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The Effect of Aloe Vera on the Healing of Second Degree Pressure Ulcers among Critically Ill Patients

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Abstract
Background*: Pressure ulcers have afflicted critically ill patients since the dawn of recorded medicine. Pressure ulcers had adverse patient outcomes. Aloe vera as a non-pharmacological modality can be used in the pressure ulcer management.*
Aim of the study*: to investigate the effect of Aloe Vera on the healing of second degree pressure ulcers among critically ill patients.*
Research design*: A quasi-experimental research design was used to conduct this study.*
Sample*: 60 adult critically ill patients developed second-degree pressure ulcer.*
Setting*: Intensive Care Units of Emergency Hospital Mansoura University.*
Results*: There were highly statistical significant differences between study and control groups regarding pressure ulcer wound's characteristics: size, depth, edges, wound undermining presence, skin color surrounding wound, granulation tissues presence, and epithelial tissues presence (P < 0.001**) at post intervention assessment.*
Conclusion*: Aloe vera cream is effective in management pressure ulcers as it stimulates and accelerates the healing process. It is excellent, cheaper and safer choice than current conventional therapeutic management of pressure ulcers. Therefore, it can be routinely employed in management of pressure ulcers.* ***Recommendation****: Encourage the establishment of non-pharmacological remedies using (aloe vera) in treatment of pressure ulcer wounds and other different types of wounds.*

Keywords: *Aloe Vera, Critically Ill Patients, Pressure Ulcer, Wound Healing*

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I. Introduction

Pressure ulcers (PUs) are serious complications and persistent problem for critically ill patients throughout the world. Goerlich and Moore (2017) [1] reported that "current estimates of the prevalence of pressure ulcers in hospital patients vary between 5% and 17%" (p. 1169). Just a PU develops, its adverse consequences affect both patients as well as health care providers. The patient has painful wounds in addition to long hospital staying for the PUs treatment that often result in decreasing the patients' quality of life. Moreover, increasing the costs of nursing and medical aid (Crawford & Kleinpell, 2016, p. 1330) [2]. Burns (2014) [3] defined PU according to the National Pressure Ulcer Advisory Panel (NPUAP) as "a localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear" (p. 305). It is important to recognize the differences between PU wounds from other ulcers types that are related to pathological causes like diabetic foot ulcers or venous leg ulcers as PU caused by direct pressure to the skin as it is mentioned in the past definition (Paige & Wakelin, 2017, p. 1376) [4].Carter, Amde, & Luchette, (2014) [5] stated that critically ill patients usually exposed to a number of intrinsic and extrinsic factors in the intensive care units. Those factors make them at high risk to have PU. Typically, the patient has multiple invasive devices as respiratory equipment, restraints, urinary catheters, and multiple intravenous catheters that may contribute to limitation of patients positioning and mobility even so increasing the risk of PU occurrence (p. 872). Moreover, others such as poor nutrition, dehydration add to co-morbid conditions like diabetes and peripheral vascular disease, hemodynamic instability side by side with the patients' underlying disease help a PU development (Burns, 2014, p. 305) [3].The novel expansions in therapeutic field have revived the traditional medicines utilization. In recent years, the herbal medicine spread increases owing to the plants natural origin

and its safe effects, therefore, the herbal-based remedies as a source of therapeutic helps in health care systems all over the world (Tiwari, Chakraborty, & Dhama, 2013, p. 217) [6]. Complementary and alternative medicine or modalities (CAM) are defined as "the health care approaches with a history of use or origins outside of mainstream medicine". The antibiotics appearance in the early 1900s slumped the CAM Using, but, it is retrieved the saleability in the 1970s (Kramlich, 2014, p. 50) [7]. CAM; for examples (honey and aloe vera plants) can be used for managing PUs because of its benefits and less side effect (Dorai, 2012, p. 418) [8].Aloe vera as a non-pharmacological modality is used in the treatment of the PU. It is a cactus-like plant, which is a member of the Lilaceae family. The mucilaginous tissue in the Aloe vera leaf center has been used topically for sunburn, wounds and to cure the gastrointestinal problems through the oral intake, espacially as a laxative. Today, in addition to those uses, many conditions can be treated by the aloe vera as a folk or traditional remedy; including diabetes mullites, respiratory disorders like asthma, convulsion attacks, and joint cartilage degeneration. It is also used topically for osteoarthritis, burns, and psoriasis (Karim et al., 2014, p. 14) [9]. The aloe vera has healing properties due to presence of a compound that is known glucomannan, it inhibits fibroblast growth factor and exhibits the tissues activity and proliferation. Aloe vera mucilage includes some compounds like vitamin E and vitamin C and some of amino acids, which can play important role in acceleration of wound healing (Khorasani, Hosseinimher, Azadbakht, Zamani, & Mahdavi, 2009, p. 589) [10].

II. The aim of the study

The aim of this study was to investigate the effect of aloe vera on the healing of second degree pressure ulcers among critically ill patients at Emergency Hospital Mansoura University. To fulfill the aim of this study, the following research hypotheses were formulated, H1: aloe vera will improve the healing of second degree PUs of the study group versus the control group that will be treated with dermazin among critically ill patients, H2: aloe vera will be more effective for the healing of second degree PUs among critically ill patients than conventional therapy (dermazin)..

III. Subjects And Methods

3.1Research design

A quasi-experimental research design was used to conduct this study.

3.2 Setting

This study was conducted at the Intensive Care Units (ICUs) of Emergency Hospital Mansoura University. It encompassed three units (Two surgical ICUs 16 beds and the new ICU 4 beds); each bed has cardiac monitor, suction machine, air mattress and oxygen supplementation unit. The nurse patient ratio was nearly 1:3. These units receive critically ill patients mainly traumatic patients from Emergency department as well as patients' wards or referred from another hospital.

3.3Subjects

A purposive sample of 60 adult critically ill patients of both sexes, admitted to the above-mentioned settings requiring critical care were enrolled in the current study according to the following criteria:

3.4Inclusion criteria

Adult critically ill patients in the age group ranged from 20 to 45 years old (mid age) with normal body mass index and had second-degree PUs were included in the study.

3.5 Exclusion criteria

Patients with diseases that affect ulcer healing negatively as un-controlled diabetes mellitus, hypoxemia, heart failure, irreversible shock, hypo-proteinemia, malnourished patients and chronic renal failure, in addition to allergy to Aloe Vera were excluded from the study.

3.6 Tool

Data were collected using one tool in order to achieve the aim of the study, BATES- JENSEN wound assessment tool that was utilized to assess and monitor healing of wounds types. It was consisted of two main parts: Part A: biosocio-demographic characteristics and medical related data of the studied patients, as patient name, age, gender, the patient current diagnosis and admission date that was developed by the investigator. Part B: BATES- JENSEN wound assessment tool, this part was adapted from Barbara Bates-Jensen (1992) [11] and consists of thirteen assessment parameters were rated to investigate wound status.

IV. Methods

4.1 Protection of Human Rights

An official Permission to conduct the proposed study was obtained from the Ethical Committee of Nursing Faculty, Mansoura University and the director of the hospital. Participants were informed that their participation in the study is voluntary and they have the right to accept or refuse to participate.; each potential subject was informed about the purpose, procedure, benefits, and nature of the study. Moreover, participants were assured that withdrawing from the study can be at any time without any rationale and without any negative effect on the care that they received then written consents were obtained. Furthermore, protection of obtained data and information through coding was assured to achieve each participant confidentiality and anonymity.

4.2 Preparation phase

This study involved one tool; BATES- JENSEN wound assessment tool. It was adapted to be suitable for the study after reviewing recent literature. Tool was tested for content related validity by 7 experts in the field of Critical Care & Emergency Nursing and Medicine from the Faculties of Nursing and Medicine; professor in Intensive Care medicine and professor in Dermatology, Faculty of Medicine, Mansoura University; professor in Medical Surgical Nursing and lecturer in Critical Care and Emergency Nursing, Faculty of Nursing, Mansoura University; professor in Critical Care and Emergency Nursing and lecturer in Critical Care and Emergency Nursing, Faculty of Nursing, Alexandria University and assistant professor in Critical Care and Emergency Nursing, Faculty of Nursing, Cairo University. Necessary modifications were done accordingly. The overall reliability of the tool was tested using (α) Cronbach test and found to be 91 %.Aloe Vera cream preparation: the formula prepared according to the reference recommended doses; (4 g) White liquid paraffin, (15 g) stearyl alcohol, (15 g) cetyl alcohol, (6 g) solid white paraffin, and (0.03 g) propyle paraben were mixed and heated to a boil. (1 g) Aloe Vera juice and 140 mL deionized water were added to the mixture of (14 g) propylene glycol, (6 g) sodium lauryl sulfate, and (0.05 g) methyl paraben after heating to be a liquid. Then, the oil and liquid were mixed continuously and gradual cooling. The cream was prepared under sterile conditions and was confirmed to be free of microbes. The uniform cream contained 1 % Aloe Vera should be stored in a sterile package.

4.3Pilot study

A pilot study was carried out before starting data collection on six patients (10%) to test feasibility, applicability of the tool and to assess reactions of the patients to the cream. Those patients were excluded from the study.

4.4 Fieldwork

The data collection was conducted within ten months. The study sample consisted of 60 adult critically ill patients of both sexes developed second-degree PU and meeting the inclusion criteria.Assessment phase; An initial assessment was carried out for all patients to confirm that they are free from exclusion criteria. Subjects were randomly assigned into equal two groups; study group (Aloe Vera group) and control group (Dermazin group). Each group consists of 30 patients. The study group was instructed about the action of Aloe Vera, usage, side effects and available evidence base for using it.Implementation phase; During this phase; The study subjects were divided randomly into two groups. The first group was treated with Aloe Vera twice / day. For the second group the patients were treated with the conventional therapy Silver Sulfadiazine (Dermazin), and it was applied twice / day also, with respecting to the equally ulcer surface area in control and experimental. Aloe Vera dressing was applied each other day by closed technique as hospital policy. Treatment with the topical agents continued until the ulcers was fully healed and epithelialized. Initial assessment of all patients (both groups) was done by using Bates-Jensen Wound Assessment tool. Subsequent assessment was applied every 3 days until the wound healing occurred or within 14-21 days using the same items. Bacteriological studies were done on 4th day then weekly until healing occur if needed; as patient with infected wound and/or delayed PU healing. photograph was taken if possible in the beginning and at the end of patients treated with Aloe Vera and Dermazin to follow Progress of PU healing. Evaluation phase; PU condition was evaluated weekly to detect and monitor the healing process. Evaluation of treatment results was done for both groups in second and third week of ulcer development or when full healing occurred. Initial and ongoing assessment for conventional treatment was compared with Aloe Vera results using appropriate statistical tests.

4.5 Statistical analysis

Data entry and analysis was performed using the Statistical Package for Social Sciences version 20 (SPSS). Descriptive statistics, Correlation coefficient, Arithmetic mean, Standard deviation (SD), Chi square (χ^2), and Paired sample t- tests were used in the analysis. A significance level was considered at P value = 0.05.

V. Results

This part represents the current study findings concerning the effect of aloe vera on the healing of second degree PUs among critically ill patients. Findings of the present study, there were highly statistical significant differences between study and control groups regarding PU wound's characteristics: size, depth, edges, wound undermining presence, skin color surrounding wound, granulation tissues presence, and epithelial tissues presence ($P < 0.001$**) at post intervention assessment. Table (1) represented that (70%) and (83.3%) respectively among the study group and the control group were in age group of 40-45 years with the mean age of (37.77 + 9.83) and (40.97 + 7.15) years respectively. In addition to, (66.7%) and (73.3%) respectively of the study group and the control group were males. Concerning residence area; (73.3%) and (66.7%) respectively of the study group and the control group were from rural areas. There was no statistical significant difference between study and control groups as regard socio-demographic data.Table (2) reflected that half (50%) of study group and slightly less than half (47.67%) of control group had intracranial haemorrhage. Regarding PU location; (43.3%) of the study as well as the control groups had the ulcer on the sacrum or coccyx area. In relation to PU shape; more than half (53.3%) of study group had irregular shape while slightly less than half (46.7%) of control group had irregular shape and the same percentage distribution had round shape. There was no statistical significant difference between study and control groups regarding medical related data.

Table (3) showed that at the pre-intervention assessment there was (43.3%) and (63.3%) respectively among study group and control group had wound size 4 < 16sq cm, while at the post-intervention assessment the majority (86.7%) and (16.7%) respectively of study group and control group had healed / resolved wound. There was highly statistical significant difference at the post-intervention assessment between study and control groups ($X^2 = 31.49$, $P < 0.001$**). Table (4) represented that at the pre-intervention assessment the majorities (90%) and (93.3%) of both study group and control group respectively had partial thickness skin loss involving epidermis and/or dermis, but at the post-intervention assessment (86.7%) and (16.7%) of study group and control group respectively had healed / resolved wound. There was highly statistical significant difference at the post-assessment between study and control groups ($X^2 = 29.43$, $P < 0.001$**).Table (5) revealed that at the pre-intervention assessment the majorities (83.3%) of both study group and control group had distinct, outline clearly visible wound edges attached even to wound base, while at the post-intervention assessment (86.7%) and (16.7%) of study group and control group respectively had healed / resolved wound. There was highly statistical significant difference at the post-assessment between study and control groups ($X^2 = 43.33$, $P < 0.001$**). Table (6) showed that at the pre-intervention assessment the majorities (90%) and (96.7%) of study and control groups respectively had no wound undermining, while at the post-intervention assessment (100%) of study group and (96.7%) of control group had no wound undermining. There was highly statistical significant difference between study and control groups ($X^2 = 29.51$, $P < 0.001$**).Table (7) showed that at the pre-intervention assessment (86.7%) of study as well as control groups had bright red skin color surrounding the pressure ulcer, while at the post-intervention assessment (86.7%) and (23.3%) of study group and control group respectively had normal skin color surrounding the pressure ulcer. There was highly statistical significant difference between study and control groups ($X^2 = 24.31$, $P < 0.001$**). Table (8) showed that at the pre-intervention assessment (83.3%) and (90%) of study group and control groups respectively had no granulation tissues in the PU wound, while at the post- intervention assessment (86.7%) and (16.7%) of study group and control group respectively had intact skin. There was highly statistical significant difference between study and control groups ($X^2 = 31.92$, $P < 0.001$**).Table (9) revealed that at the pre-intervention assessment (86.7%) and (96.7%) of study group and control group respectively had less than one quadrant of their PU wound covered by epithelialization, and at the post-intervention assessment (86.7%) and (16.7%) of study and control groups respectively had intact skin. There was highly statistical significant difference between study and control groups ($X^2 = 31.27$, $P < 0.001$**). Table (10) devoted that (23.3%) of study group's PU wounds healed within a period of (7-9) days and the same frequency distribution had a period of (19-21) days for healing, while the majority (83.3%) of control group their wounds need a period of (> 21) days to heal. there was highly statistical significant difference between study and control groups as regard wound healing duration ($X^2 = 27.04$, $P < 0.001$**).Table (11) reflected that (86.7%) of study group had a PU healing score (< 13) on wound status continuum which was classified as a healed wound, and (83.3%) of control group their PU healing score was from (21 to 30) which was classified as a mild wound severity. there was highly statistical significant difference between study and control groups ($X^2 = 29.43$, $P < 0.001$**). Table (12) represented that there were statistical significant differences between pre- and post-intervention assessments of study and control groups as regard wound healing mean scores ($t = 23.48$, $P < 0.001$**) and ($t = 7.79$, $P < 0.001$**) respectively. Table (13) denoted that there was highly statistical significant difference between study and control groups regarding the mean of wound healing scores at Post-intervention assessment ($t = 2.37$, $P < 0.001$**).Table (14) revealed that there was no statistical significant relation between age and mean of wound healing scores in study and control groups, while there was statistical significance relation between gender and mean of wound healing scores in both groups ($t = 4.49$, $P = 0.038$*).

VI. Tables

Table (1) Frequency and Percentage Distribution of Socio-demographic Data among Study & Control Groups (n = 60).

Variables	Study		Control		X^2	P- value
	N (30)	%	N (30)	%		
- Age						
20- < 30	8	26.67	3	10	2.95	0.228
30- < 40	1	3.33	2	6.67		
40 – 45	21	70	25	83.33		
Mean ± SD	37.77 ± 9.83		40.97 ± 7.15			
- Gender						
Male	20	66.7	22	73.3	0.32	0.573
Female	10	33.3	8	26.7		
- Residence area						
Rural	22	73.3	20	66.7	0.32	0.573
Urban	8	26.7	10	33.3		

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (2) Frequency and Percentage Distribution of Medical Related Data among Study & Control Groups (n = 60).

Variables	Study		Control		X^2	P- value
	N (30)	%	N (30)	%		
-Current diagnosis						
Intracranial Haemorrhage	15	50	14	47.67	0.38	0.827
Multi-trauma	8	26.67	9	30		
Cervical spine injuries	7	23.33	7	23.33		
- Pressure ulcer location						
Sacrum/coccyx	13	43.3	13	43.3		
Trochanter	12	40	6	20		
Heel	2	6.7	9	30	8.79	0.118
Ischeal	1	3.3	0.0	0.0		
Medial ankle	1	3.3	2	6.7		
Lateral ankle	1	3.3	0.0	0.0		

- Pressure ulcer shape Irregular	16	53.3	14	46.7	4.97	0.291
Round	8	26.7	14	46.7		
Linear	3	10.0	2	6.7		
Butterfly	2	6.7	0.0	0.0		
Square	1	3.3	0.0	0.0		

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (3) Comparison between Study Group and Control Group in Relation to Wound's Size According to Bates-Jensen Wound Assessment Tool (n= 60).

Wound's Size	Pre-intervention assessment		Post- intervention assessment	
	Study N=30	Control N=30	Study N=30	Control N=30
	N (%)	N (%)	N (%)	N (%)
• Healed wound	0 (0.0)	0 (0.0)	26 (86.7)	5 (16.7)
• < 4 sq cm	4 (13.3)	2 (6.7)	0 (0.0)	8 (26.7)
• 4 < 16 sq cm	13 (43.3)	19 (63.3)	4 (13.3)	11 (36.7)
• 16.1 < 36 sq cm	11 (6.7)	9 (30)	0 (0.0)	6 (20)
• 36.1 ≤ 80 sq cm	2 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)
• X^2 – test	3.992		31.492	
• P- value	0.262		< 0.001**	

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (4) Comparison between Study Group and Control Group in Relation to Wound's Depth According to Bates-Jensen Wound Assessment Tool (n = 60).

Wound's depth	Pre-intervention assessment		Post- intervention assessment	
	Study N=30	Control N=30	Study N=30	Control N=30
	N (%)	N (%)	N (%)	N (%)
• Healed wound	0 (0.0)	0 (0.0)	26 (86.7)	5 (16.7)
• Erythema	2 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)
• Partial	27 (90)	28 (93.3)	4 (13.3)	25 (83.3)
• Full thickness	1 (3.3)	2 (6.7)	0 (0.0)	0 (0.0)
• X^2 – test	2.352		29.433	
• P- value	0.309		< 0.001**	

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (5) Comparison between Study Group and Control Group in Relation to Wound's Edges According to Bates-Jensen Wound Assessment Tool (n = 60).

Wound's edges	Pre-intervention assessment		Post- intervention assessment	
	Study N= 30	Control N= 30	Study N= 30	Control N= 30
	N (%)	N (%)	N (%)	N (%)
• Healed wound	0 (0.0)	0 (0.0)	25 (83.3)	5 (16.7)
• Non-Clearly	2 (6.7)	0 (0.0)	5 (16.7)	0 (0.0)

• Clearly visible	25 (83.3)	25 (83.3)	0 (0.0)	25 (83.3)
• Well defined	3 (10)	5 (16.7)	0 (0.0)	0 (0.0)
• X^2 – test	2.50		43.333	
• P – value	0.287		< 0.001**	

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (6) Comparison between Study Group and Control Group in Relation to Wound's Undermining According to Bates-Jensen Wound Assessment Tool (n = 60).

Wound's undermining	Pre-intervention assessment		Post- intervention assessment	
	Study N= 30	Control N= 30	Study N= 30	Control N= 30
	N (%)	N (%)	N (%)	N (%)
• Healed wound	0 (0.0)	0 (0.0)	26 (86.7)	5 (16.7)
• None present	27 (90)	29 (96.7)	4 (13.3)	24 (80)
• < 2 cm in any area	3 (10)	1 (3.3)	0 (0.0)	1 (3.3)
• X^2 – test	1.071		29.512	
• P – value	0.301		< 0.001**	

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (7) Comparison between Study Group and Control Group in Relation to Skin Color Surrounding Wound According to Bates-Jensen Wound Assessment Tool (n = 60).

Skin Color Surrounding Wound	Pre-intervention assessment		Post- intervention assessment	
	Study N= 30	Control N= 30	Study N= 30	Control N= 30
	N (%)	N (%)	N (%)	N (%)
• Pink or normal	0 (0.0)	1 (3.3)	26 (86.7)	7 (23.3)
• Bright red	26 (86.7)	26 (86.7)	4 (13.3)	23 (76.7)
• Grey pallor	4 (13.3)	3 (10)	0 (0.0)	0 (0.0)
• X^2- test	1.143		24.31	
• P- value	0.565		< 0.001**	

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (8) Comparison between Study Group and Control Group in Relation to Wound's Granulation Tissue According to Bates-Jensen Wound Assessment Tool (n = 60).

Granulation tissue	Pre-intervention assessment		Post- intervention assessment	
	Study N= 30	Study N= 30	Study N= 30	Control N= 30
	N (%)	N (%)	N (%)	N (%)
• Skin intact	0 (0.0)	0 (0.0)	26 (86.7)	5 (16.7)
• 75% to 100%	1 (3.3)	0 (0.0)	3 (10)	5 (16.7)
• < 75% & > 25%	1 (3.3)	1 (3.3)	1 (3.3)	20 (66.7)
• ≤ 25%	3 (10)	2 (6.7)	0 (0.0)	0 (0.0)
• No granulation	25 (83.3)	27 (90)	0 (0.0)	0 (0.0)
• X^2- test	1.277		31.916	
• P- value	0.735		< 0.001**	

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (9) Comparison between Study Group and Control Group in Relation to Wound's Epithelialization According to Bates-Jensen Wound Assessment Tool (n = 60).

	Pre-intervention assessment	Post- intervention assessment

Epithelialization	Study N= 30 N (%)	Control N= 30 N (%)	Study N= 30 N (%)	Control N= 30 N (%)
• Surface intact	0 (0.0)	0 (0.0)	26 (86.7)	5 (16.7)
• Cover 75% to <100%	1 (3.3)	0 (0.0)	2 (6.7)	3 (10)
• Cover 50% to <75%	1 (3.3)	1 (3.3)	2 (6.7)	17 (56.7)
• Cover 50% to <75%	2 (6.7)	0 (0.0)	0 (0.0)	5 (16.7)
• Cover < 25%	26 (86.7)	29 (96.7)	0 (0.0)	0 (0.0)
• X^2- test • P- value	3.164 0.367		31.268 < 0.001**	

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (10) Comparison between Study Group and Control Group Concerning Wound Healing Duration (n= 60).

Duration of wound healing	Study (N=30)		Control (N=30)		X^2	P – Value
	N	%	N	%		
• 7-9 days	7	(23.3)	0	(0.0)		
• 10-12 days	3	(10)	0	(0.0)		
• 13-15 days	3	(10)	2	(6.7)		
• 16-18 days	6	(20)	0	(0.0)	27.042	< 0.001**
• 19-21 days	7	(23.3)	3	(10)		
• > 21 days	4	(13.3)	25	(83.3)		

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (11) Comparison between Study Group and Control Group Concerning Wound Healing Score on Wound Status Continuum According to Bates-Jensen Wound Assessment Tool (n = 60).

Score of wound healing	Study (N=30)		Control (N=30)		X^2	P – Value
	N	%	N	%		
• < 13	26	(86.7)	5	(16.7)		
• 13 to 20	4	(13.3)	0	(0.0)	29.433	< 0.001**
• 21 to 30	0	(0.0)	25	(83.3)		

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (12) Comparison between Pre- & Post-intervention Assessments of Study and Control Groups in Relation to Mean of Total Wound Healing Scores (n = 60).

Variables	Wound healing scores $\bar{x} \pm SD$	t- test	P- Value
Study group (N = 30) • Pre-intervention assessment • Post-intervention assessment	27.63 ± 3.37 10.43 ± 3.37	23.48	< 0.001**

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (13) Comparison between Study Group and Control Group in Relation to Mean of Total Wound Healing Scores (n = 60)

Variables	Wound healing scores	t- test	P-Value
Pre-intervention assessment • Study group (N = 30) • Control group (N = 30)	 27.63 ± 3.37 26.30 ± 2.05	5.38	0.069
Post-intervention assessment • Study group (N = 30) • Control group (N = 30)	 10.43 ± 3.37 19.23 ± 4.68	2.37	< 0.001**

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

Table (21) Relation between Socio-demographic Characteristics and Mean of Total Wound Healing Scores of Study and Control Groups (n=60).

Variables	Wound healing score			
	Study group	Control group	Significance test	
	$\bar{x}$ ± SD	$\bar{x}$ ± SD		
Age				
• 20- < 30 yrs	13.13 ± 4.70	17.33 ± 7.23	f = 0.237	P = 0.79
• 30- < 40 yrs	---	21.00 ± 0.00		
• 40 – 45 yrs	9.48 ± 2.18	19.32 ± 4.63		
Gender				
• Male	10.7 ± 3.64	20.68 ± 2.66	t = 4.494	P = 0.038*
• Female	9.9 ± 2.85	15.25 ± 6.69		

** Highly statistical significant difference (P < 0.001)
*statistical significant difference (P < 0. 05)

VII. Discussion

The present study findings are discussed in reference to the aims and research questions of the study. The total number of the current studied sample was 60 patients (study and control groups). There were no statistical significant differences between study and control groups in all socio-demographic and medical related data of the current study. This finding was supported by (Mousa, Mohamed, Tadros & Ibrahim, 2016) [12] who carried out research to investigate the impact of AV natural gel on PU healing. Two thirds of study group and more than two thirds of control group were males. This would be attributed to that males are the main responsible for their families which expose them to more route traffic accidents that lead to ICU admission and ulcer occurrence. This result was in harmony with (Khorasani, Ahmadi, Hosseinimehr, Taheri & Fathi, 2011) [13] who study the effects of aloe vera cream on split-thickness skin graft donor site management; noted that the majority of their study subjects were males. Similarly, (Mousa et al., 2016) [12] who revealed that nearly two thirds of their study group and half of control group were males. While this finding contradicted with (El-Leithey, Alaa-Eldin, Bahaa-Eldin, Soliman & Nour, 2016) [14] who carried out research about effect of aloe vera versus moist exposed burn ointment (MEPO) on healing process of second degree burned patient; commented that more than three fifth of the studied patient were females. Panahi et al., (2012) [15] who applied a study on A herbal cream consisting of aloe vera, lavandula stoechas, and pelargonium roseum as an alternative for sliver sulfadiazine in burn management, reported that there were no statistical significant differences between both study and control groups in relation to gender. As regards age, more than two thirds of study group and the majority of control group ranged between 40 and 45 with the mean (37.77 + 9.83) and (40.97 + 7.15) years respectively. It was noticed that mid age group was more susceptible to ulcer development than other age groups due to having critical cases as intracranial hemorrhage and cervical spine injuries which increase length of staying in ICU. This result was disagreed with (Mousa et al., 2016) [12] who denoted that less than one quarter of study group as well as control group was located in the same age group with mean age of (20.61±1.76, 22.45 ±2.97 respectively). This study revealed that, more than two thirds of study group and two thirds of control group were coming from rural areas. This finding may be due to much travelling of rural population than urbans for working and studying which expose them to more accidents and hospital admission even so hospital

acquired PU development. This result was supported with (El-Leithey et al., 2016) [14]; (Mousa et al., 2016) [12] and (Weheida, Riad & Masry, 2013) [16], who carried out a study about the "effect of skin preparation by using aloe vera gel on incidence of skin reactions among breast cancer patients undergoing radiation therapy" that the majority of their study sample were not working, and more than two thirds of both study and control groups were coming from rural areas.Concerning medical related data, half of study group and slightly less than half of control group their current diagnoses were intracranial hemorrhage. In the light of this result; it could interpret increasing the incidence of PUs among critically ill patients who had disturbed conscious level and immobilized due to their neurologic problems. This current finding coincided with (Mousa et al., 2016) [12] who denoted that more than one third of study group and less than half control group had current diagnoses of multiple sclerosis and paraplegia.

The current study findings denoted that slightly less than half of both study group and control groups had PU on sacrum or coccyx areas, this could be explained as those studied sample haven't received adequate routine care in the form of positioning and lying in supine position, therefore they developed pressure ulcer. On the same context, (Panahi et al., 2015) [17] who carried out a study entitled "comparative trial of aloe vera/olive oil combination cream versus phenytoin cream in the treatment of chronic wounds" reported that more than two thirds of both study and control group had PU in lower body.In the current study, the finding data that could be attributed to the research first hypothesis that aloe vera will improve the healing of second degree PUs of the study group versus the control group that will be treated with dermazin among critically ill patients. There were highly statistical significant differences between study and control groups in relation to PU wound's characteristics according to Bates-Jensen Wound Assessment Tool that include (size, depth, edges, presence of wound undermining, skin color surrounding wound, granulation tissues presence, and epithelial tissues presence) at post intervention assessment.According to the study findings, it was noted that after using of aloe vera cream dressing the majority of the study group had full wound healing as regards PU wound's characteristics of Bates-Jensen Wound Assessment Tool, this could elaborate the effect of aloe vera cream on wound status as it improves and enhances wound healing side by side with exposure to hospital routine care. This result supported by (Mousa et al., 2016) [12] who mentioned that after one week (at post-assessment 1), the study group had been expressed decrease in the pressure ulcer's wound size, depth, edges, exudates, edema around the wound site, induration, presence of granulation tissues, and epithelialization after using of natural aloe vera gel.Also, this finding was in agreement with a study conducted about "the effectiveness of Aloe Vera Gel compared with 1% silver sulphadiazine cream as burn wound dressing in second degree burns" there were highly statistical significant difference between study and control group regarding epithelialization of burn wound that was reported by (Shahzad & Ahmed, 2013) [18]. In a similar study, about "the effects of aloe vera cream on chronic anal fissure pain, wound healing and hemorrhaging upon defection" mentioned that there were statistical significant differences between study and control group in relation to wound healing before and after treatment using aloe vera cream, which was carried out by (Rahmani, Khademloo & Assadpour, 2014) [19].

Moreover, a supported study conducted by (Panahi et al., 2015) [17] who revealed that there were statistical significant differences in chronic wounds characteristics between both study and control groups. And in the same line of (Avijgan et al., 2009) [20] who examined healing effect of aloe vera gel, in non-healed ulcer, denoted that using aloe vera gel in the treatment of chronic ulcers stimulated and accelerated the healing process. Hasan, Asif & Quadri, (2014) [21] clarified that aloe vera had a lot of biological effects include, healing effect on wound as it contains Glucomannan, a mannose-rich polysaccharide, and gibberellin, a growth hormone, moreover its interaction with growth factor receptors on the fibroblast, increases collagen content of the wound, this enhance the wound contraction, increases blood supply and improve oxygenation to wound site. And Olawoye, Osinupebi & Ayoade, (2009) [22] who found that more than half of participants had a satisfactory wound healing when they studied open burn wound dressing: a practical option in resource constrained settings. But, the findings were contradicted with (El-Leithey et al., 2016) [14] who revealed that "regarding the items of wound assessment according to Bates-Jensen Wound Assessment Tool. A general improvement in all parameters could be observed in the both groups during treatment period. But improvement was in favor with MEBO and no significant difference between both groups except wound depth, necrotic tissues type and amount and exudate type in third week".In the current study, the finding data that could be attributed to the research second hypothesis that aloe vera will be more effective for the healing of second degree PUs among critically ill patients than conventional therapy (dermazin). There were highly statistical significant differences between both study and control groups. Regarding wound healing duration, the study findings devoted that nearly one quarter of the study group who was dressed with aloe vera cream dressing their PU wounds healed within 7-9 days, while the majority of control group who was dressed with dermazin dressing their wounds need a period of (> 21) days to heal. this could reflect the effect of aloe vera cream on PU healing. This result was supported by (Avijgan et al., 2009 [20]; Mousa et al., 2016 [12]) who mentioned that half of the study group who received aloe vera gel and one tenth of control group who received routine hospital care only, their wounds healed within 4-7 days. And in the line with (Shahzad & Ahmed, 2013) [18] who noted that more than half of study group and less

than quarter of control group developed wound healing during a period of 5-10 days. Also, in the same context with (Khorasani, Hosseinimher, Azadbakht, Zamani & Mahdavi, 2009) [10] who performed a research entitled "aloe versus silver sulfadiazine creams for second-degree burns" revealed that there was significant difference between study and control groups regarding wound healing time after aloe vera cream applying. A support study about "wound healing and toxicity evaluation of aloe vera cream on outpatients with second degree burns" which was conducted by (Moghbela, Ghalamborb & Allipanaha, 2007) [23], revealed that average percent of healing with aloe vera on day 10 was 90.6% versus 29.8% was with sliver sulphadiazine. While the result was in disharmony with (El-Leithey et al., 2016) [14] who noted that more than half of control group and two third of study group their wounds healed within 13-18 days.Concerning wound healing score, the current study revealed that of study group had a PU healing score (< 13) on wound status continuum which was classified as a healed wound, and (83.3%) of control group their PU healing score was from (21 to 30) which was classified as a mild wound severity. This result was in agreement with (Shahzad & Ahmed, 2013) [18] who denoted that healing of burn wound in patients treated with aloe vera was remarkably early than those who were treated with 1% sliver sulphadiazine. But, it was contradicted with (El-Leithey et al., 2016) [14] who found that half of MEBO group burn wounds were mild severity and other half was moderate, while more than half of aloe vera group was moderate severity at third week.As regards wound healing mean scores, the current study noted that, there were statistical significant differences between pre- and post-intervention assessments of both study and control groups ($t = 23.48$, $P < 0.001$**) and ($t = 7.79$, $P < 0.001$**) respectively. This result was supported with (Rahmani, Khademloo & Assadpour, 2014) [19] who noticed statistical significant differences in wound healing grades before and after using aloe vera. As well as by (Mousa et al., 2016) [12] who mentioned that there was statistical significant difference between study and control group at the second assessment.The current study revealed that there was no statistical significant relation between socio-demographic characteristics and medical related data with mean of total score of wound healing except gender, there was statistical significance relation between gender and mean of wound healing scores in both groups ($t = 4.49$, $P = 0.038$*). This finding was in the same line with (Mousa et al., 2016) [12] who commented that there was no statistical significant relation between age and gender with mean of total score of wound healing ($F = 0.123$, $P = 0.727$) and ($F = 0.485$, $P = 0.489$) respectively. The study finding was partially contradicted with (Laverdet, Danigo, Girard & Demiot, 2015 [24]; Sgonc & Gruber, 2013 [25]), who mentioned that there was a correlation between age and wound healing impairment. Also, the study finding was in disagreement with (Khalil, Cullen, Chambers & Walker, 2015) [26] who carried out a study entitled "Elements affecting wound healing time: An evidence based analysis" found that there was no statistical significant relation between gender and wound healing.

VIII. Conclusion

The findings of this study show that PUs are among the most common adverse events in nursing practice. Moreover, PUs lead to a more intensive nursing and medical care. Aloe vera cream is effective in management PUs as it stimulates and accelerates the healing process. It is excellent, cheaper and safer choice than current conventional therapeutic management of PUs. Therefore, it can be routinely employed in management of PUs. Findings of this study were limited to small sample number of (60) patients. Therefore, it may not necessarily be representative of the general population, many patients died and were excluded from the study and most of patients were elder (more than 60 yrs.) not mid age.In the light of findings of the present study, the following recommendations were made; encourage the establishment of non-pharmacological remedies using (aloe vera) in treatment of PU wounds and other different types of wounds, further studies for aloe vera in treating PUs with different formula ingredients to make aloe vera results more evidence and replication of the study on a larger probability sample from different geographical areas.

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