

The Importance of the Chemical Composition of Henna Tree Leaves (*Lawsonia inermis*) and its Ability to Eliminate *Tinea pedis*, with Reference to the Extent of Usage and Storage in the Saudi Society, Taif, KSA

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Abstract: This paper was done for study the importance of the chemical composition of Henna tree leaves (*Lawsonia inermis* leaves) (L.I-Ls) and its ability to eliminate *Tinea pedis* (T.P), with reference to the extent of usage and storage in the Saudi Society, Taif, KSA. L.I-Ls natural constituents were essential oils, 1,4-naphthoquinone, tannins, gallic acid, flavonoids, lipids, sugars, tri-acontyl tri-decanoate, mannitol, xanthones, coumarins, resins, tannic ingredients and lawsone. The prevalence of an in-vitro total fungicidal-test for L.I-Ls-Water extract (WE) in the Concentration (Conc.) of (5, 10 and 15%), against T.P were resulted at (13, 9 and 5hr.), the mean percentages of fungicidal-test effects were in (65.9, 75.2 and 81%) for (5, 10 and 15%) Conc., respectively. The prevalence of L.I-Ls extent usages in the Saudi Society survey were answered in males and females as (16 and 84%), the ages were (less and more than 30yr.) were resulted in (33 and 67%). The mean prevalence of L.I-Ls mixed types and uses results were 99% of mixed with water, the mixed of herbal ingredients were included (Tea, Coffee, Roselle and Coriander) were resulted in (91, 77, 64 and 26%). Whereas the mixed ingredients of nutrients were included (Egg, [Honey+Vinegar] and Mayonnaise) were resulted in (37, 37 and 27%). The L.I-Ls uses results were advantaged in the treatments of (Head scalp, Hair [loose, softness, and chicness], Headache and Fungicidal) were in (99, 99, 96, 96, 93 and 86%). The prevalence of L.I-Ls extent of storage in the Saudi Society, were included the characters (good odour, insecticide, rodenticide and microbicide) of were resulted in (70, 80, 100 and 90%) respectively. L.I-Ls had a very active chemical contents which superior in anti-microbial. The results were demonstrated that L.I-Ls had anti-fungal activity against T.P. The surveys were finished in a short time that were indicated the importance of L.I-Ls in the Saudi Society and also the uses in the life.

Keywords: *Lawsonia Inermis* leaves (L.I-ls), *Tinea Pedis* (T.P), Water Extract (WE), (L.I-Ls-WE), Concentration (Conc.).

I. Introduction

In Arabic, the word "Henna" refers to *L.I-Ls*, from family *Lythraceae* widely grown in various tropical regions as Asia, Africa and America^[1], was a flowering plant tree, 2-6m in height, and in genus *Lawsonia*^[2], found in Africa, southern Asia, and Northern-Australasia and well known worldwide for cosmetic used of *L.I-Ls* coloring material^[3]. It was a much branched glabrous shrub or small tree, were cultivated for *L.I-Ls* used in the traditional medicine^[4]. It was naturally grown or were cultivated from North-east-Africa to India, represents a natural material derived from dried powdered. *L.I-Ls* natural constituents were essential oils, 1,4-naphthoquinone, tannins, gallic acid, flavonoids, lipids, sugars, tri-acontyl tri-decanoate, mannitol, xanthones, coumarins (5-alkyloxy-7-hydroxy-coumarin), (2-3%) resins, (5-10%) tannic ingredients and up to 2% lawsone (2-hydroxy-1,4-naphthoquinone). A major portion of lawsone was glycosidic bound, and that cleave by enzymatic hydrolysis of the glycosidic hennosids and auto-oxidation of aglucons, was the principle natural dye contained as (1.0-1.4%)^[5]. Also, were 1,4-di-hydroxy-naphthalene, 1,4-naphtho-quinone, 1,2-di-hydroxy-glucoxyloxy-naphthalene and 2-hydroxy-1,4-di-glucoxyloxy-naphthalene, flavonoids (luteolins, apigenin, and their glycosides), coumarins (esculetin, fraxetin, scopletin) and steroids (β -sitosterol)^[6]. *L.I-Ls* contained a

soluble matter tannin, gallic acid, glucose, mannitol, fat, resin and mucilage^[7], were yield tannic acid and olive oil green resin, the un-saponified matter contained waxes and colouring matter^[8], contained carbohydrates, proteins flavonoids, tannins and phenolic compounds, alkaloids, terpenoids, quinones, coumarins, xanthenes and fatty acids. *L.I-Ls* were considered as a valuable source of unique natural products for development of medicines against various diseases^[4]. *L.I-Ls* were found to exhibit strong fungi-toxicity, naphtha-quinones were the active factor, exhibit strong fungi-toxicity and non-phyto-toxicity, the minimum effective was done against tested micro-organisms was in 1000ppm^[9]. Lawsone was isolated from *L.I-Ls* and had a significant anti-fungal effect^[10]. *L.I-Ls-WE* was involved in defensive mechanism against spores of *Drechslera oryzae*^[11]. It had used to treat skin infections, had attributed to naphtha-quinones, included lawsone^[12]. *L.I-Ls-WE* exhibited an absolute toxicity against *Microsporium gypseum* and *Trichophyton mentagrophytes*, which showed broad fungitoxic spectrum and was tested against *Ring worm* fungi^[13], it was used against superficial fungi *Malassezia*^[14]. It was used as a cooling anti-fungal herb for the skin and hair, its core chemical components was lawsone, mannite, tannic acid, mucilage and gallic acid, the main one was lawsone in (0.5-1.5%), its bio-active feature was thought to be due to its high protein binding capacity^[15]. Essential oils were obtained from *L.I-Ls* in Iran and analyzed, showed an anti-fungal activity^[16]. *L.I-Ls-WE* was bio-assayed in-vitro in different concentrations for its bio-activity to inhibit the growth of 6human pathogenic fungi, it was clearly superior. Phyto-chemical analyses showed the presence of anthra-quinones as major constituents of the *L.I-Ls* and were commonly known to possess anti-microbial activity^[17]. *L.I-Ls-WE* was tested for the anti-fungal potential against 8important fungal *Spp.*, *Aspergillus flavus* was recorded a high susceptibility^[18]. *L.I-Ls* had a strong fungicidal, its chemical constituents were naphthalene derivatives, quinoids, β -sitosterol glycoside, xanthenes, flavonoids, gallic acid, coumarins, and lawsonia-sides, which responsible for the fungicidal activity^[3]. *L.I-Ls* had reported as anti-fungal, considered as a valuable source of unique natural products for development of medicines against various diseases^[4]. *L.I-Ls-WE* was more effective and was demonstrated as anti-fungal activity in-vitro against the yeast, because of the chemical agents side effects, herbal can be a proper substitution, cheaper and more efficient. As the develop into a more scientific world, must use natural products and replace with scientific and synthetic medicines, as well *L.I-Ls-WE* was completely inhibit the growth of *Malassezia*^[19], property in-vitro as anti-fungal was effective against (*Trichophyton* and *Microsporium Spp.*)^[20]. *L.I-Ls* were commonly recognized in traditional system of medicine, consisted of various categories of phyto-constituents like flavonoids, coumarins, tri-terpenoids, steroids, xanthenes, had traditionally reported as anti-fungal^[21]. Ancient Egyptians prepared *L.I-Ls* oil and ointment for the limbs treatment. In Islamic culture it was used very evident in the book of "Prophetic Medicine", *L.I-Ls* were mentioned in medicinal practices of the Prophet Mohamed (PBUH)^[22], the concept was based on the Sunnah of Prophet Mohamed (PBUH) of using *L.I-Ls* as a medication for the wounds^[23]. The dye derived from *L.I-Ls* was used to dye hair, wool and Mehndi design art, was widely used for different traditions such as a ceremonial art for weddings, body decoration and mummification. *L.I-Ls* had a natural healing property used for the past several years, application was beneficial for medical interventions to aid in a therapeutic way in headaches, ulcer, sores, burns, and skin diseases. Application of *L.I-Ls* paste on the skin provided a cooling effect action that helped to protect skin from bacteria and fungi, was healing capabilities, and head-scalp. It was an all-natural dye colour that was very gentle and safe to use for the hair, it aided in hair growth and as a great source of hair conditioner that strengthens the hair roots and was given radiance and shine. It was used for body art, tattoos since the ancient times for different vast cultures and ceremonies^[24]. *L.I-Ls* were used as a cosmetic, treat wounds and mycotic infections^[25]. *L.I-Ls* possessed high anti-bacterial activities against *Pseudomonas aeruginosa*, *L.I-Ls-WE* was among the (*British Bio-technology*) as the most active extracts^[26].

The aim: This research was inspired by the Sunnah of Prophet Mohamed (PBUH) particularly for the *L.I-Ls* as a plant in its advantages in the substitution of medical substances. That work was done for the *L.I-Ls* importance in the Saudi Society. The 1st purpose was for the importance of the chemical composition of *L.I-Ls* to clarify the chemical contents, the 2nd purpose was to evaluate the anti-fungal properties of *L.I-Ls-WE* by an in-vitro fungicidal-test against *T.P*, the 3rd purpose was for the extent of *L.I-Ls* usage in the Saudi Society and the 4th purpose was for the extent of *L.I-Ls* storage in the Saudi Society.

II. Materials and Methods

- **The 1st Purpose:** It was for chemical composition of *L.I-Ls* to clarify the main chemical materials, characters and functions.
- **The 2nd Purpose:** It was for *L.I-Ls* ability to eliminate *T.P*, it was employed in an in-vitro fungicidal-test by the use of serial *L.I-Ls-WE Conc.*, against *T.P*, which were done in the following steps:
 - L.I-Ls-WE* preparation:** *L.I-Ls* were collected freshly from a private garden at Taif region, KSA as a normal habitat, were identified by the (*Plant Taxonomist*). The harvested *L.I-Ls* were washed by Sterile Distilled Water (*SDW*) to remove sand, dust and dirt, then were left to dry at room temperature on (shaded area and well ventilated room) for (24-48hr.). The dried *L.I-Ls* were grounded to powder with a sterile mixture grinder electric knife, then were thieved for separation the fine from course powder, the fine

powder were kept in a dry containers. *L.I-Ls* powder had obtained were done a *WE* in a serial *Conc.* of (5, 10 and 15%), by dissolving the weighted *L.I-Ls* powder in *SDW* for 1hr., and then were filtered by sterile medical gauze, *L.I-Ls-WE Conc.*s., were labeled and kept in the refrigerator at -4°C for the test use^[27-28].

-In-vitro Fungicidal-test: *T.P* strain was identified and collected from the (*Off. Micro. Lab.*), which caused the chronic infection of patient foots. It was sub-cultured on Sabouraud Dextrose Agar (*SDA*) and after the obviously growth, the culture was maintained at -4°C, as well it had prepared as suspension according to *MacFerland* in the degree of (0.5=1.5X10⁸/ml) was in Sabroud Dextrose Broth (*SDB*). The test was started by added (*V/V*) of (*L.I-Ls-WE Conc./T.P* suspension) separately for each *L.I-Ls-WE Conc.*, then left for (1, 3, 5, 7, 9, 11and 13hr.) at 37°C. Sub-culture were done by added 0.5ml from an each mixture on a double *SDA* plate, then were incubated at (35-37°C) for 2wk. The growth were checked at (1, 3, 5, 7 and 14day). The total and the mean colony-counts were done and recorded^[29]. The preparation of Control positive (*C+*) and Control negative (*C-*), had also prepared by (*V/V*), of (Antifungal drug for *C+* or *SDW* for *C-/T.P* suspension in the degree of *MacFerland* [0.5]) were done in sterile Capped Wezerman Tube (*CWT*) and incubated at (35-37°C) for 24hr, then added 0.5ml from *CWT* on a double plate of *SDA* for each, incubation were at (35-37°C) for 2wk. Examination for growth were at (1, 3, 5, 7 and 14day). The total and the mean colony-counts were done and were considered as a control for the test calculation. The calculations of fungicidal percentage were done by this law [(Mean Colony-counts No. produced/Mean Colony-counts No. of *C-*)]X100 -100].

- **The 3rd Purpose:** It was for the extent of *L.I-Ls* usage in the Saudi Society, it was prepared by the surveys were contained 2questioner for *L.I-Ls* uses in items (mixed ingredients and the uses results). The questioners were up-loading on the net, the volunteers No. were (570±50) daily and the questioners were stayed for 3day on the net, the results were collected and recorded from the net as data and curves.
- **The 4th Purpose:** It was for the extent of *L.I-Ls* storage in the Saudi Society, it was prepared a survey was contained 1questioner for *L.I-Ls* character was in items (good odour, insecticide, rodenticide and microbicide). The questioner was up-loading on the net, and were stayed for 3days, the results were collected from the net to analysis.
- **Data Analysis:** The data were recorded and were entered into (*Microsoft Excel Sheet*), then were summarized and analyzed in the presented showed results in this work^[30].

III. Results and discussion

Table and graph1: Prevalence of an in-vitro fungicidal-test of **L.I-Ls-WE* against **T.P*

| Items | * <i>T.P</i> Colony Count | | * <i>L.I-Ls-WE</i> * <i>Conc.</i> | | |
|-------------|---------------------------|-------------|-----------------------------------|------|-------|
| | * <i>C+</i> | * <i>C-</i> | 5% | 10% | 15% |
| After | Mean fungicidal effect | | | | |
| 1*hr. | 00 | 76 | 31% | 46% | 62% |
| 3*hr. | | | 42% | 61% | 81% |
| 5*hr. | | | 54% | 77% | 100% |
| 7*hr. | | | 65% | 92% | |
| 9*hr. | | | 78% | 100% | |
| 11*hr. | | | 91% | | |
| 13*hr. | | | 100% | | |
| Means | | | | | 65.9% |
| Differences | | | 9.3% | | 5.8% |

**L.I-Ls-WE*s: *Lawsonia inermis*-Leaves-Water Extract, **T.P*: *Tinea pedis*, **Conc.*: Concentration, **C+*: Control Positive, **C-*: Control Negative, *hr.: Hour

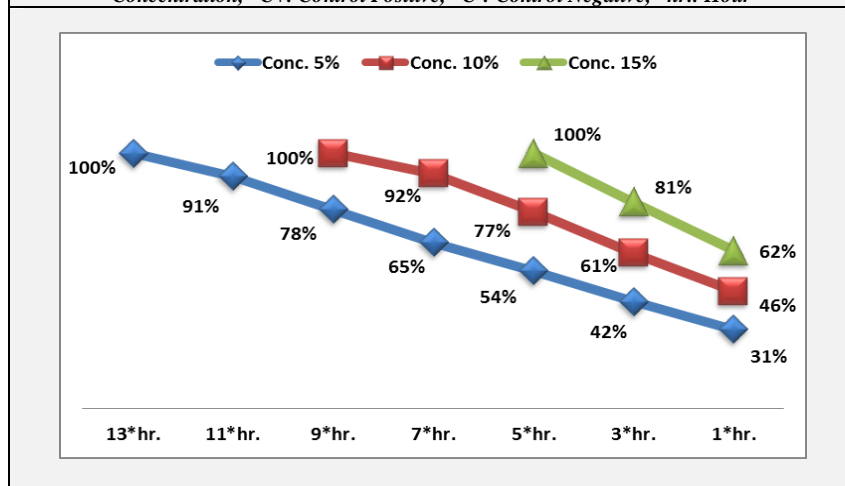


Table and graph1 showed the prevalence of an in-vitro fungicidal-test of *L.I-Ls-WE* against *T.P*, it resulted as a fungicidal-test to all *T.P* by used of *L.I-Ls-WE* in *Conc.*, (5, 10 and 15%), were at (13, 9 and 5hr.) respectively. The fungicidal-test degrees for 5% *Conc.*, were by the *hr.*, exposures at (1, 3, 5, 7, 9, 11 and 13hr.) as (31, 42, 54, 65, 78, 91 and 100%), for 10% *Conc.* were at (1, 3, 5, 7 and 9hr.) as (46, 61, 77, 92 and 100%), and for 15% *Conc.* were at (1, 3 and 5hr.) as (62, 81 and 100%) respectively. There were a different as 5hr., between each *Conc.*, in the total numbers of *hr.* The means percentages of fungicidal-test effects were (65.9, 75.2 and 81%) for *L.I-Ls-WE Conc.*, in (5, 10 and 15%), the differences between the means were (9.3 and 5.8%) respectively. *L.I-Ls* were found to exhibit strong fungi-toxicity, naphtha-quinones were the active factor, exhibit strong fungi toxicity and non-phyto-toxicity^[9], lawsone was isolated from *L.I-Ls* had a significant anti-fungal effect^[10]. *L.I-Ls* had used to treat skin infections, which had attributed to naphtha-quinones, including lawsone^[12]. *L.I-Ls-WE* which showed broad fungi-toxic spectrum^[13], used against superficial fungi^[14], cooling and anti-fungal herb for the skin and hair, its core chemical components was lawsone, mannite, tannic acid, mucilage and gallic acid, its bio-active feature was thought to be due to its high protein binding capacity^[15]. Essential oils showed an anti-fungal activity^[16]. *L.I-Ls-WE* in different concentrations was bio-assayed in-vitro for its bio-activity, it was clearly anti-microbial superior, were possess anti-microbial activity^[17], were recorded high anti-fungal susceptibility^[18]. *L.I-Ls* had a strong fungicidal, in constituents (naphthalene derivatives, quinoids, β -sitosterol glycoside, xanthenes, flavonoids, gallic acid, coumarins, and lawsonia-sides)^[3], had reported as anti-fungal, considered as a valuable source of unique natural products for development of medicines against various diseases^[4]. *L.I-Ls-WE* was more effective and demonstrated as anti-fungal activity in-vitro, because of the chemical agents side effects and some fungi resistance to them, herbal can be a proper substitution, cheaper and more efficient. As the develop into a more scientific world, must use natural products and replace with scientific and synthetic medicines, it was completely inhibit the growth of fungi^[19]. *L.I-Ls-WE* was property in-vitro anti-fungal was effective against (*Trichophyton* and *Microsporum Spp.*)^[20]. *L.I-Ls* were commonly recognized in traditional system of medicine, it consisted of various categories of phyto-constituents like (flavonoids, coumarins, tri-terpenoids, steroids, and xanthenes), it had traditionally reported as anti-fungal^[21]. Application of *L.I-Ls* paste to the skin provided a cooling effect action that helped to protect skin from fungi^[24]. *L.I-Ls* were used as mycotic infections^[25] and *L.I-Ls-WE* was among the (*British Bio-technology*) the most active extracts^[26].

Table and graph2 : Prevalence of volunteers answered **L.I-Ls* extent usage in the Saudi Society survey

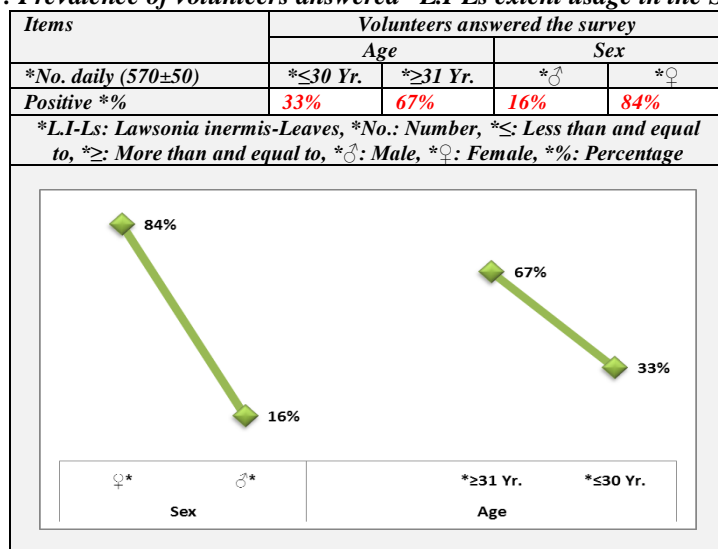


Table and graph2 showed the prevalence of volunteers answered *L.I-Ls* extent usage in the Saudi Society survey, the results of the questionnaire was in males and females as (16 and 84%) respectively of the targets, that, because of the most using *L.I-Ls* were females and a few of males for their treatment. The most of the targeted age (less and more than 30yr.) were (33 and 67%) respectively, this was due to the most women interested adultery to use the *L.I-Ls* in their life. The volunteers were created the answers very fast, that for the present of *L.I-Ls* in their life for use, even in their gardens as a trees. The peoples were from different country in KSA enhanced the uses of *L.I-Ls*, as well some of them were brought the whole *L.I-Ls* from their country for their uses, as if *L.I-Ls* were the useful herbal medication and decoration activities. As well *L.I-Ls* were un-expensive and can be transferred without any dismissed in its contents and characters, so it was important in their life uses^[24].

Table and graph3 : Prevalence of *L.I-Ls extent of usage in the Saudi Society survey

| Items | Mixed ingredients | | | Uses results |
|------------|-------------------|----------------------|--------------------------|---------------------------|
| | Water | Herbals | Nutrients | Advantage in treatment |
| Positive % | Water=99% | Tea=91% | Egg=37% | Head scalp=99% |
| | | Coffee=77% | Honey+Vinegar=37% | Hair loose=99% |
| | | Roselle=64% | Mayonnaise=27% | Hair softness=96% |
| | | Coriander=26% | | Hair chickness=96% |
| | | | | Headache=93% |
| | | | Fungicidal=86% | |

*L.I-Ls: Lawsonia inermis- Leaves, %: Percentage

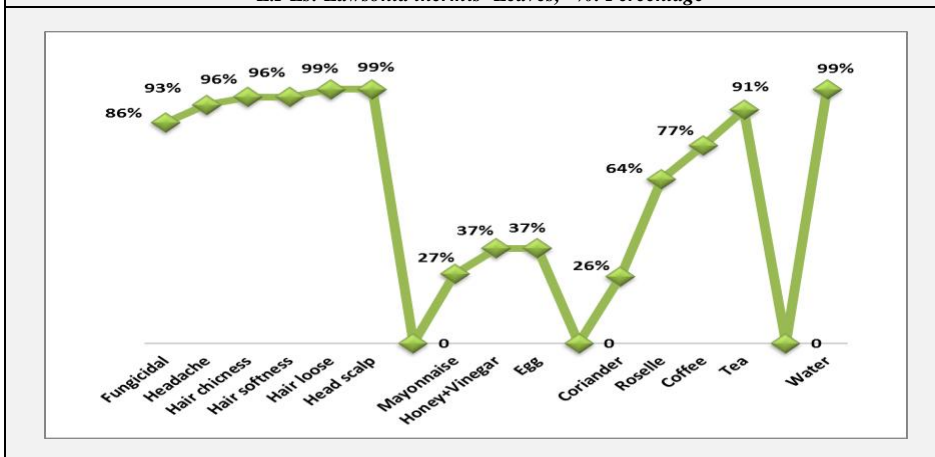


Table and graph3 showed the prevalence of *L.I-Ls* extent of usage in the Saudi Society survey, the mean prevalence of *L.I-Ls* mixed types and uses results of the volunteers were answered the survey on the net found that 99% of the target *L.I-Ls* mixed with water for use. The mixed ingredients herbal types were mixed with *L.I-Ls* were included (Tea, Coffee, Roselle and Coriander) were resulted in (91, 77, 64 and 26%) respectively, this was attributed to give good results of *L.I-Ls*. Whereas the mixed ingredients of nutrients as (Egg, [Honey+Vinegar] and Mayonnaise) were resulted in (37, 37 and 27%) respectively. The uses results were advantaged in treatments of (Head scalp, Hair [loose, softness, and chickness], Headache and Fungicidal) were in (99, 99, 96, 96, 93 and 86%) respectively. That surveys were finished in a short time through the net, that indicated the importance of *L.I-Ls* in the Saudi Society and also the uses in life. Ancient Egyptians prepared both *L.I-Ls* oil and ointment for the limbs treatment. In Islamic culture it was used very evident in the book of "Prophetic Medicine", *L.I-Ls* was mentioned in medicinal practices of the Prophet Mohamed (PBUH)^[22]. The concept was based on the Sunnah of Prophet Mohamed (PBUH) of using *L.I-Ls* as a medication for the wounds^[23]. The dye derived from *L.I-Ls* was used to dye hair, wool and Mehndi design art. It was widely used for different traditions such as a ceremonial art for weddings, body decoration and mummification. It had a natural healing property used for the past several years. Its application was beneficial for medical interventions to aid in a therapeutic way in headaches, ulcer, sores, burns, and skin diseases. Application of *L.I-Ls* paste to the skin provided a cooling effect action that helped to protect skin from bacteria and fungi. It was healing capabilities, and head-scalp. It was an all-natural dye colour that was very gentle and safe to use for the hair. It aided in hair growth and as a great source of hair conditioner that strengthens the hair roots and was given radiance and shine. It was used for body art, tattoos since the ancient times for different vast cultures and ceremonies^[24]. *L.I-Ls* were used as a cosmetic, treat wounds and mycotic infections^[25]. It possessed high anti-bacterial activities, *L.I-Ls-WE* was among the (*British Bio-technology*) the most active extracts^[26].

Table and graph4: Prevalence of *L.I-Ls extent of storage in the Saudi Society survey

| Items | *L.I characters | | | |
|------------|-----------------|-------------|-------------|-------------|
| | Good odour | Insecticide | Rodenticide | Microbicide |
| Positive % | 70% | 80% | 100% | 90% |

*L.I-Ls: Lawsonia inermis-Leaves, %: Percentage

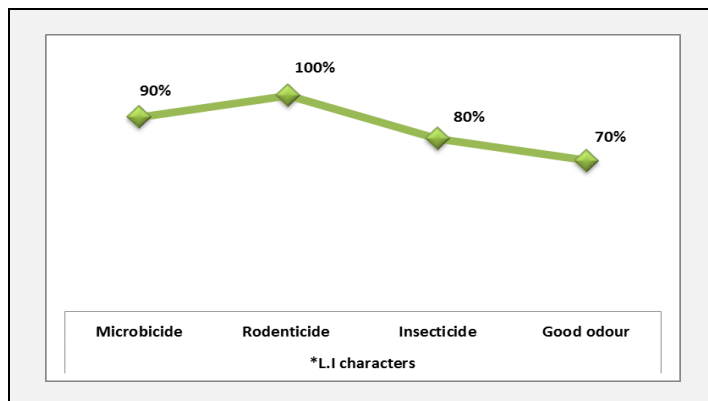


Table and graph4 showed the prevalence of *L.I-Ls* extent of storage in the Saudi Society survey, it was included in *L.I-Ls* characters as (good odour, insecticide, rodenticide and microbicide) as were in (70, 80, 100 and 90%) respectively. That were indicated the storage of *L.I-Ls* in KSA and the important were targeted to the *L.I-Ls* characters because the use of it in every house in a different manners. In Arabic, the word "Henna" refers to *L.I-Ls*, is from family *Lythraceae* widely grown in various tropical regions as Asia, Africa and America^[1]. It's a flowering plant, 2-6m in height, and in genus *Lawsonia*^[2], it found in Africa, southern Asia, and Northern-Australasia and well known worldwide for cosmetic used of leaves coloring material^[3]. It a much branched glabrous shrub or small tree, cultivated for its leaves used in the traditional medicine^[4]. Its naturally grown or were cultivated from North-east-Africa to India, represents a natural material derived from dried powdered leaves. It was considered as a valuable source of unique natural products for development of medicines against various diseases^[4]. In Islamic culture it was used very evident in the book of "Prophetic Medicine", *L.I-Ls* were mentioned in medicinal practices of the Prophet Mohamed (PBUH)^[22], the concept was based on the Sunnah of Prophet Mohamed (PBUH) of using *L.I-Ls*^[23].

IV. Conclusions

L.I-Ls had a very active chemical contents which had a clearly action as anti-microbial, *L.I-Ls-WE* had anti-fungal activity on the fungi responsible for the common foot skin infections in human. The results were demonstrated from the in-vitro fungicidal-test, that *L.I-Ls* had anti-fungal activity against *T.P* was effective according to the serial *Concs*. The all surveys were finished in a short time through the net, that was indicated the importance of *L.I-Ls* in the Saudi Society and also the uses of it in the life. *L.I-Ls* had also a more usages for human and a good characters in storage, that were cleared from surveys were used. In Islamic culture it was used very evident in the book of "Prophetic Medicine", *L.I-Ls* were mentioned in medicinal practices of the Prophet Mohamed (PBUH), the concept was based on the Sunnah of Prophet Mohamed (PBUH) of using *L.I-Ls* as a medication for the wounds.

V. Acknowledgments

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VI. References

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