



Gum Arabic Correlation with Serum Erythrocytes Sedimentation in Patients with elevated rate

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Submission: May 31, 2016; Published: August 29, 2016

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Abstract

Introduction: Gum arabic acacia is a complex polysaccharide, aggregates of sugars and hemicelluloses composed of Arabic acid nucleus, it is found in nature as slightly acidic calcium, magnesium, potassium or sodium salt and there is different metal ions present in gum arabic molecules. Chemically, it is an arabinogalactan-protein complex composed by weight of 17-34% arabinose, 32-50% galactose, 11-16% rhamnose, 13-19% glucuronic acid and 1.8-2.5% protein. Erythrocyte sedimentation rate (ESR) is a blood test measures how quickly erythrocytes, or red blood cells, separate from a blood sample that has been treated so the blood will not clot. A lab specialist will measure the rate that red blood cells settle toward the bottom of the tube after 1 hour. If one have inflammatory condition or cell damage, the red blood cells tend to clump together, became heavier, so they settle faster [1].

Material and Method: Instant soluble gum form (granulated one) was used in this trial case using 20 gm single solution in 250 mls drinking water or divided dose two times per day in the morning and evening for one month. Twenty four volunteers having elevated Erythrocyte se dimentation rate with different inflammatory symptoms, three blood samples were taken, one as base line and after every two weeks for analysis.

Results: It was shown that the ESR levels in the blood decreases clearly as (before 70.70 +/- 15.00, and after two weeks 37.00 +/-9.19 with P-value 0.000, and 28.50 +/- 6.69 after next two weeks with P-value 0.000).

Conclusion: Gum arabic acacia, plays novel effect in increasing the blood viscosity which helps floating of the blood constituents, hence it decrease the sedimentation rate of the erythrocyte in the blood.

Keywords: Gum Acacia; Erythrocyte in the blood; Inflammations.

Literature Review

Chemical description of Gum Arabic (GA)

Gum arabic is a complex mixture of arabinogalactan oligosaccharides, polysaccharides, and glyco-proteins. It is a branched neutral or slightly acidic substance. The chemical composition of the mixture can vary with the source, climate, season, age of trees, rainfall, time of exudation, and other factors. The backbone has been identified to consist of b-(1→3)-linked d-galactopyranosyl units. The side chains are composed of two to five b-(1→3)-linked d-galactopyranosyl units, joined to the main chain by 1,6-linkages. Both the main and the side chain contain units of :-

- a-l-arabinofuranosyl,
- a-l-rhamnopyranosyl,
- b-d-glucuronopyranosyl, and
- 4-O-methyl-b-d-glucuronopyranosyl.

The latter two usually occur preferably as end-units [1,2].

Nature has provided us a wide variety of materials to help improve and sustain the health of all living things either directly or indirectly. For centuries man has made effective use of materials of natural origin in the medical and pharmaceutical field. In recent years there have been important developments in different dosage forms for existing and newly designed drugs and natural products, and semi-synthetic as well as synthetic excipients often need to be used for a variety of purposes but today, the whole world is increasingly interested in natural drugs and excipients [3]. Gum Arabic or gum acacia is a natural gum is made from African acacia tree. It is one of the world's most-common gums and can boast the longest history and has approved by FDA as pharmaceutical products that use in a wide variety of applications mainly as tablet binder, film forming agent, emulsifier, and suspending agent. Also it has been processing and supplying into the food, beverage, and pharmaceutical markets for many years and are a significant supplier worldwide [4,5].

The erythrocyte sedimentation rate (ESR) measures how fast

red cells fall through a column of blood. It is an indirect index of acute-phase protein concentrations (particularly depends on the concentration of fibrinogen) and is a sensitive but nonspecific index of plasma protein changes which result from inflammation or tissue damage [6] showed that a low viscosity acacia at a dose of 15gms per day had no effect on the rate profile even high viscous one, so and hence 20gms per day up to 25 gives good rate lowering effect [7]. Thus prolong ingestion of GA may lead to significant reduction in the rate of ES in the blood interestingly more recent proposed mechanism by which viscous dietary fibers can increase the blood viscosity and hence reduces the rate of sedimentation [8].

The ESR is increased in inflammation, pregnancy, anemia, autoimmune disorders (such as rheumatoid arthritis and lupus), infections, some kidney diseases and some cancers (such as lymphoma and multiple myeloma). The ESR is decreased in polycythemia, hyperviscosity, sickle cell anemia, leukemia, low plasma protein (due to liver or kidney disease) and congestive heart failure. The basal ESR is slightly higher in females [9].

It can sometimes be useful in diagnosing some diseases, such as multiple myeloma, temporal arthritis, polymyalgia rheumatica, various auto-immune diseases, systemic lupus erythematosus, rheumatoid arthritis, inflammatory bowel disease and chronic kidney diseases. In many of these cases, the ESR may exceed 100 mm/hour, Westergren's original normal values (men 3 mm and women 7 mm) made no allowance for a person's age. In 1967 it was confirmed that ESR values tend to rise with age and to be generally higher in women. Values are increased in states of anemia, and in black populations [10]. Gum Arabic was found to be a useful prebiotic, which promotes beneficial physiological effects [11].

Others describe three fractions: arabinogalactan (88.4%) with 3.8×10^5 g/mol, arabinogalactan-protein com-plex (10.4%) with 1.45×10^6 g/mol, and a low molar mass glycoprotein (1.2%) with 2.5×10^5 g/mol. Because it is a mixture, which varies with source, the exact chemical composition and molecular structures are still debated. However, the name is also used for other gums produced by other Acacia species [12]. Despite there being more than 500 species of acacia trees, most commercial Gum Arabic is produced from Acacia Senegal and Acacia seyal, which are grown commercially throughout the Sahel from Senegal and Sudan to Somaliland.

Increased plasma and blood viscosity are usually associated with pathological conditions; however there are several situations in which the elevation of both parameters results in increased perfusion and the lowering of peripheral vascular resistance. Moderate elevations of blood viscosity by increasing hematocrit (approximately 10% of baseline) result in reductions of blood pressure by 10 mmHg of baseline [13].

In a different context these studies suggest that moderate elevation of blood viscosity is not necessarily a health hazard,

and in some circumstances may be beneficial, an effect shown experimentally for the elevation of plasma viscosity in hemorrhage resuscitation, and cardiovascular effects due to the small acute elevation of Hct [13].

Objectives

To determine Erythrocytes Sedimentation Rate in patients with elevated Rate. To investigate the correlation of gum arabic with serum erythrocytes in patients with high elevated sedimentation rate.

Aim

The aim of this study was to determine the effect of Gum Arabic Acacia ingestion on ESR profile among adults Sudanese patients with high Erythrocyte Sedimentation Rate which is an indicative inflammatory signs. To make use of the benefit that Gum decreases the ESR as a preclinical precautions to avoid Erythrocytes clumping which may leads to other health problems.

Material and Methods

Material

Gum Acacia from Kordofan region in west Sudan was collected. The instant granulated formula which was stable and free from contaminating microorganism was prepared in Alnasr Factory in Khartoum. It was packed in sachets of 20 gms to be used daily for one month.

Type of the study: Cohort study.

Place of the study: Was conducted at Omdurman Medical service Hospital –Sudan, during the period of September-October 2015.

Population of the study

Patients inclusion criteria: Patients complaining of joint pain and general body aches and feeling un well for more than 6 months while taking prescribed medicines. ESR was done and proved to be above 40.

Exclusion criteria: diabetic and hypertensive, pregnant females and any know chronic illness (active disease)

Sample size

24 subjects were recruited by direct response to a call for participation in the referred clinic.

Study design

It is a Randomized clinical trial study. daily fasting single dose for one month after blood analysis as a control base line of six months before as a reference.

Dosage form administration and sample collection

Administration of the dose for all subjects was 20gms dissolved in 250 mls drinking water to be taken daily for one month. Venous blood samples (3mls) were collected at zero time –pre-dose, two weeks and four weeks post-dose. Blood analysis

for erythrocyte sedimentation rate was done and documented at zero time and for each interval before the next dose .

Dosage of gum arabic:- The minimal lethal dose was determined as 20gms used as follows

- a) Gum arabic in instant soluble form was dissolved into 250 mls of drinking water.
- b) All the volunteers were started with the 10gm in 250 water taken for 2 weeks.
- c) The dose was given orally in early morning on daily basis. It was 20gms in 2 weeks interval.
- d) 3mls of venous blood was collected in tube before the first dose to determine the baselines erythrocytes sedimentation rate.
- e) Blood samples were collected at the end of last week for each dose interval.
- f) All the samples were analyzed for serum erythrocytes sedimentation rate in the central medical service laboratory

in the center of Khartoum city.

g) ESR was done in central medical laboratory, using Westergrene tube , German origin

h) The data was computed in SPSS version 20 and ANOVA was obtained

Ethical consideration

The study was ethically reviewed and approved by the ethical reviewing committee of the research directorate – Federal Ministry of Health, Khartoum. Written informed consent forms have been signed by participants up on agree before they accepted into the study, they were un hospitalized.

Result

24 informed adults (10 male +14 female) volunteers aged 37-65 years participating in this Study with 12+/-2% of ideal body weight for height, selected on acceptable medical six month history physical and clinical laboratory test results of 90 mm/h (Table 1).

Table 1: Microbial Contamination of Purified Gum Acacia.

No	Test	Specifications	Results
1	Total viable aerobic count	Bacteria not more than 10 ² CFU. Fungi not more than 10 ³ CFU.	Ic/g absent
2	Detection of Bacteria	Red gram negative colonies in violet red agar	No growth
3	E - coli	Red non-mucoid colonies of gram negative rods in Macconkey agar	No growth
	Salmonella typhoe	1. Well-developed of colorless colonies in deoxychocolate agar	No growth
		2. Developed of red colonies with or without black centers on XLD agar	No growth
		3. Small transparent colorless or pink or opaque white colonies often surrounded by a pink or red zone brilliant green agar.	No growth
		4. Deep growth and forming gas on triple sugar iron agar	No growth
	Pseudomonas aeruginosa	Growth of gram negative rods colonies on cetrimide agar	No growth
	Staphylococcus aureus	Black colonies of gram positive cocci surrounded by clear zone on baird parker agar.	No growth.
		Coagulase positive	Negative
		Colonies surrounded with clear zone with deoxyribonucleic acid agar	No growth

Statistical data analysis

Were done based on mean +/- standard deviation (SD) using ANOVA statistical one way to investigate the variance

significance. In all analysis of data generated from in vivo studies the probability p-value 0.05 was considered as appoint for significance (Individual 95% CIs For Mean Based Pooled St-Dev) (Table 2) (Figure 1).

Table 2: layout of variable setting in different parameter is displayed in the analysis result for ESR which included in Figure 1.

Reference value	Before starting (mean +/- SD)	After two weeks (mean+/-SD)	After next two weeks (mean+/-SD)	P-valu
20 - 30	70.70 +/- 15.00	37.00 +/- 9.19	28.50 +/- 6.69	0.000

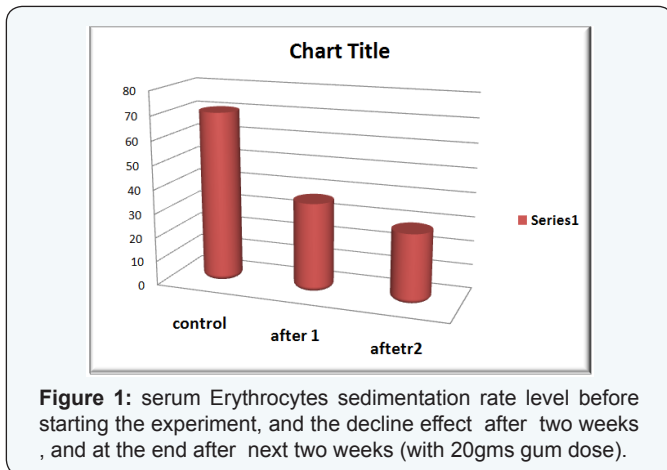


Figure 1: serum Erythrocytes sedimentation rate level before starting the experiment, and the decline effect after two weeks , and at the end after next two weeks (with 20gms gum dose).

Discussion

The ESR blood test is most useful for diagnosing or monitoring diseases that cause pain and swelling from inflammation. Other symptoms may include fever and weight loss. These diseases include:

- i. Temporal arthritis
- ii. Rheumatoid arthritis
- iii. Polymyalgia rheumatic

Many things that are not active diseases can increase your ESR. These include:

- A. Old age
- B. Having a menstrual period
- C. Having recently eaten a fatty meal
- D. Being obese
- E. Taking certain medicines

ESR above 100 mm/h is most likely caused by an active disease. For instance, you may have:

- I. A disease that causes inflammation in your body
- II. Active infection
- III. Cancer
- IV. Heart disease
- V. Kidney disease
- VI. Blood disease
- VII. Diabetes
- VIII. Collagen vascular disease.

As a support for these findings analysis of variance data, indicate that Gum arabic acacia played great role in lowering the ESR which indicates an inflammatory case and un well feelings.

In summary, the current study showed a statistically significant reduction in total ESR with study group, compared to the control one. Prospective studies with larger No of participants and longer duration was needed to evaluate the effect of Gum Acacia on ESR profile.

The main finding of current study is the lowering effect of the Gum Acacia on the Rate of Erythrocyte Sedimentation in patients with high elevated rate. Thus prolong ingestion of GA may lead to significant reduction in the rate of ES in the blood interestingly more recent proposed mechanism by which viscous dietary fibers can increase the blood viscosity and hence reduces the rate of sedimentation.

Conclusion

Gum arabic acacia, plays novel effect in increasing the blood viscosity which helps floating of the blood constituents, hence it decrease the sedimentation rate of the erythrocytes in the blood. The data resulted from this trial will help doctors in charge to get use of it as a pretreatment while searching for the main cause at least to avoid more side effects that can take place with elevated Erythrocyte Rate.

This data sheds light on a new era of erythrocyte sedimentation rate management that worth further studies according to the curative property of Gum A. Acacia is a hot research area, more efforts are needed to confirm its effectiveness and exact mechanisms of action in blood serum. Long duration clinical trials (more than 6 months) will be beneficial to assess the sustainability of decreasing Erythrocyte sedimentation rate and other clinical advantages.

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