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Is there a relationship between malnutrition and wound healing in Hospitalized patients with burns?

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Abstract: **The incidence of burn injuries is increasing in Africa. Nearly 3.2% of South Africa population is burned annually. Purpose: The current study aimed to find out there a relationship between malnutrition and wound healing in hospitalized patients with burns. Methods: Design: A descriptive correlational research design was utilized. The study was performed in the burn unit at a General Hospital. Sample: The study was conducted with a convenience sample of 70 patients with burns. Tools: Three tools were used to collect the study data: a structured interview, the malnutrition risk assessment scale (MUST) and the modified pressure ulcer scale for healing (PUSH) version 3.0. STROBE checklist was also used for reporting this. Results: The study revealed that more than one-third of the study sample was at high risk for malnutrition. However, there was no statistically significant relationship between malnutrition risk and wound healing. The study concluded that there was no relationship between malnutrition and wound healing in hospitalized patients with burns?**

Keywords: **Burn, Malnutrition, Risk, Patients, Healing.**

1. INTRODUCTION

The incidence of Burn injuries is increasing in Africa because of moving from rural areas and increase overcrowded urban regions. Yet, there is a paucity of data regarding burn injuries on the African continent. Nearly, 3.2% of South Africa population is burned annually as reported by African Medical Research Council: where 50% of individuals who suffer from burns are younger than 20 years. (Prins, 2013). Burns can cause injuries that mostly need physiological treatment. The cost for both individuals and medical systems could be substantial (Murray, 2006). Burn injuries still challenging practical problems, with many negative consequences that can frequently lead to mortality and morbidity. Great effort was focused on understanding nature of burn wound healing and developing management of wound, with focus on new approaches its treatment (Sami, Heibaa & Abdellatifa **,** 2018). In an attempt to reduce the burn wound burden, much effort has focused on understanding the physiology of healing and developing effective wound care (Opnejaa, Kapoora & Stavrou, 2019).

The depth of burn wounds and/or their healing potential are the most important determinants of therapeutic management and residual morbidity or scarring. Traditionally, burn surgeons divide burns into superficial burns that heal by rapid re-epithelialization with minimal scarring and deep burns requiring surgical therapy. (Monstrey , Hoeksem, Verbelen, Pirayesh, & Blondeel, 2008). Nutrition is an important aspect affecting burn patients; while it is considered one of the

most basic medical issues, it is often ignored in chronic wounds management (Molnar, undertown, & Clark 2014). Proper nutrition promotes growth, supports organ function and is vital to the healing of burn wounds. Therefore, malnutrition increases the mortality rates of burn patients (Ishida et al., 2014; Yu, Hunter, Perry, & Cross, 2016). The mortality rate among malnourished patients was 3 to 4 times higher than well-nourished patients (Saunders, Smith, and Stroud, 2011).

2. BACKGROUND

There are many risk factors for nutrition could cause impaired healing of the wound. Inadequate intake, overeating and lack of specific nutritional elements could lead to malnutrition. Malnutrition risk factors include poor appetite and specific nutrient deficits. In addition to poor appetite, the inability to feed oneself or requiring assistance to eat, impaired senses of taste and smell, or simply inadequate or excessive intake of calories, protein, fluids, or micronutrients (Stotts, 2012).

Malnutrition result of impaired or inadequate absorption of protein and energy is one of the major kinds of malnutrition, which lead to break down of body protein for energy, decreasing the supply of amino acids that attributed to conserve needed protein, enhance healing process and lead to lack of body mass. Impaired or inadequate absorption of protein and energy could attribute to lack of healing in wounds. PEM could be refer reduction in lean of body mass or undesirable loss of weight reached to 5% and more that associated with loss of body mass and wasting muscle (Corilee, 2002).

The goal of healing is to improve the process of healing using debridement of wound with utilization of local enzymatic preparation and performing dressing frequently. However, it takes longer to prepare a clean wound bed after deep thermal burns than after superficial burns. A clean wound bed is necessary for epidermal migration to occur and the burn to heal. The longer preparation time increases the period during which the patients tolerate high intensity pain. Furthermore, wounds take long time for healing are more vulnerable for scar formation broadly. This is usually correlated with increased inflammatory period (Summer, Puntillo, Miaskowski, Green, & Levine, 2007).

Chronic or unhealed wounds is attributed to malnutrition due to prolongation of the inflammatory phase, a decrease in the proliferation of fibroblasts and the formation of collagen, in addition to a depletion in angiogenesis. The role of nutrition in the treatment of burn wound injuries has been recognized, and aggressive nutritional support after burn injuries has been now recommended (Yu et al., 2016). Future research on the care of burn patients should focus on a variety of areas, given the current survival rate of burn patients of over 97%. Major advancements in the past several decades have improved patient care such that significant future improvements in the survival rate would be more difficult.

However, improvements are still needed in individualized care, namely, the prediction of patient outcomes and the ability to tailor treatment to optimize functional recovery (American Burn Association, 2013). Improvements are also needed to accelerate wound closure and healing and to improve psychological care to promote successful reintegration. Therefore, research on inflammation control, infection, grafting, biomarkers, and rehabilitation will continue to improve individualized care and create new treatment options (Rowan et al., 2015).

STUDY OBJECTIVES.

The current study aimed to:

1. Assess the characteristics of burn patients in the burn unit at a General Hospital.
2. Assess the risk of malnutrition among burn patients at a General Hospital.
3. Determine the relationship between malnutrition risk and wound healing among patients admitted with burns

3. METHODS

3.1 Research design

A descriptive correlational research design was utilized in the current study.The STROBE checklist was used for reporting this research.

3.2. Research Question

Is there a relationship between malnutrition and wound healing in hospitalized patients with burns?

3.3. Setting:

The study was conducted in the burn unit at a Hospital. This unit is the only burn unit in the city, and it is affiliated with the Ministry of Health.

3.4. Sample:

A convenience sample of 70 patients hospitalized in burn unit at a General Hospital participated in the current study. The data were collected over a period of six months from June to November 2017.

3.5. Tools of data collection:

Three tools were used to collect data:

The first tool was a structured interview developed by the researchers after reviewing the recent relevant literature regarding burn characteristics and parameters, (Morton and Fontaine (2013). This interview consisted of two parts. The first part contained the socio-demographic characteristics of the patients, as age, sex, occupation, and marital status, and the burn characteristics and parameters, such as the burn degree, burn percent (total body surface area) and burn causes.

The second tool was the malnutrition risk assessment (MUST) scale developed by Elia, (2003). It aimed to assess the risk for malnutrition in adult patients, covering three items.

1- BMI was divided into three levels as follows:

>20 or >30, which was assigned a score of zero, >18.5 to 20, assigned a score of one, and <18.5, assigned a score of two.

2- The undesirable loss of weight through the most recent three to six months was divided into three levels as follows:

<5% undesirable weight loss scored zero, 5 to 10% undesirable weight loss scored one, and greater than 10% undesirable loss of weight was scored two.

3- Acute disease effect was considered, and two was added to the total score if the patients did not have any oral feeding for more than five days. The total score was divided into three levels as follows: a score of zero was classified as low risk, a score of two was considered intermediate risk, and a score of greater than two was classified as high risk. The sensitivity and specificity of the MUST scale was tested and were both ≥ 95% (Elia, 2003), and the concurrent validity of malnutrition screening tool with similar tools was tested in practical field (Stratton, King, Stroud, Jackson, & Elia, 2006).

The third tool was the pressure ulcer scale for healing (PUSH) version 3.0, which was developed by the National Pressure Ulcer Advisory Panel. It aimed to assess pressure ulcer wound healing. It was then modified to assess burn wound healing. It included three items namely: **total surface area of the burn** expressed as a percentage of the total body area; **the presence of exudates**, scored from one (no exudate) to three (heavy exudate); and **the type of tissue**, scored from zero (closed) to four (necrotic). The total scale ranges from zero (indicating a healed burn), to 17, (indicating an unhealed burn). A comparison of the total scores over time provides an indication of the improvement or deterioration in burn wound healing.

After the development of the first tool and the translation of both the second and third tools into Arabic, the latter two tools were retranslated back from Arabic back to English to ensure their clarity.

3.6. Pilot study:

In order to ascertain the clarity and feasibility of the study tools, a pilot study was performed with 10% of the sample (7 patients). It aimed also to estimate the exact time needed, and detect any problems that the researchers might encounter that would interfere with data collection. The interview took 25 - 30 minutes. After conducting the pilot study, minor necessary changes were made. It involved mainly rephrasing some sentences and changing some terms. The tool was then finalized. Patients in the pilot study were not involved in study sample.

3.7. Content validity:

The content validity of the tools used was ascertained by a jury. The jury consisted of eleven academic experts in surgical nursing to ensure that the instruments used measured the intended variables and to evaluate the translation. Changes were made according to the expert opinions given by the jury.

3.8. Ethical considerations:

An approval number (03) was obtained from Research Ethical Committee (REC) to conduct the current study. The required official permission was obtained from the hospital director after explaining the study aims and processes before conducting the study. The researchers explained the aims and processes of the study to each patient and informed them of

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their right to refuse or withdraw from the study at any time without rationalization. The confidentiality and anonymity of the information gathered were ensured.

3.9. Data collection

The data collection started the beginning of June and ended at November 2017. It was three days weekly during two shifts (morning and afternoon). Data collection lasted for each patient around 25 to 30 minutes.

3.10. Statistical analysis

The data were managed and analysed using SPSS version 20. Computerized data were tabulated and analysed using descriptive statistics to investigate the research objectives.

4. RESULTS

The study results revealed that more than half (55.7%) the study patients were females, and the largest percentage (38.2%) of their ages ranged between 20 to less than 30 years old. Completion of preparatory school education was the most prevalent education level among the studied patients, and 45.6% of the patients were married (see Table I).

Moreover, the study results found that the burn characteristics and parameters were as follows: 42% of patients had burns caused by dry heat (flame), followed by 39.1% with burns caused by boiling fluid and 1.4% with burns caused by chemical substances. Furthermore, more than one-third (38.6%) of the patients had both first and second degree burns. Additionally, approximately 81.4% of the patients experienced burns due to accidents, and 75.4% of the burns occurred at home (see Table II).

Moreover, the study results demonstrate that the greatest proportion (47.8%) of the patients had a BMI ranging from 18.5 to 20. However, loss of weight in the last six months occurred in approximately two-thirds (63.2%) of the studied patients. It ranged between 5 to 10% of the total body weight (see Table 3). Additionally, more than one-third (38.6%) of the patients had a high risk of malnutrition, while 32.9% had a moderate risk, and 28.6% had a low risk.

The assessment of wound healing in the current study revealed that 17.1% of the patients did not have wound exudates, while 10% had heavy exudate. However, 34.3% and 38.6% had light and moderate exudate respectively. Regarding the tissue type, of closed wounds was 5.7% while that of the necrotic tissue was 4.3%. Epithelial tissue accounted for 40%, and granulation tissue represented 34.3% of the total wound area; whereas only 15.7% had sloughing tissue. The current study results revealed that the greatest proportion of patients with burns had total healing scores of 2, while 7 had lower healing scores (see Figure I).

Furthermore, the current results revealed that there were no significant relationship between the burn degree and the risk of malnutrition (see Table IV). No statistical significant relationship between total wound healing scale and the malnutrition risk level was found among the studied patients.

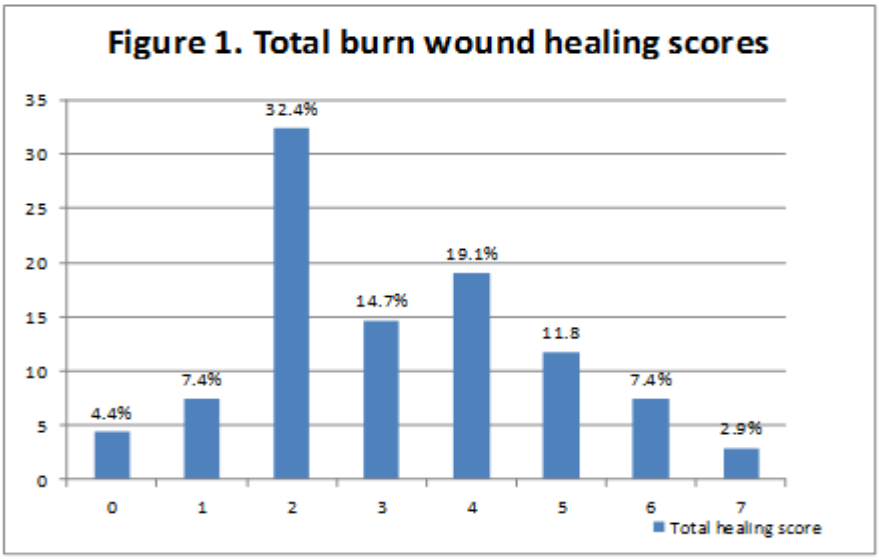

Figure I: Relationship between malnutrition and wound healing in patients with burn

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Table I: Socio-demographic characteristics of the study patients

Socio-demographic characteristics	N (%)
• Gender	
Male	39 (55.7%)
Female	31 (44.3%)
• Age (years)	
<20	4 (5.9%)
20 - <30	26 (38.2%)
30 - <40	13 (19.1%)
40 - <50	11 (16.2%)
50 - <60	9 (13.2%)
≥60	5 (7.4%)
• Education level	
Illiterate	14 (20.0 %)
Primary	11 (15.7%)
Preparatory school	21 (30%)
Secondary	13 (18.6%)
University	11 (15.7%)
• Marital status	
Single	26 (38.2%)
Married	31 (45.6%)
Divorced	3 (4.4%)
Widowed	8 (11.8%)

Table II: Burn characteristics and parameters

Burn characteristics and parameters	N (%)
• Burn causes	
Dry heat (flame)	29 (42.0%)
Boiling fluid	27 (39.1%)
Hot equipment	7 (10.1%)
Electricity	2 (2.9%)
Ray substance	3 (4.3%)
Chemical substances	1 (1.4%)
• Burn degree	
First	4 (5.7%)
Second	7 (10.0%)
Third	14 (20.0%)
First and second	27 (38.6%)
First and third	3 (4.3%)
Second and third	10 (14.3%)
First, second and third	5 (7.1%)
• Burn circumstances	
Suicide	12 (17.1%)
Accident	57 (81.4%)
Criminal	1 (1.4%)
• Burn place Home	52 (75.4%)
Work	15 (21.7%)
Others	2 (2.9%)

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Table III: Malnutrition risk assessment using the MUST scale

MUST scale	N (%)
• Body mass index (BMI) - < 18.5 - 18.5 - 20 - >20	 9 (13.0%) 33 (47.8%) 27 (39.1%)
• Weight loss in last 6 months - <5% - 5 – 10% - >10%	 43 (63.2%) 24 (35.3%) 1 (1.5%)
• Nothing per mouth for more than five days	0 (0.0%)

Table IV: Relationship between malnutrition risk and burn degree among studied patients

Burn degree	Malnutrition risk level			P-value
	Low	Medium	High	
First degree	2 (2.9%)	2 (2.9%)	0 (0.0%)	0.474
Second degree	3 (4.3%)	2 (2.9%)	2 (2.9%)	
Third degree	2 (2.9%)	5 (7.1%)	7 (10.0%)	
First and second degree	7 (10.0%)	8 (11.4%)	12 (17.1%)	
First and third degree	2 (2.9%)	1 (1.5%)	0 (0.0%)	
Second and third degree	2 (2.9%)	5 (7.1%)	3 (4.3%)	
First, second and third degree	2 (2.9%)	0 (0.0%)	3 (4.3%)	

5. DISCUSSION

Mortality rate is increased relatively in burn wounds that cover large areas and in elderly patients (Jackson et al., 2014). However, Rate of survival for hospitalized patients with burns has positive progress usually through the last four decades. The improvement could be associated with improved quality of wound care (Rowan et al., 2015). However, the process of wound healing still challenging practical problem, and adequate care of wound is crucial (Sami et al., (2019). In this respect, it is essential that nutrient requirements are met to optimize burn wound healing, especially in patients with burns exceeding 20% of their total body surface (TBSA) (Prins, 2013). Therefore, the current study aimed to assess the burn characteristics and circumstances and risk of malnutrition in patients with burns to found out the association between wound healing and malnutrition risk in patients with burns.

The current study was conducted with a convenience sample of 70 patients with different burn characteristics and circumstances. The study results revealed that more than half the study patients were females, and the highest percent were in the 20-30 year age range. Preparatory school education was the most prevalent education level among the studied patients. Additionally, less than half of them were married, and more than one-third were single. These results contrasted with the results of a retrospective study conducted with 1363 patients with burns in Sweden from 2000 to 2015, which reported that 70% of those patients were males (Abdelrahman, Fredrikson, & Steinvall, (2018). This difference could be related to cultural differences.

Moreover, the study results found that more than two-fifths of the burns were caused by dry heat (flame) and nearly two-fifths were caused by boiling fluid. This result agrees with the report by Wounds International (2014), which stated that burn injuries result of dry heat are usually noticed in people in both sex that are working and their age ranged from 15 to 64 years old in developing countries. Agree with them the study by Lami, and Al Naser (2019) which revealed that young people, and males, children and low educated patients are the most patients with burn hospitalized in Iraq. This

demonstrates a similarity in one burn circumstance despite differences in cultures and ways of life. Additionally, consistent with the study of Abdelrahman et al. (2018), which revealed that flames caused almost half the burns in study patients in Sweden, while chemical burns accounted for the smallest proportion of patients. In the same study, the mean age of patients with burns was 32.9 years old. Consistent with these results, the study by Lami, and Al Naser (2019) which reported that flame and scalds were also the most common causes of burn among patients in Iraq.

The current study results showed that most patients have more than one degree of burn, with more than one-third of the studied patients having first and second degree burns. Additionally, more than three-quarters of the patients were burned by accident, and three-quarters of them were burned at home. The assessment of wound healing in the current study revealed that the lowest percentages of patients had heavy exudates and no exudates, while more than one-third of the patients had light exudates and less than two-fifths had moderate exudates. In addition to tissue types, the lowest percentages of patients had closed wounds and necrotic tissue. On the other hand, two-fifths of patients developed epithelial tissue, and more than one-third developed granulation tissue. Less than one-fifth of the patients developed sloughing tissue. Nearly one-third of the patients had total healing scores that indicated close to complete healing was occurring. This finding could be attributed to the patients' age, with the highest percentage falling between 20 and 30 years, which affect the burn healing process. In contrast, older patients with burns are vulnerable to impaired or delayed wound healing as a result of age-related changes (Keylock et al., 2008). Moreover, increased age and total body surface area were independently, significantly associated with wound healing failure as reported by Rittenhouse et al. (2019). On the other hand, the process of wound healing is influenced by patient's gender as stated by Gilliver, Ashworth, &Ashcroft, (2007), who found that male patients need more time for wound healing than female patients; and this goes in the same line of the current study which found that more than half the study patients were females.

Meanwhile, there were no statistically significant associations between the degree of the burn and malnutrition risk. Similarly, none statistically significant association between total wound healing scale and malnutrition risk among studied patients was found. The results revealed that more than one-third of the studied patients had a high risk of malnutrition, and another approximately one-third of them had a moderate risk.

Additionally, nutrition is known as very crucial which impact the healing of the wound. it is clear that lack of specific nutritional elements can affect extremely on the process of wound healing, Morton and Fontaine (2013). Therefore, the correlation between the risk of malnutrition and wound healing found in this study did not match the prediction; however, this could be due to the high percentage of study participants who were female. Additionally, most of the patients included in the study were younger than fifty years, which could also increase the rate of healing. Moreover, none of the patients parenteral nutrition in the five days before data collection; the oral administration of nutrients could be more helpful for improving the healing process.

6. CONCLUSION

The current study results revealed none statistically significant relationship between burn severity and level of malnutrition risk or wound healing. Although more than one-third of the study patients were at high risk for malnutrition, this lack of a significant relationship could be attributed to burn circumstances and patient characteristics such as age and gender. However**,** increased attention to basic nutrition and the provision of appropriate supplements might assist in burn wound healing.

6.1 Relevance to clinical practice: According the study results the patients characteristics as age however patients ranged in age from 20 to less than 30 years could have increasing in healing process than older. Furthermore, female gender burn wound healed more than male gender also ideal weight is an effective factor that leads to avoid burn wound complication as delayed healing. Other factor should be considered is burn circumstances as burn causes and place of burn which affect the burn wound healing. Additionally, Although malnutrition risk can be predicted for patients hospitalized with burn but nutritional oral intake could be improve healing process.

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What does the current study added to the clinical field?

- The young adult women represented more than half patients hospitalized with burn.
- The greatest cause of burn was flame spit of cultures differences.
- There was no significant association between burn wound degrees and/or healing and malnutrition risk and this could be referred to patients' characteristics and burn circumstances.

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AUTHOR CONTRIBUTION

Author contribution: All authors are contributing to study, conception and design.

AMAL Baker Aboelatta and HANAN Hasan Elezaby are contributing to data collection.

EMAN SM Shahin is contributing to data analysis and interpretation.

Drafting of the article: **AMAL Baker** and **HANAN Hasan Elezaby** are contributing to drafting the article

Critical revision of the article: **NESRINE Ezzat Abdel-Karim** is contributing to article critical revision.

Paper submission: **NESRINE Ezzat Abdel-Karim** is contributing to submission process.

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