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Potential of faba bean and tomato extracts as microbiological culture media

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Abstract:

This study was undertaken to investigate and assess the potentiality of some plant materials (tomato and faba bean) as sources of nutrient for cultivation of bacteria. The pH values of these plant extracts were determined and adjusted to 7.4. Tomato and faba bean (dry and soaked) were used as culture media for *Kiebsiella sp*. and *Staphylococcus aureus*.

Viable counts of *Klebsielia sp*. on different plant extracts were similar to that on the nutrient agar (control). Culture medium prepared from tomato extract supported growth of *Staphylococcus sp*. where the faba bean medium was unable to support the growth of this organism.

Introduction:

Generally microorganisms need various nutrients to maintain growth, multiplication and reproduction. The most important ingredients of solid media include water; in fact approximately 80% of the living cells of bacteria are water (1).

Plant media used as modified culture media for the microorganism growth:

Davis (2) compared the morphology of lactobacillus by growing on oxid tomato juice agar and other media. Atles (3) used tomato at meal past agar for cultivation of flexi bacteria species.

Another study by Mohammed (4) investigated degradation of microbes of ten fungal and 70 different bacterial isolates using Gum Arabic.

This study refine the ability of bacteria to grow on Gum Arabic but grow the lead to the drop of pH values due to production of organic acid while the media became alkaline in case of the fungal isolate with the production of ethanol.

Osman (5) using twenty plants extracts as culture media for bacteria and the fungi. The results indicated that the viable count of some bacteria of some plant extracts were larger or similar when they are compared with those produced on the control nutrient agar and blood agar. The results of the survival period of both staphylococcus sp and *Kiebsielia sp* extended for several weeks at 37°C and for long time at 4°C.

Plant materials used as microbial culture media in this study:

Tomato (*Lycopersicones culentuin mill*): is one of most important vegetable in Sudan the dry seeds contain (in 100 g of food product) 4.0 g crude fibers, 55g carbohydrate, 0.6 g fat, 24.0 g crude protein, 60mg calcium, 32 mg phosphorous, 3.0 g ash, and 7 mg Fe^{++} (6).

Faba bean (*Vicia faba*): one of the most main source of protein in diets for Sudanese and most of third world nation, it is rich in calcium, phosphorus, zinc and lysine (7) and it is deficient in sulphur containing amino acid. The dry seed was found to contain about 28% protein, 3% fat,

2% glucose, 48% carbohydrates, 3% minerals salts [6].

The objective of this study was development and evaluation of culture media derived from plant products (tomato and faba bean) because the culture media solid as dehydrated preparation, have become very expensive in the local market and in the most instances are not available.

Materials and Methods:

Collection of samples:

Tomatoes and faba beans purchased from local market of Khartoum State, so as to be used as culture media for bacterial growth.

Bacterial growth on the different extracts:

Klebsiella sp and *Staphylococcus aureus* strains were obtained from Faculty of Basic Medical Science, Omdurman Islamic University.

Procedure for plant materials extracts [8]:

Specific amount of each plant sample was weighted. The samples were mixed with distilled water in 500 ml conical flask. Then the mixtures were boiled in an autoclave at 121°C for 15 minutes. The plant extract were removed from the autoclave and allowed to cool, then filtered through sterile gauze. Then the volume was completed to one liter by adding distilled water. These extracts were stored at 4°C. 20 g of purified agar (agarose) were added to one liter of the above extract.

The pH of these extracts was adjusted to 7.4 by pH meter using alkaline solution (NaOH) and acidic solution (HCl). Then after autoclaving, the extracts were cooled to 45°C and distributed into disposable Petri dishes (about 17 ml for each).

Preparation of nutrient agar media [8]:

Twenty grams of agar were added to 1000 ml nutrient broth components, and then allowed to dissolve in a water bath. The pH was adjusted using pH meter to 7.4. Then autoclaving at 121°C for 15 minutes allowed to col and distributed into disposable Petri dishes in about 17 ml for each.

Preparation of inoculums: A loopful of over night pure culture of each strain was taken and dipped into a pure sterile nutrient broth 5 ml, incubated at 37°C for 24 hours, smeared and stained before use.

Viable count on different plant extracts:

Serial dilution, of *Klebsiella sp*. and *Staphylococcus aureus* were made, according to surface viable counts method the oven-dried nutrient agar and plant extracts agar Petri dishes ,were divided into two half, on each half one drop (0.02 ml) from the diluted culture was spread. Then the plates were incubated aerobically at 37°C for 24 hours. The duplicate plates were counted according to the average method [9].

Results:

Growth of *Staphylococcus aureus*:

The tomato extract media supported the *Staphylococcus aureus* growth but the media prepared from faba bean (A and B) failed in supporting the *Staphylococcus aureus* growth as in table 1.

Growth of *Klebsiella sp.*:

Referring to table 2 and figure 2 the growth of *Klebsiella* sp. on tomato and faba beans (A and B) was similar to that on the nutrient agar (control).

The colony size of *Klebsiella sp*. on the plant media were smaller than that on nutrient agar, but

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the colony size of *Staphylococcus aureus* on the plant media were very small than that on nutrient agar

Table (1): The Growth Rate *of Staphylococcus aureus* on different plant media (log_{10} of cfu/ml) and nutrient agar**:**

Media Source	Viable Count	Colony	
		Size (mm)	Morphology
Tomato	11.71180723	(0.4 - 0.6)	Circular smooth raised glistening golden yellow
Nutrient Agar (control)	11.72427587	(2 — 3)	Circular smooth flat opaque gray white
Faba bean(A)*	No growth	No growth	-
Faba bean(B)**	No growth	No growth	-

* dry
** soaked

Table (2): The Growth Rate of *Kiebsiella sp* on different plant media (log_{10} of cfu/ml) and nutrient agar:

Media Source	Viable Count	Colony	
		Size (mm)	Morphology
Tomato	11.05115252	(3-6)	Circular large raised entire glistening mucoid gra
Nutrient Agar (control)	11.00	(1—3)	Circular large flat very mucoid light pink
Faba bean(A)*	10.82930377	(1—4)	Circular large raised mucoid light pink
Faba bean(B)**	11.09691001	(3 —7)	Circular very large raised mucoid

* dry
** soaked

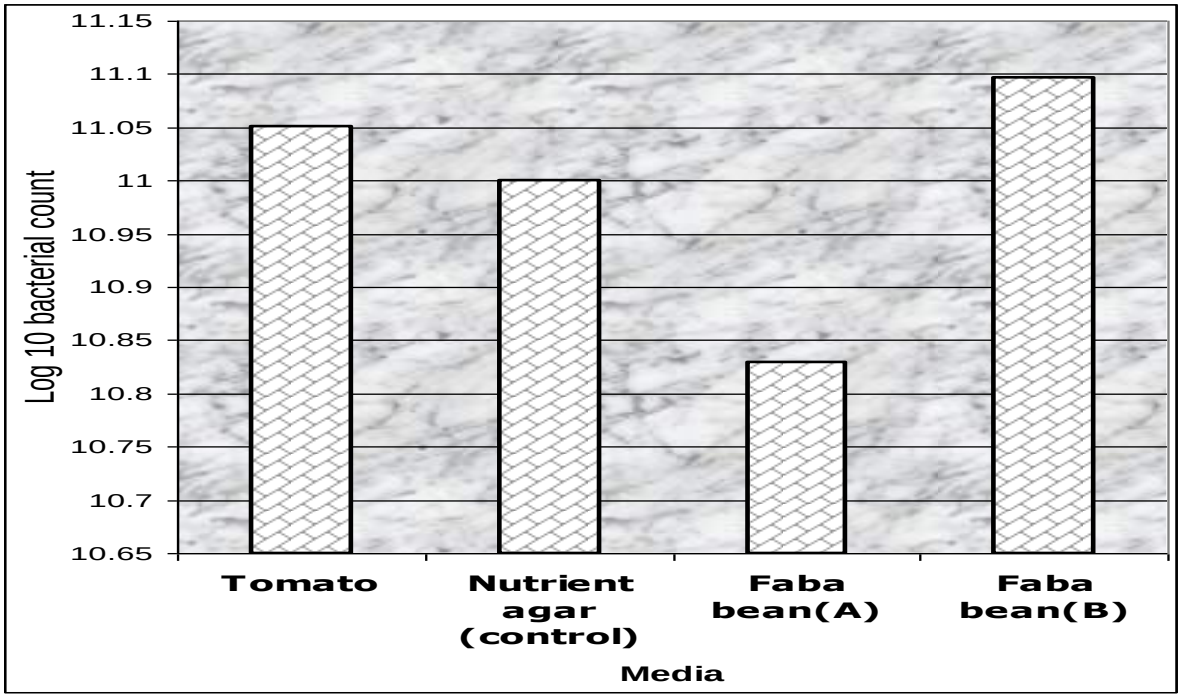

Fig. (1): The growth rate of *Klebsiella sp* on different plant extract and control

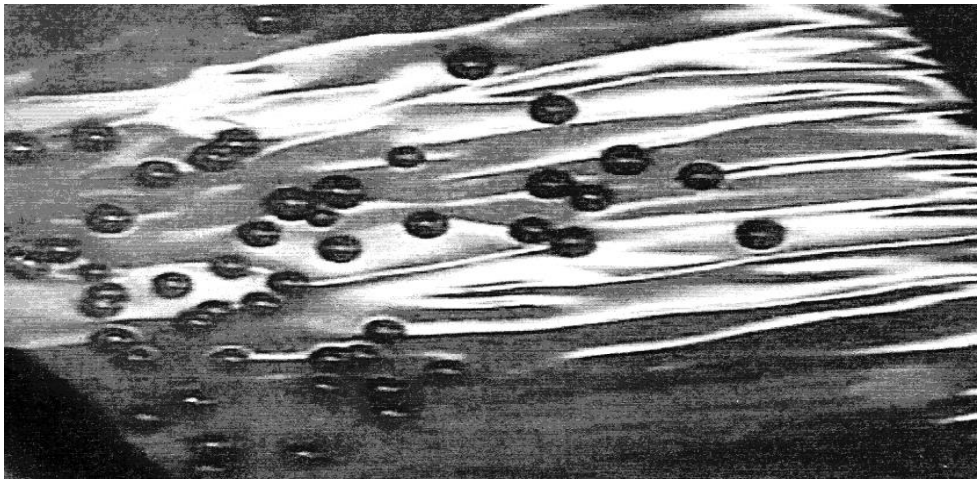

Fig.2: Colonies of *Klebsiella sp* on faba bean (A)

Discussion:

The search for bacterial culture media derived from plant materials as a source of nutrients has been investigated in this work.

The pH values of the culture media prepared from plant extracts, for bacterial growth were adjusted to the requirements of the bacteria under cultivation, for obtaining maximum growth.

Compared to nutrient agar (control), the tomato and faba bean extracts were able to support the growth of both Gram (-ve) bacteria *Kiebsiella sp.* and *Staphylococcus aureus* Gram (+ve) bacteria and the viable count, of these bacteria were similar to that on Nutrient Agar (control) this 'because these plant extracts, are rich in proteins, fats, carbohydrates and essential elements which help the bacteria to grow.

Staphylococcus aureus failed to grow on faba bean (dry and soaked) although faba beans have a high content of protein carbohydrates and fats hut this variation in nutrients concentration, may lead to inhibit the *Staphylococcus aureus* growth, and might be due to the absence of active transport across the cell wall. These findings were in agreement with the observations of Osman [(5)].

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