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STUDIES ON ACACIA SEYAL GUMS FROM SUDAN: EFFECT OF TREE AGE AND EXUDATES FORM ON THE TANNIN LEVEL

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ARTICLE INFO	ABSTRACT
<p>Article History:</p> <p>Received 18th January, 2024</p> <p>Received in revised form 23th January, 2024</p> <p>Accepted 19th February, 2025</p> <p>Published online 28th February, 2025</p>	<p>Acacia Seyal is the most important supplier for gum Arabic a natural polysaccharides that drips out of the cracks of the bark and solidifies. The brown color of Acacia. seyal gum is due to presence of tannin. The factors that affect the tannin level in Acacia. seyal gums (different exudates) var. fistula and var. seyal) grown in Sudan (Sennar area) were determined and varieties in their properties evaluated. Tannin content was determined using tannin content method. The results showed that the effect of variants (two variants), age (old and young trees) and types of exudates (nodule, seeping and lumps) affect tannin contents. In evaluating the result, tannin content was maximum in seeping gum (0.11-0.29) and there was variation with varieties and age of the trees, The results for physicochemical properties moisture, ash, nitrogen, protein, viscosity, pH and specific rotation were determined and showed that physicochemical properties for seeping gum var. fistula and var. seyal old and young differ from nodule and irregular gum type. Cationic contents showed that the abundance of the alkali and alkaline earth metals in Acacia. Seyal gum exudates follow the trend $Ca > Na > K$, except seeping, irregular and nodule in var. fistula old and young respectively. The iron content was high in nodule gum in both varieties old and young age. In case of Acacia. seyal var. fistula young age, the seeping gum had higher iron content than irregular and nodule type.</p>
<p>Key words:</p> <p>Acacia syal, age, exudates, tannin</p>	
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INTRODUCTION

Gum Arabic (GA) or Acacia gum is dried gummy exudate (mainly shaped in tears, spherical, or subspherical forms) obtained pathologically, mainly by incision, from the stems and stem branches of acacia trees, especially *Acacia senegal* and *Acacia seyal*, family Fabaceae. *Acacia senegal* gum is called “hashab gum” and has a milky white appearance and is hard; while *Acacia seyal* gum is known as “Talha gum”, which has mainly amber yellow color and is friable [1]. Gum Arabic is an arabinogalactan-protein complex (known as arabin) which is composed mainly of calcium, magnesium, and potassium salts of Arabic acid [2].

Acacia seyal is an important source of gum Arabic. The availability, traditional, medicinal, pharmaceutical, nutritional, and cosmetic applications of gum acacia have pronounced its high economic value and attracted global attention [2].

Historically, *Acacia seyal* gums in the Sudan is ranked as a second important gum product after *Acacia senegal* in terms of quantities 10% in average until 2011. Thus, the contribution percentages within the last four years (2012–2015) jumped to almost 60% in average *Acacia seyal* trees coverage extend in an area of 36,000 square

kilometers (3.6 million ha) in a latitude ranging between 10° and 14° North. The distribution of the seyal stand is extensively on the clay soil plains where an average rainfall is ranging between 300 and 400 mm. Two infraspecific variants of *Acacia seyal* widely distributed in Sudan separated on the basis of the presence and absence of the ant-galls and the colour of the bark. Ant-gall and white colored bark are the characteristics of variety fistula, while the bark of variety of seyal is green or red. [3]

In a study reported by Karamalla 1999 [4], average moisture and ash content of *Acacia seyal* gum was reported to be 14.41% and 3.5%, respectively [4].

GA is acidic; its pH is 4.66, as described by Karamalla 1999. [5] The average optical rotation of hashab gum (*A. senegal* gum) is -30° , while the $[\alpha]_D$ values of talha gum (*A. seyal* gum) are ranged between $+45^\circ$ to $+54^\circ$ [6].

Gum talha (Sudanese type) is mainly formed of rhamnose (3–4%) and arabinose (41–45%) in addition to nitrogen contents (0.147–0.175%) and protein (0.97–1.15%). Gum talha has $[\alpha]_D$ values ranging between $+45^\circ$ and $+54^\circ$ [6].

Tannin exists in leaves, branches and barks of *Acacia seyal* trees. In the bark the tannin content is 18-20%. The difference between *A. Senegal* gum and *A. seyal* gum is in the colour, *Acacia senegal* is pale yellow while *Acacia seyal* is light brown–dark brown, is due to presence of tannin.

Tannins are water soluble phenolic compounds having molecular

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weight between 500 and 3000. The most characteristic feature of tannins the ability to precipitate protein, including the protein found in animal skin. It is established that tannin is antinutritional

Study of raw gums from different *Acacia* species of Sudan (table1) for their taxonomic classification showed that these *Acacia* species could be divided into two main groups. The species falling in large group showed presence of tannins in their gums. The tannin content ranged between 0.03 to 1.63%. The only gum that did not show presence of tannin was the gum from *Acacia Senegal* variety *Senegal* [7]

Table 1. The tannin contents of gums from different *Acacia* species of Sudan

Acaci species	A.sengal var.sengal	A.seyal Var. seyal	A.seyal Var. fistula	A.laeta subsp. nilotica	A.nilotica Subsp .tomentosa	A. drepanolobium	A.gerrardi	A. polycantha	A. tortillis sub sp.radiana
Tannin content	0.00	0.11	0.09	0.13	0.14	0.03	0.16	0.16	1.63

The information about tannin content in *A. seyal* gum is very spare. In this work, we will study the tannin content in *A. seyal* gums (different exudates) from two varieties (var. fistula and var. seyal) grown in Sennar areas in the Sudan and variation in their property's evaluation.

EXPERIMENTAL

Material

Samples were collected by the authors (ishraga G. Abdalla) by tapping trees in Sennar area (12°58'N 34°3'E) in Sudan located in The North of the Blue Nile state.

In order to differentiate between the samples we shall refer to *Acacia seyal* variants fistula as ASF and *Acacia seyal* variants seyal as ASS. Two varieties of *A. Seyal* var. seyal and *A. Seyal* var. fistula were collected from young (*A.SSY*, *A. SFY*) (aged 5-8years) and old(aged 15years and above) (*A. SSO*, *A.SFO*) trees, three types of exudates nodules, seep and lumps (irregular shaped) .

Preparation of the samples for analysis

Gum samples: crushed using pestle and mortar just to get small particle size, mixed well.

Analytical methods: - (i) physiochemical analysis (ii) tannin analysis.

Quantitative Method for tannin content [7]

Quantitative estimate of tannin was carried out using the modified method of vanillin HCL in methanol (1% of vanillin in methanol) (Price, etal 1978)

The reagent was prepared by mixing equal volume of 1% vanillin in methanol & 8% concentric HCL in methanol. It was discarded if a trace of colour appeared. D(+) catechin was used to prepare standard curve. This was done by adding 100mg of D(+) catechin to 50ml of 1% HCL in methanol. From this stock solution various dilution were

prepared. 5ml of vanillin –HCL reagent (0.5%) were added to 1ml of each dilution. Then incubated at 30C for 20minutes. The absorbance was read using spectrophotometer (SP6-200 Unicam) at 500nm. The absorbance was plotted against catechin concentration.

Procedure

Gum sample was ground to fine powder. 0.2g of it was put in a test tube. Then 10ml of 1% concentrated HCL in methanol were added. The test tube was capped and continuously shaken for 20minutes & then centrifuge at 3000rpm for 5minutes. 1ml of the supernatant was

pipetted from each of the tube & the proceeding as was described for the standard curve. For the zero setting 1ml distilled water(blank) was mixed with 5ml 4% Conc.HCL&5ml vanillin reagent in a test tube & incubated at 30C for 20minutes(blank). Absorbance at 500nm was read on the spectrophotometer (SP6-200 Unicam). Tannin concentration was expressed as catechin equivalent as follows.

C.E. % = CXVX100/ w where

C= concentration correspond to the optical density.

V= volume of the extract (ml)

W= weight of the sample (mg)

RESULTS AND DISCUSSIONS

Since the samples of *A. seyal* var. seyal (ASS) and *A. seyal* var. fistula (ASF) from old and young trees in this study were collected in Sudan (Sennar area) by the author (Ishraga.G-E, A.), we could be assured of their authenticity.

Their general properties were measured. No direct previous comparison of the variant seyal and variant fistula from old and young trees, three type of exudate (nodules, seep and irregular shape) is available and there are now given in table (1-4).

Our major object to compare between seyal and fistula and to search for the cases of the presence of tannin.

From the physiochemical properties in table (1-4) ash, pH, and viscosity they do not appear significant differences. There is difference, nitrogen and protein less, but moisture and specific rotation more in *acacia syal* var. fistula (ASF)

Table 2. physiochemical properties of *Acacia seyal* var. fistula old (ASFO)

Shapes	Moisture%	Average	Ash%	Average	Nitrogen	protein	viscosity	pH	Specific rotation
Nodule	11.36-07-40	9.380	2.52 2.47	2.495	0.07	0.462	13.30	4.26	+60.0
Irregular	11.96 07.87	9.905	2.55 2.99	2.77	0.07	0.462	13.30	4.36	+60.0
Seeping	11.04 07.42	9.230	3.76 4.16	3.96	0.07	0.462	12.00	4.40	+61.0

Table 2. Physicochemical properties of Acacia seyal var. fistula young (ASFY)

Shapes	Moisture%	Average	Ash%	Average	Nitrogen%	Protein%	Viscosity	pH	Specific rotation
Nodule	12.34 07.35	9.845	2.60 2.59	2.595	0.07	0.462	12.60	4.37	+48.51
Irregular	11.80 07.31	9.555	2.64 2.48	2.56	0.07	0.462	12.60	4.47	+48.72
Seeping	10.74 06.83	8.785	5.03 5.31	5.17	0.07	0.462	11.2	4.50	+51.21

Table 3. Physicochemical properties of Acacia seyal var. seyal old (ASSO)

Shapes	Moisture%	Average	Ash%	Average	Nitrogen%	Protein %	Viscosity	pH	Specific rotation
Nodule	14.29 08.38	11.335	2.83 2.80	2.815	0.14	0.924	16.20	4.49	+40.21
Irregular	13.79 08.59	11.19	2.85 3.08	2.965	0.14	0.924	16.20	4.45	+39.51
Seeping	11.69 07.85	9.77	3.75 4.40	4.075	0.14	0.924	15.20	4.56	+41.23

Table 4. Physicochemical properties of Acacia seyal var. seyal young (ASSY)

Shapes	Moisture%	Average	Ash%	Average	Nitrogen%	Protein%	Viscosity	pH	Specific rotation
Nodule	15.08 08.34	11.71	2.83 2.79	2.81	0.14	0.924	15.50	4.50	+43.02
Irregular	11.62 08.36	9.99	2.82 2.85	2.835	0.14	0.924	15.50	4.52	+43.21
Seeping	11.30 08.05	9.675	3.79 3.86	3.825	0.14	0.924	14.20	4.59	+43.59

The results for physicochemical properties moisture, ash, nitrogen, protein, viscosity, pH and specific rotation, in table (1,2,3 &4) showed that the seep gum type from two varieties fistula and seyal, young and old see to be more in values than irregular and nodules gum type.

All the results in agreement with the previous studies [4,8,5]

Table 5. Tannin content in Acacia seyal var. fistula old (ASFO) &Acacia seyal var. fistula young (ASFY)		
Shape	A..SFO	A..SFY
Nodule	0.024998	0.041663
Seep	0.11666	0.13332
irregular	0.04995	0.06665

Table 6. Tannin content in Acacia seyal var. seyal old (ASSO) &Acacia seyal var.seyal young (ASSY)		
Shape	A.SSO	A.SSY
Nodule	0.049995	0.05833
Seep	0.29997	0.14999
irregular	0.06665	0.04995

The result showed in table (5,6) and figures (1,2) that the tannin content was maximum in seep gum for the two varieties seyal and fistula old and young, while the nodule gum showed the less values. Table (6) showed that tannin seem to be more in A. seyal var. seyal old (ASSO) than the young one (ASSY) , while in table (5) the

opposite for A. seyal var. fistula. The result in agree with previous studied [10, 7].

Table 7. Cation contents for Acacia seyal var. fistula and var. seyal							
Sample	Ca mg/L	Na mg/L	K mg/L	Fe mg/L	Pb mg/L	Cd mg/L	Zn mg/L
ASSO (nodule).	59.90	33.20	9.70	1.346	0.013	0.004	0.084
ASSO (irregular).	105.90	19.80	3.39	0.127	nd	0.006	0.049
ASSO (seep)	21.20	15.20	3.83	0.032	nd	nd	0.004
ASSY (nodule).	40.70	17.10	6.80	0.715	0.033	nd	0.046
ASSY (irregular)	16.00	0.001	3.62	0.033	nd	nd	0.081
ASSY (seep)	29.40	18.30	3.45	0.307	0.038	0.010	0.055
ASFO (nodule)	36.10	16.80	3.00	0.431	0.033	nd	0.056
ASFO (irregular)	8.10	1.59	3.64	0.014	nd	nd	0.072
ASFO (seep)	19.60	1.10	3.63	0.043	nd	0.013	0.055

ASFY (nodule).	7.00	1.12	5.90	0.381	nd	0.001	0.075
ASFY (irregular)	38.60	21.10	3.59	0.421	0.012	0.012	0.047
ASFY (seep)	27.60	14.90	3.63	0.601	0.028	0.032	0.125

Cationic contents showed in table (7) that the abundance of the alkali and alkaline earth metals in *Acacia*. *Seyal* gum exudates follow the trend Ca > Na > K, except seeping, irregular and nodule in var. fistula old and young respectively. The iron content was high in nodule gum in both variants old and young age. In case of *Acacia. seyal* var. fistula young age, the seeping gum had higher iron content r than irregular and nodule type

CONCLUSION

Tannin content in both depends on the gum exudates contact with the bark.

These results give a clear difference between these two *Acacia* gum varieties, both of which are currently regulatory approved as gum arabic for food use.

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