Journal of Evidence-Based Integrative Medicine
Volume 23: 1-9

DOI: 10.1177/2515690X18772807
journals.sagepub.com/home/cam
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Henna (*Lawsonia inermis*) as an Inexpensive Method to Prevent Decubitus Ulcers in Critical Care Units: A Randomized Clinical Trial

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Abstract

Background. Henna has been used to combat various diseases and pathological conditions of the skin. This study aimed to determine the cooling and protecting effects of henna on prevention of decubitus ulcers in critical care units. *Method.* This is a randomized clinical trial. It was conducted on 80 patients hospitalized in intensive care units. Patients were randomly allocated into 2 groups of control and intervention (n = 40) by blocking method. For the intervention group, along with the standard prevention cares for decubitus ulcers, henna was applied with 15 cm extent on the patients' sacrum. *Results.* At the end of the study, 1 patient in the intervention group (2.7% male) and 6 patients in the control group (14.29% male, 2.85% female) had developed decubitus ulcers; this difference was significant ($P = .001$). *Conclusion.* For every patient at risk of developing decubitus ulcers, application of henna as a preventive measure is recommended.

Keywords

Braden's scale, intensive care unit, *Lawsonia inermis*, decubitus ulcers

Received January 23, 2018. Accepted for publication March 4, 2018.

Lawsonia inermis Linn. (Henna), belonging to the Lythraceae family, is a widespread medicinal plant and natural dye in the world.[1-4] *Lawsonia inermis* is also known as *Henna*, *Mhendi*, *Shudi*, *Madurang*, *Mendi*, *Manghati*, *Madayantika*, and *Goranti*. A native of North Africa and Southwest Asia, the plant is now widely cultivated throughout the world as an ornamental and dye plant.[5]

The henna plant is a glabrous, much branched shrub or quite a small tree with grayish-brown bark. Leaves are opposite, subsessile, elliptic, or broadly lanceolate, entire, acute or obtuse, 2 to 3 cm long and 1 to 2 cm wide. Lawsone is the chief constituent responsible for the dying properties of the plant. Dried powdered leaves of henna contain about 0.5% to 1.5% lawsone, traditionally used to produce colorfast orange, red, and brown dyes.[6,7] *Lawsonia inermis* is reported to contain carbohydrates, proteins, flavonoids, tannins and phenolic compounds, alkaloids, terpenoids, quinones, coumarins, xanthones, and fatty acids. The plant has been reported to have analgesic, hypoglycemic, hepatoprotective, immunostimulant, anti-inflammatory, antibacterial, antimicrobial, antifungal, antiviral, antiparasitic, antitrypanosomal, antidermatophytic, antioxidant, antifertility, tuberculostatic, and anticancer properties.[5,8]

In several Iranian traditional medicine texts, including *al-Qanun fi al-Tibb* (Avicenna), *Al Havi* (Rhazes), *Al-abniah An Haghayegh el-adviah* (Heravi), *al-jāmi li-mufradāt al-adwiyawa al-aghdhiy* (Ibn al-Baitar), *Ekhtiarat-e-Badiee* (Ansari), *Tohfat-ul-momenin* (Momen Tonekaboni), and *Makhzan-ul-Adviah* (Aghili Shirazi), henna has been used to combat various diseases and pathological conditions of the skin.[1,2,9]

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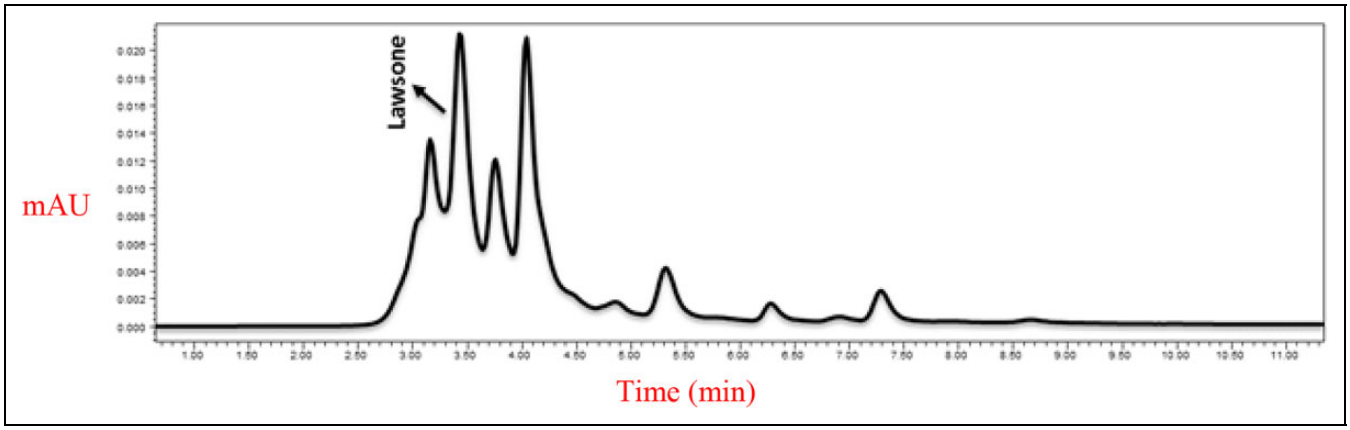

Figure 1. High-performance liquid chromatography–ultraviolet analysis of the *Lawsonia inermis* extract at 280 nm.

Background

Decubitus ulcer is a local damage to skin or its underlying tissues that usually occur around bony prominences due to decubitus or a combination of decubitus and friction of sliding forces.[10-13]

The occurrence and prevalence of decubitus ulcers are mostly the indicators of nursing care quality.[14] Various studies have reported the prevalence of decubitus ulcers in intensive care units to be between 10% and 41%.[11,15] In Iran, in several studies the prevalence of decubitus ulcers in intensive care units (ICUs) was reported to be more than 26.7%.[16-18]

According to statistics of 2012, about 1.6 million patients annually would develop decubitus ulcers in care units and it would cost US$11 to US$17.2 billion.[11,19,20] The complications of decubitus ulcers would increase the rate of mortality among patients by 55%.[21] Also, each decubitus ulcer would add 50% more workload to nurses' work.[21,22]

Preventing decubitus ulcers is the priority of nursing care.[23] Efteli and Gunes,[19] in their prospective study, reported that almost 90% of decubitus ulcers could be prevented by accurate predictions and appropriate nursing interventions.

The World Health Organization has reported that 80% of the population of all countries cannot afford pharmaceutical drugs and they would refer to traditional medicine, which is based on herbs, to support their primary health needs.[8,24] Considering the history of henna consumption[25,26] and the main uses of henna as a cooling agent, as an antifungal and antibacterial herb for the skin and hair,[5,27-31] and also since there are no scientific studies regarding its effect on preventing decubitus ulcers, we decided to evaluate this plant's effect on prevention of decubitus ulcers in critical care settings.

Materials and Methods

The Study

This randomized clinical trial under registration number IRCT2015070323035N1 was conducted in 2015 in intensive care units of Al-Zahra Hospital of Isfahan, Iran. Initially considering $d = 1.1$, $S1 = 1.74$, $S2 = 1.35$, $\beta = 0.2$, and $\alpha = 0.05$,[10] the sample size was determined to be 74 patients. Considering 5% to 10% of attrition, 80 patients were purposefully selected. The inclusion criteria were being 18 to 75 years old, willingness to participate in the study, not having any decubitus ulcers at the time of admittance, probable continuous hospitalization at the ICU, being admitted to the ICU less than 24 hours ago and not being hospitalized at any other wards before admission to the ICU, not being diabetic, having a systolic blood pressure of 100 mm Hg or more, not being addicted to narcotics, not having anemia (hemoglobin level of less than 12 g/dL in men and 10 g/dL in women) or any other blood diseases, and not having a fever ($\leq$37.5°C). The exclusion criteria were unwillingness to continue in the study or death of the patient.

Collection of Plant Material

Fresh leaves of the *Lawsonia inermis* Linn. (Henna) were collected from around the city of Yazd (one of the local areas growing Henna), Iran. Voucher specimens of leaves were identified by a botanist scientist in Shahrekord University of Medical Sciences, Herbarium Research Center, and deposited with the identification number 503 at the herbarium unit. The leaves were washed and dried in shade under aseptic conditions. The dried leaves were powdered with the help of a grinder.

High-Performance Liquid Chromatographic Analysis of Lawsonia inermis (Henna)

High-performance liquid chromatographic–ultraviolet analyses were performed on an Alliance 2695 instrument (Waters, Milford, MA) equipped with a ultravioled detector. Separations were performed on a C_{18} Eurospher column (5 µm, 4.6 × 150 mm) equipped with a guard column. The column temperature was set at 30°C. The *Lawsonia inermis* extract was separated in an isocratic mode. The mobile phase composition was 0.1 mol/L acetic acid–methanol in ratio 35:65; flow rate was 0.8 mL/min. Chromatograms were registered at 280 nm. Injection volume was 5 µL. The stock solution (1.0 mg/mL) containing the standard was prepared in dimethyl sulfoxide. For the calibration curve, working solutions in the range of 0.05 to 100 µg/mL were obtained from the stock solution by serial dilution with dimethyl sulfoxide. All analyses was done in triplicate (Figures 1 and 2).

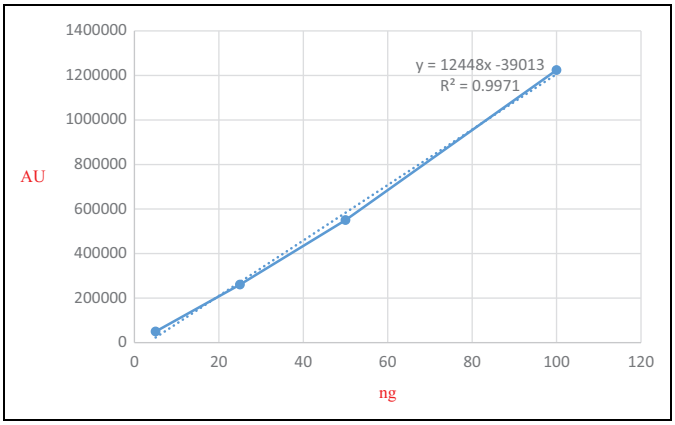

Figure 2. Standard plot of Lawson (dash interval) and sample of *Lawsonia inermis* (Area 1, 353617; Area 2, 369915; Area 3, 367549).

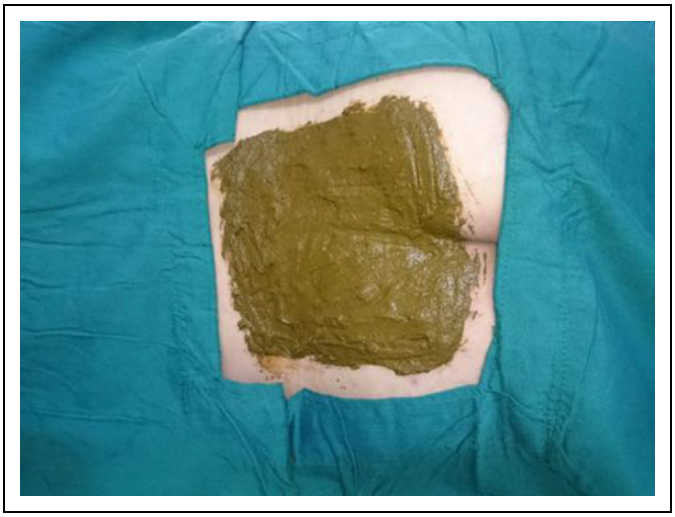

Figure 3.

The calibration curve for lawsone was linear ($R^2 = 0.9971$, $y = 12448x - 39013$) over the concentration range of 0.05 to 100 mg/mL. The content of Lawsone in methanolic extract was 32.3 mg/g of dry weight in *Lawsonia inermis*.

Implementation

After taking written informed consent from patients' families, 80 patients were randomly allocated into 2 groups of control and intervention using blocking method. Then daily standards of nursing care for prevention of decubitus ulcers were applied for all the patients by nurses. Along with the standard measures for preventing decubitus ulcers, for the intervention group, first henna (mixing 1 gram of powdered leaves of henna with 10 mL of distilled water) was applied on the inner part of the forearm, and if the patient showed no allergic reaction to henna, the prepared henna (combination of 50 grams of powdered henna in 500 mL of distilled water) was applied on the sacrum with a 15 cm extent. The applied henna was left on the skin for 30 minutes and then it was rinsed with warm water and the skin was dried (Figures 3–6). No particular measure besides routine care for decubitus ulcers was applied for the control group (Figure 7).

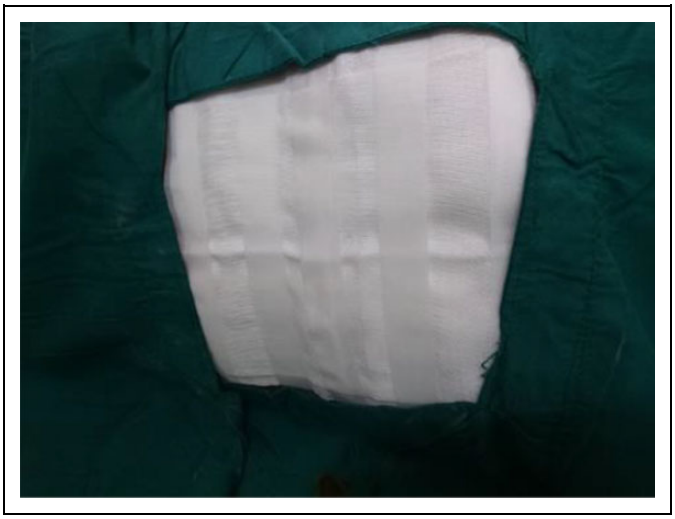

Figure 4.

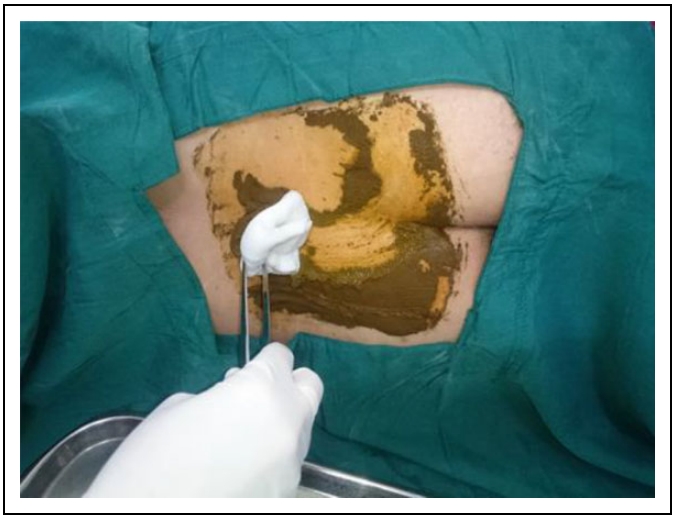

Figure 5.

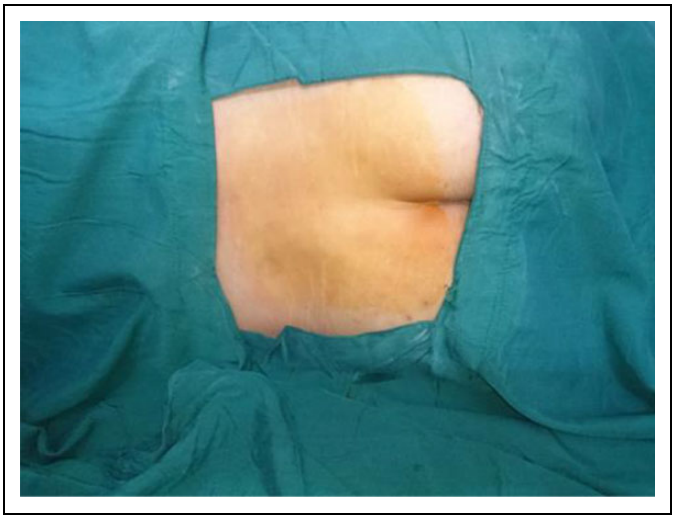

Figure 6.

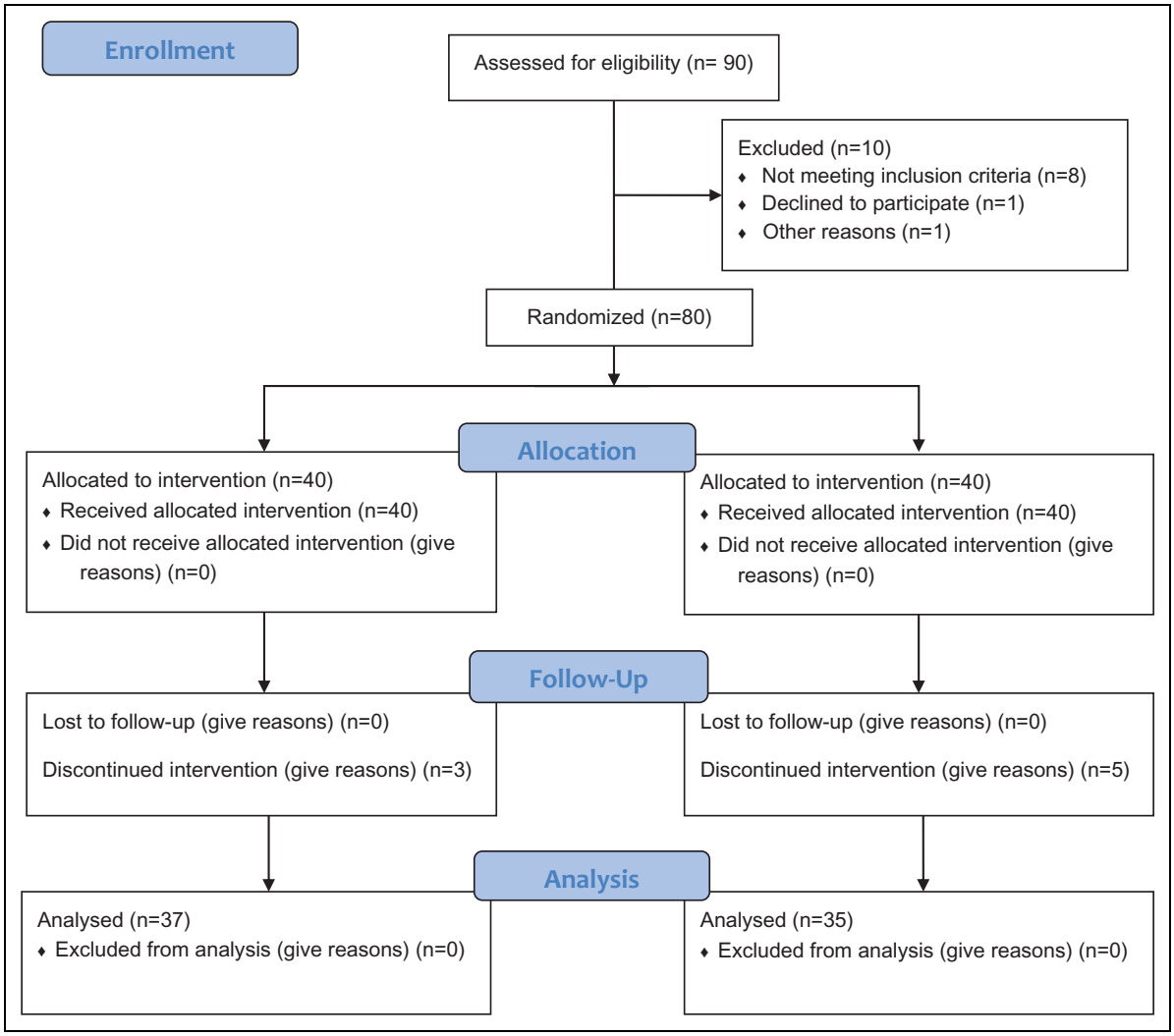

Figure 7. CONSORT flow chart.

Data Collection

Data were collected through a demographics questionnaire at the time of admission by the researcher; Braden scale for predicting decubitus ulcers risk was completed at the first, fourth, and seventh days of the study by the researcher. It includes 6 dimensions of sensory perception, humidity, mobility, activity, diet, and friction force. This scale is scored from 6 (highest risk) to 23 (lowest risk).[11] According to this scale, a score of 9 or lower indicates extremely high risk, 10 to 12 high risk, 13 to 14 moderate risk, 15 to 18 low risk, and a score of more than 18 indicates no risk.[18] The table for controlling daily record of sacrum and forehead temperature was completed by a trained nurse using a Microlife infrared thermometer, made in Switzerland, every day at 9 AM. Any increase in the temperature of sacrum of the intervention group compared to the control group was considered a local inflammation and type 1 decubitus ulcers. The type of the ulcer was also determined according to the definition of the European Decubitus Ulcers Advisory Panel. Study of the participants was continued for 1 week, in case of not developing any decubitus ulcer (of course, in both groups occurrence of permanent and indelible redness by pressuring the finger was also considered as an indicator of occurrence of type 1 decubitus ulcers).[11]

Validity and Reliability/Rigor

Braden's scale is a valid tool for evaluating the risk of decubitus ulcers in the guidelines of Wounds, Ostomy, and Continence Nurses Society.[11] This scale was also tested on 35 patients in Iran. The range of reliability of the scale between 2 educated observers was 84.1% to 100%. It showed a high interclass correlation.[17] The tool for controlling daily record of sacrum and forehead temperature was confirmed by 5 faculty members of Arak University of Medical Sciences for face validity.

Ethical Considerations

This study was approved by the Medical Ethics Committee of Arak University of Medical Sciences. After confirmation, the ethical code of IR.ARAKMU.REC.1394.36 was given to the study. This study was done based on all instructions of ethical codes of Tehran Declaration of Ethics in Medical Research.

Statistical Analysis

Data were analyzed using SPSS 21, and tests included χ^2 test, repeated-measure ANOVA (Greenhouse Gaser), Pearson correlation, and independent t tests.

Table 1. Comparison of Demographic Characteristics of Intervention and Control Groups of Henna Effect on Prevention of Pressure Ulcers in Critical Care Settings.

Demographic Characteristics	Group		*P* Value
	Intervention, Mean ± SD	Control, Mean ± SD	
Age	51.35 ± 17	52.94 ± 19.61	.7
Body mass index	23.85 ± 3.19	24.43 ± 3.72	.4
Consciousness level	10.59 ± 3.58	9.40 ± 3.83	.17
Serum albumin	3.31 ± 0.63	3.16 ± 0.60	.3
Probable duration of hospitalization	7.51 ± 1.70	7.71 ± 1.93	.6
Systole blood pressure	127.84 ± 15.8	130.67 ± 15.08	.4
Diastole blood pressure	77.93 ± 8.8	78.62 ± 8.7	.7

Results

In the present study, in the intervention group 29 (78.4%) were male and 8 (21.6%) were female, and in the control group 22 (62.9%) were male and 13 (37.1%) were female. Most of the patients in the intervention (51.4%) and control (65.7%) groups had endotracheal tubes. The medical diagnosis for most of the patients of the intervention group (45.9%) was brain damage, and in the control group (37.1%) it was trauma. None of the studied participants had a history of deep vein thrombosis. In the intervention group, the highest frequency of previous surgeries was urinary tract and reproductive system surgery (16.2%), and in the control group the highest frequency was cardiovascular system surgery (17.1%). Most of the patients in both intervention (54.1%) and control (54.3%) groups had underlying diseases. Twenty-seven percent of the intervention group and 34.3% of the control group had cardiovascular problems. Seventy-three percent of the intervention group and 77.1% of the control group had no history of narcotic consumption, and of those who had a history of substance abuse, most of them (21.6% in the intervention group and 14.3% in the control group) were cigarette smokers. Data analysis showed that both groups had no significant statistical differences regarding their demographic characteristics and other variables before the intervention ($P > .05$; Table 1). Of 80 patients during the study, 8 patients (6 men and 2 women) were excluded from the study. Six patients died during the study and the others did not cooperate. Data analysis continued with 72 patients; 35 in the control group and 37 in the intervention group.

Results showed that the mean score of Braden's scale at the first, fourth, and seventh days of the study for both the control and intervention groups was 12.27 ± 2.85, 14.23 ± 3.21, and 15.73 ± 3.82, respectively. Statistical tests showed a significant difference between the mean scores at the 3 different times ($P < .0001$). The mean score of Braden's scale for the intervention and control groups at the first day was 12.75 ± 3.07 and 11.77 ± 2.55, at the fourth day 14.89 ± 3.42 and 13.54 ± 2.86, and at the seventh day 16.24 ± 3.78 and 15.20 ± 3.84, respectively. Statistical tests showed no significant interaction between the mean scores of the 2 groups at the 3 different times ($P < .755$), meaning that the mean scores were not significantly different in both groups (Table 2).

Table 2. Mean of Braden Score of Pressure Ulcer in the 3 Time Periods Among Intervention and Control Groups.

Mean of Braden Score (Days)	Group	Mean ± SD
First	Control	11.7 ± 2.5
	Intervention	12.7 ± 3.07
Fourth	Control	13.5 ± 2.8
	Intervention	14.8 ± 3.4
Seventh	Control	15.2 ± 3.8
	Intervention	16.2 ± 3.7

Regarding the risk of decubitus ulcers using Braden's scale at the first, fourth, and seventh days of the study, statistical tests showed that at the first day 75.6% of the intervention group and 85.7% of the control group, at the fourth day 45.9% of the intervention group and 68.6% of the control group, and at the seventh day 35.1% of the intervention group and 51.4% of the control group had a moderate to high risk of developing decubitus ulcers (score of 6-14). Based on Fisher's exact test, there was no significant difference between both groups regarding the risk of developing decubitus ulcers ($P > .5$). Also, results showed that most of the participants had a score of 10 to 12 (high risk) at the first day and a score of more than 18 (no risk) at the seventh day of the study (Table 3).

Results showed that in both control and intervention groups during all the 7 days of study there was a negative correlation between decrease in the score of Braden's scale and increase in local warmth of sacrum ($r = -0.409$, $r = -0.558$, respectively). The mean local warmth of the sacral region during the 7 days of study in the intervention group was 37.84 ± 0.52 and in the control group it was 38.06 ± 0.67. From the beginning of the study (first day) till its end (seventh day), the mean local warmth of sacrum in the intervention group was lower than in the control group, but the difference was not statistically significant ($P = .14$). According to the independent *t* test, only at the beginning of the study the difference between mean local warmth of sacrum of both groups was significant ($P = .001$; Table 4).

The mean warmth of forehead during the 7 days of the study was 37.09 ± 0.41 in the intervention group and 37.03 ± 0.44 in the control group. There was no significant difference between both groups regarding the mean warmth of their forehead, which indicates their body temperature ($P = .5$; Table 5).

Regarding the relationship between the mean of body temperature (forehead) with local warmth of sacrum in both groups after the study, independent *t* test showed that the total mean score of sacrum of the intervention group was lower than in the control group but their difference was not significant ($P = .14$). The total mean score of forehead in the intervention group was higher than in the control group but the difference was not significant ($P = .5$). Also, the results of Pearson correlation

Table 3. Comparison of Risk Rate of Braden Score of Pressure Ulcer in the 3 Time Periods Among Intervention and Control Groups.

	Intervention Group			Control Group		
Risk of Pressure Ulcers	First Day	Fourth Day	Seventh Day	First Day	Fourth Day	Seventh Day
Moderate to high risk (%)	75.6	45.9	35.1	85.7	68.6	51.4
Low risk (%)	13.5	32.4	24.3	8.6	20	17.1
No risk (%)	10.8	21.6	40.5	5.7	11.4	31.4

Table 4. Comparison of Means of Sacral Local Temperatures During 1 Week Among the Intervention and Control Groups.

Mean of Sacral Local Temperatures (Day)	Group	Mean ± SD	*t* Test	*P* Value
First	Control	0.6 ± 37.9	3.51	.001
	Intervention	0.6 ± 37.3		
Second	Control	0.6 ± 37.9	1.43	.281
	Intervention	0.6 ± 37.7		
Third	Control	0.9 ± 38.08	0.413	.457
	Intervention	0.8 ± 38		
Fourth	Control	1.1 ± 38.1	0.580	.239
	Intervention	0.8 ± 38.1		
Fifth	Control	0.9 ± 38.2	1.43	.481
	Intervention	0.8 ± 37.9		
Sixth	Control	0.8 ± 37.9	0.392	.177
	Intervention	0.7 ± 37.9		
Seventh	Control	0.6 ± 38.3	1.18	.370
	Intervention	0.6 ± 37.8		
Total mean (during a week)	Control	38.06 ± 0.41	1.48	.14
	Intervention	37.48 ± 0.15		

Table 5. Comparison of Means of Forehead Local Temperatures During 1 Week Among Intervention and Control Groups.

Mean of Forehead Local Temperatures (Day)	Group	Mean ± SD	*t* Test	*P* Value
First	Control	0.53 ± 36.9	1.2	.722
	Intervention	0.3 ± 37.08		
Second	Control	0.6 ± 37.07	0.221	.309
	Intervention	0.6 ± 37		
Third	Control	0.6 ± 37	0.533	.937
	Intervention	0.5 ± 37		
Fourth	Control	0.6 ± 36.9	1.78	.560
	Intervention	0.6 ± 37.2		
Fifth	Control	0.6 ± 37.2	1.70	.582
	Intervention	0.6 ± 37		
Sixth	Control	0.6 ± 36.7	1.72	.602
	Intervention	0.6 ± 37		
Seventh	Control	0.6 ± 37	0.475	.865
	Intervention	0.4 ± 37		
Total mean (during a week)	Control	37.03 ± 0.44	0.675	.5
	Intervention	37.09 ± 0.41		

coefficient showed a significant relationship between the increase in mean local warmth of sacrum and increase in forehead temperature during the 7 days of the study, although there was a stronger association in the intervention group ($r = 0.677$).

Daily observations showed that 1 patient in the intervention group and 6 patients in the control group had redness in the sacral region. The comparison of the 2 rates showed that the difference between both groups regarding redness in the sacral region at the sixth and seventh days of the study was significant ($P = .01$). Results showed that 1 patient in the intervention group (1 male, 2.70%) and 6 patients in the control group (5 male, 14.29% and 1 female, 2.85%) developed decubitus ulcers at the end of the study and this difference was significant ($P = .001$).

Discussion

Regarding the mean score of risk of developing decubitus ulcers using Braden's scale for all patients, the results showed that the mean scores of Braden's scale at the first, fourth, and seventh days of the study for both the control and intervention groups was 12.27, 14.23, and 15.73, respectively, and the difference between the mean scores at the 3 different times was significant, meaning that all the patients in both groups had a lower score in Braden's scale at the first day of the study than in the seventh day, which indicates higher risk of developing decubitus ulcers at the first day of admission. This increase in score could be explained by the recovery process of the patients after 7 days of hospitalization. Therefore, at the first days of admission, due to less activity and decreased level of consciousness, the patients are at higher risk of developing decubitus ulcers. Jiang et al[12] also showed that 11.79% of patients with Braden's scale score less than 17 had a high risk for developing decubitus ulcers. Also in the study of Eberlein-Gonska et al[13] decrease in the score of Braden's scale was one of the risk factors for developing decubitus ulcers during hospitalization. The results of the present study were similar to the results of these studies.

Results showed no significant difference between the mean score of Braden's scale at the 3 different times (first, fourth, and seventh days of the study) of the intervention and control groups. This means that the mean score of both groups were similar, which indicates both groups were similar regarding the risk for developing decubitus ulcers based on Braden's scale and they were comparable. Soozani et al[18] in their study showed that the mean scores of wound assessment in patients who developed decubitus ulcers was 13.8 ± 3.6 and in those who did not it was 20.2 ± 3.5, according to Baden's scale, and independent *t* test showed the difference between both groups was significant. Regarding the risk for developing decubitus ulcers using Braden's scale, the results of the present study

were similar to other studies. Jiang et al[12] in their study showed that 11.79% had a high risk of developing decubitus ulcers and their score of Braden's scale was less than 17; this group needed more attention for prevention of developing decubitus ulcers. Also 88.21% of the patients with a score of 17 or more in Braden's scale had no risk of developing decubitus ulcers. In the study of Lupiáñez-Pérez et al,[14] one of the inclusion criteria was diagnosis of risk for developing skin ulcers by Braden's scale that was conducted by the nurse; a score of 12 or less was considered high risk of developing decubitus ulcers and a score of 13 to 16 was considered moderate risk.

In the present study, in both control and intervention groups, there was a correlation between decrease in score of Braden's scale and decrease in local warmth of sacrum, meaning that the lower the score of Braden's scale, the higher the risk of developing decubitus ulcers. Efteli and Gunes[19] also showed that low score of Braden's scale indicated low level of activity and hence high risk for developing decubitus ulcers. In the study of Amirifar et al,[17] it was shown that the lower the score of Braden's scale, the higher the risk for developing decubitus ulcers. As could be seen, the results of the present study are similar to the aforementioned studies.

Although in the present study the local warmth of sacrum, from the first to the seventh days of the study, was lower in the intervention group than in the control group, the difference between both groups was only significant at the first day. Because in the intervention group prepared henna was applied on sacrum and rinsed with warm water after 30 minutes and then patients' skin was dried, they had lower local warmth of sacrum; but the control group did not receive any special measures. European Decubitus Ulcer Advisory Panel has mentioned that for diagnosing decubitus ulcers skin observation must include evaluation of location's warmth, edema, or stiffness, especially in patients with dark skin. Warmth, edema, and stiffness are indicators of developing decubitus ulcers because the signs of decubitus ulcers or redness could not always be seen in patients with dark skin.[11] So it could be implied that increase in the local warmth of sacrum could indicate development of decubitus ulcer, and based on the results of the present study, since the mean local warmth of sacrum was lower in the intervention group than in the control group, it could be concluded that applying henna on sacrum might have been effective in lowering the local warmth of sacrum and somehow has prevented increased warmth, which is an indicator of developing decubitus ulcers.

Although throughout the study the mean warmth of sacrum in the intervention group was lower than in the control group, their difference was not statistically significant. In other words, the difference between the mean of forehead's temperature, which indicates the body temperature, in both groups was not significant. So it could be concluded that the 2 groups were comparable. In the study of Mogarehi and Zarif Sanaiey[32] also it was mentioned that the mean body temperature of patient with decubitus ulcers was 37.2°C and of patients without decubitus ulcers it was 37°C, which indicates that the difference was not significant. Mogarehi and Zarif Sanaiey[32] also showed in their study that the body temperatures in patients with decubitus ulcer were higher. According to the results of the present study, in both the intervention and control groups the warmth of sacrum was higher than the forehead's temperature, but the difference between sacrum's temperature and forehead's temperature in the intervention group was less than in the control group, meaning that the warmth of sacrum in the intervention group has increased less than the control group, which indicates lower risk of developing decubitus ulcers among the patients of the intervention group. Also, results showed that the mean temperature of sacrum and forehead had a significant relation during the study; the relation between local warmth of sacrum and forehead's temperature was direct. Akbari et al[16] in their study mentioned that fever by changing patient's metabolism on one hand and sweating on the other hand would make the patient prone to developing decubitus ulcers. This is similar to the results of the present study.

In the present study, only 1 patient in the intervention group developed redness in sacrum at the third, fourth, and fifth days of the study, and at the sixth and seventh days of the study, the redness was disappeared, but in the control group redness occurred in 6 patients. The difference was significant. According to the European Decubitus Ulcer Advisory Panel,[11] the definition of type 1 decubitus ulcer includes healthy skin with a pale red region or with a different colored region that usually occurs around bony prominences and could be more painful, smoother, softer, warmer, or colder than adjacent regions. Redness means that body is not able to release from the previous decubitus and needs rest before being decubitus again. Considering the above-mentioned, it could be said that 1 patient in the intervention group and 6 patients in the control group developed decubitus ulcers and the difference was significant in this regard. So the applied intervention has been effective and could have prevented redness in sacrum and eventually decubitus ulcer, especially type 1. In the study of Yucel and Guzin,[4] the authors evaluated the effect of henna on hand-foot syndrome caused by drug capecitabine, and henna, due to its anti-inflammatory, analgesic, and antipyretic effects, could have a good therapeutic effect on reduction of this syndrome without the need for reducing drug's dosage.

According to the results, 1 patient in the intervention group developed type 1 decubitus ulcer, which the redness in sacrum region was resolved after 72 hours, and in the control group 5 patients developed type 1 decubitus ulcer and 1 patient developed type 2 ulcer. The study of Eberlein-Gonska et al[13] also revealed that the lower grades of decubitus ulcers (type 1 or 2) are more common than its higher grades (type 3 or 4) in a way that 41% of patients had type 1 (784 patients out of 1914) and 48% had type 2 (915 patients) decubitus ulcers. In the study of Mistiaen et al,[33] which was conducted for 3 years from 2006 to 2008, nurses who visited patients at home reported all the cases of decubitus ulcer at sacrum region, and from all the patients (2772 patients) 1517 patients had type 1, 820 had type 2, 288 had type 3, and 147 had type 4 ulcers. In the study of Soozani et al,[18] which was conducted in Iran in 72 patients, 53 (73.6%) had type 2 and 16 (22.2%) had type 1 decubitus ulcers. In most

of the studies type 1 and type 2 ulcers are more common, which is similar to the present study. Considering that most of the ulcers have low grades and their treatments are costly, preventing these ulcers is a high priority. In the present study, it was shown that 1 patient in the intervention group and 6 patients in the control group developed decubitus ulcer. So it could be said that applying henna on sacrum could have been effective in preventing decubitus ulcer and could be suggested as a clinical preventive method.

Conclusion

Considering all the above-mentioned points about the effects of henna in preventing decubitus ulcers and also the results of the present study, it could be suggested that henna is effective in preventing decubitus ulcers, but due to the limited time of the study and small sample size, it is recommended that a long-term study on larger sample size should be conducted.

Author Contributions

Davood Hekmatpou, Fatemeh Ahmadian, Maryam Eghbali, and Shadi Farsaei participated in the study design and carried out the experiments. Davood Hekmatpou and Fatemeh Ahmadian wrote the article and critically revised the manuscript. All authors read and approved the final manuscript for submission.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Deputy of Research of Arak University of Medical Sciences (Grant Number: 2170).

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Ethical Approval

The Medical Ethics Committee of Arak University of Medical Sciences approved the study (Approval No. IR.ARAKMU.REC. 1394.36).

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