata, naročito tanina i inhibitora tripsina, u poređenju sa netretiranim uzorkom semena. Tretmani su bili efikasni i u smanjenju sadržaja saponina, oksalata, fitata i cijanogenih glukozida. *In vitro* svarljivost proteina je bila značajno veća nakon kuvanja i potapanja u alkalnim sredstvima u poređenju sa netretiranim uzorcima, pri čemu je najbolji efekat bio uočen u tretmanima kuvanja semena u ceđi. Seme sesbanije može da se koristi kao komponenta stočne hrane nakon tretmana u ceđi, koji predstavlja jeftiniju alternativu tretmanu sa hidratisanim krečom.

Ključne reči: *pepeo, kalcijum-hidroksid, kuvanje, potapanje, tanini, tripsin inhibitor*

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