IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 8 Issue 12, December 2021
ISSN (Online) 2348 – 7968 | Impact Factor (2020) – 6.72
www.ijiset.com

Antibacterial Activities of The Ethanol Extracts From Six Sudanese Traditional Fruits Against *E.coli , Staphylococcus aureus and Salmonella*

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Abstract

Indigenous fruits of Sudan are a popular source of traditional medicine throughout Africa, despite more extensive use in traditional remedies still knowledge of the fruits antibacterial activity is limited, The antibacterial activity of ethanolic crude extract of edible portions of six indigenous fruits Tabldi (*Adansonia digitata*), Aradiab (*Tamarindus indica*), Nabag (*Ziziphus-spina christi*), Doum (*Hyphaene thebaica*), Lalob (*Balanites aegyptiaca*) and Godeim (*Grewia tenax*) were detected against *E.coli , Staphylococcus aureus and Salmonella* using agar-well diffusion technique. Yield of fruit extracts ranged from17.86 to 44.16 for Doum and Godeim respectively, Aradaib recorded the highest inhibition zone diameter against *E. coli* and *Salmonella* (11.10 and 7.88 mm respectively), while, Lalob showed the highest inhibition zone (9.97mm) against *Staphylococcus aureus* The lowest inhibition zone against *E.coli* and *Staphylococcus aureus* obtained by Nabag extract (3.83 and 3.50 mm respectively). Lalob, Aradaib and Tabldi were noticed to have the highest inhibition zone among the six fruit extracts examined**.**

Introduction

In Africa indigenous fruit trees supplement the diet of many rural families by providing essential micronutrients and health benefits as well as serve as an alternative for cash and income, especially in times of famine. (Bille *et al*, 2013). Among all the benefits that plants, herbs and spices can contribute to foods, many studies have confirmed their antimicrobial activity as well;

such studies have assigned the most potent status to those with a broad spectrum of activity against numerous bacteria and fungi. These antimicrobial compounds are helping the plants as defense mechanism to protect them from pathogens and other predators. It also regulates growth, pollination and fertilization (Cowan, 1999). Recently, it is clearly known that they have roles in the protection of human health, when their dietary intake is significant. Sudan has large area, with multi- culture, habits rich biodiversity and valuable indigenous plants. Some of the most important medicinal plants in Sudan from economic point of view and have contribution to Sudanese national income according to Bank of Sudan (2007-2017)*Adansonia digitate*(Tabaldi) (Issa *et al*., 2018), *Balanites aegyptiaca*(Heglig**)** (Chothani and Vaghasiya 2011)*Hyphaene thebaica*(Doum) (Abdalla and Abdallah 2016), *Grewia tenax*(Godeim**)** (Issa *et al*., 2018) *Tamarindus indica*(Aradaib) (Zohrameena *et al*.,2017) Theses fruits are known to provide dietary fiber and essential nutrients such as vitamins and energy. In addition, they thought to be a good source of phytochemical components which are known as secondary plant metabolites and have biological properties such as antioxidant activity, antimicrobial effect, modulation of detoxification enzymes, stimulation of the immune system. However, very little information is documented on the antibacterial activities of these fruits. This study was undertaken to support this information.

2- MATERIALS AND METHODS

2.1 Preparation of Forest Fruits (NWFPs)

Forest fruits Aradaib, Lalob, Tabldi, Godeim, Doum and Nabag (Figures 1, 2,3,4,5 and 6), were cleaned, ground and sieved then kept in a clean and sterilized glass container until required.

Figure1: Aradaib Figure2: Lalob Figure3: Tabldi

Figure4: Godeim Figure5: Doum Figure6: Nabag

2.2 Preparation of crude extract

The extraction was carried out according to the method described by Sukhdev *et al.,* (2008).

2.3Antimicrobial of the forest fruits extract against indicator organisms

The agar well-diffusion assay (AWDA) described by Schillinger and Lücke (1989) and Takahiro *et al*. (1991) was used to determine the antagonistic activity against the indicator organisms.

2.4 Statistical analysis

The data collected from the different treatments were subjected to analysis of variance and whenever appropriate the mean separation procedure of Duncan was employed (Steel and Torrie, 1980). The SAS program (SAS, 2002), was used to perform the general of liner model (GLM) analysis.

3. RESULTS AND DISCUSSION

3.1 Yield of fruits extract

Table 1, shows that, the yield percentage is significantly ($P \leq 0.05$) influenced by the fruits type. The highest yield percentage was recorded for Doum 44.16%, while, the lowest was recorded for Godeim 17.86%. Slightly higher Godeim extract yield 18.6% was found by Aamer (2015), however, lower yield (12.07%) of Godeim was obtained by Adam *et al.,* (2019). Nabag, Aradaib, Lalob and Tabldi yield extracts percentages were 32.48%, 29.76%, 27.96% and 20.11%, respectively. Higher Lalob yield (45.6%) was obtained by Abdallah *et al.,* (2012). Lower yield of Aradaib extract 22.84%, was reported by Alrasheid *et al.,* (2019).

3.2 Anti-microbial activity of fruits extracts

Ethanolic extract of Aradib, Lalob, Tabldi, Godium, Doum and Nabag exhibited antibacterial activity against *Escherichia coli, Staphylococcus aureus* and *Salmonella* (Table 2). All tested extracts showed various degrees of biological activity on the tested pathogens.

3.2.1Anti-microbial activity of crude extracts against *E.coli*

Table 2, showed the antibacterial activity of fruit extracts against *E.coli*. The findings of this study indicated that *E. coli* was more sensitive to the extracts than other bacteria examined. Aradaib exhibited the highest activity against *E. coli* with an inhibition zone of 11.10mm. Lalob showed inhibition zone of 9.83mm, while, Tabldi recorded was 8.43mm. Adeola *et al.,* (2010) found that, the inhibition zone of Aradaib extract against *E.coli* was 11.30mm. Alrasheid *et al.,* (2019) found that, Tabldi and Aradaib had inhibition zone of 11mm and 10mm, respectively. The present results of Aradaib were in agreement with those reported by Nwodo *et al.,* (2011) who assessed the antibacterial activity of *Tamarindus indica* fruit pulp extract against some bacterial isolates. Doughari *et al*., (2007), Maregesi *et al.,* (2008) and Parekh and Chanda (2008) found that, Lalob had an antibacterial activity on *E.coli*. The above results are supported by the fact that, the antibacterial activities of medicinal plants are attributed to the presence of flavonoids, tannins, steroids, organic acids and alkaloids as reported by Burapadaja and Bunchoo (1995).Regarding other fruits, Godeim, Doum and Nabag showed inhibition zones of 8.37, 5.43 and 3.83 mm, respectively. Sharma *et al.,* (2016) found that, *Grewia Tenax* (Godeim) exhibited a well-marked antibacterial activity against *E. coli* with inhibition zone of 7.82mm. Kapoor *et al.,* (2013) stated that, Godeim had good antimicrobial activity against *E.coli* bacteria. Regarding Nabag, Abalaka *et al.,* (2010) noted that, the plant extracts of Nabag was found to be inactive against *E.coli* even at very high concentration. Mohamed *et al.,* (2010) observed that, Doum extract showed stronger antifungal and anti-yeast activities more than antibacterial.

3.2.2Anti-microbial activity of crude extract against *Staphylococcus aureus*

Table 2, illustrated that, fruit extract type significantly ($P \leq 0.05$) affected *Staphylococcus aureus.* Lalob recorded the highest antimicrobial activity against *Staphylococcus aureus* with inhibition zone 9.97mm, followed by Aradaib 9.83mm, Tabldi 8.57mm and Godeim 5.37mm. Doum and Nabag recorded the lowest diameter of inhibition zone 4.50 and 3.50, respectively. Higher inhibition diameter (13mm) for Lalob against *Staphylococcus aureus* was obtained by Abdallah *et al.,*(2012). Lalob extract is a promising effective antibacterial agent against different bacterial pathogens (Abalaka *et al.*, 2010). Slightly higher (10.2mm) inhibition diameter of Aradaib was reported by Adeola *et al.,* (2010). The current results are supported by those stated by Baif (2002) who mentioned that, Aradaib pulp was more pronounced on *Staphylococcus aureus*. Alrasheid *et al.,* (2019) found that, Aradaib and Tabldi extract showed inhibition zone of 14.1

and 11.1mm, respectively. Sharma *et al.,* (2016) found that, the inhibition zone of Godeim extract against *S. aureus* was 5.72mm. Lower inhibition zone of (3.37mm) for Nabag was reported by Abalaka *et al.,* (2010). Abdallah *et al.,*(2012) stated that, some factors affect inhibition diameter such as: plant species, age, type of soil, agricultural system and methods of extract.

3.2.3Anti-microbial activity of crude extracts against *Salmonella*

Table 2, also revealed that fruit extracts type significantly (P≤0.05) affected *Salmonella* inhibition zone. The inhibition zone diameter of the different fruit extracts ranged between 4.71 and 7.88mm. Clearly, Aradaib (*Tamarindus indica*) exhibited the highest inhibition zone diameter against *Salmonella*, while, Godeim (*Grewia tenax*) showed the lowest inhibition zone. Kaigongi (2014) reported that, Godeim extract produced 4.89mm diameter against *Salmonella*. Lalob and Tabldi recorded a strong effect against *Salmonella* with inhibition zone of 6.83 and 6.77mm, respectively. Alsadig (2015) found that, Aradaib and Tabldi had 8.90 and 8.80mm inhibition zone diameter, respectively. Doughari *et al*., (2007) noted that, Lalob extract showed 16 mm inhibition zone. These results are supported by the finding of Alrasheid *et al.,* (2019) who mentioned that, natural plant extract contains different antimicrobial component such as alkaloids, lignins, tannins, organic acids, polyphenols and flavonoids. Doum and Nabag recorded inhibition zone of 5.63 and 4.93, respectively. Similar Doum inhibition zone of (5.60mm), was reported by Mohamed *et al*., (2010). It is worth mentioning that, Kaigongi (2014) stated that, phytochemical screening of natural plant extracts especially those which have been used in traditional medicine is therefore essential so as to identify phytochemical constituents in the plants that are responsible for a given bioactivity. No significant (P≤0.05) different was found in antimicrobial activity of Doum and Nabag extracts against different tested bacteria.

Table 1: Yield of fruit extracts

Plant Type	Yield %
Aradaib	29.76^{c} (±0.00)
Lalob	27.96^{d} (±0.02)
Tabldi	20.11^{C} (±0.00)
Godeim	17.86^{f} (±0.00)

Doum	44.16[a] (±0.00)
Nabag	32.48[b] (±0.00)
$Lsd_{0.05}$	0.00
SE±	0.00

*Values are means ± SD. Mean value (s) having different superscript letters in the same column are significantly (P≤ 0.05) different.

Table 2: Anti-microbial activity of crude fruit extracts against *E.coli, Staphylococcus aureus* and *Salmonella*

Inhibition Zone (mm)	*E.coli*	*Staphylococcus aureus*	*Salmonella*
Lalob	9.83[ab] (±0.29)	9.97[a] (±4.43)	6.83[b] (±4.71)
Aradaib	11.10[a] (±0.53)	9.83[b] (±1.15)	7.88[a] (±5.15)
Tabldi	8.43[c] (±1.69)	8.57[c] (±0.60)	6.77[c] (±0.95)
Godeim	8.37[cd] (±1.80)	5.37[d] (±0.71)	4.71[d] (±0.64)
Doum	5.43[e] (±1.40)	4.50[e] (±2.65)	5.63[e] (±0.49)
Nabag	3.83[f] (±1.04)	3.50[f] (±1.32)	4.93[f] (±1.62)

*Values are means ± SD. Means in columns rows bearing different superscript letters are significantly different (P≤ 0.05).

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Conclusion

Attention of scientists and food companies should be concentrated on this area of the world to keep the heritage of these plants in Sudan. The present screening result demonstrated that some of these fruits could be used as good preserving agent by inhibiting some food borne pathogens.

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