

# Nutritional status and quality of nutrition in chronic wound patients

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## Abstract

Malnutrition is a negative confounding factor influencing wound healing. The prevalence of malnutrition increases with age, as do chronic wounds. The aim of this prospective study was to analyse the nutritional status of patients with chronic wounds. Data collection of sociodemographic and nutritional parameters was based on an inter-professionally developed questionnaire as well as the Mini Nutritional Assessment (MNA). A total of 90 patients with chronic wounds of different aetiologies were included. Pain and dental health were found to be significant factors: Patients with malnutrition or the risk of malnutrition had significantly lower tooth and oral health scores ( $rs = -0.218$ ,  $P = .039$ ), and higher pain levels at rest ( $rs = 0.339$ ,  $P < .001$ ), while dressing ( $rs = 0.268$ ,  $P = .014$ ), and upon exercising ( $rs = 0.303$ ,  $P = .005$ ). Our data address the impact of nutrition on chronic wounds and confirm the relationship between pain, dental health, and nutritional status. Clinicians should be aware of adequate pain management and dental health care in chronic wound patients. Further studies, particularly on characterisation of preventive and therapeutic measures in the nutrition of chronic wound patients, are of great importance.

## KEYWORDS

leg ulcer, malnutrition, wound healing, wounds

## 1 | INTRODUCTION

The prevalence of chronic wounds, such as venous leg ulcers, increases with age.<sup>1</sup> It is estimated as 1.69%<sup>2</sup> for people over 65 years of age and ranges from 0.87% to

3.38%<sup>3,4</sup> for those over 80. The majority of chronic wounds are due to vascular causes. About 57% to 80% of leg ulcers are caused by venous insufficiency, 10% to 25% by arteriosclerosis, and 5% to 12% by diabetic angiopathy.<sup>5</sup> Chronic wounds are a great burden for

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those affected and the health care and social system due to incapacitating symptoms associated with the disease, such as pain, immobility, wound odour, and discharge, the chronic course of the disease, which can lead to social withdrawal and isolation.<sup>6</sup> Wound care is complex, and treatments are expensive; it requires interdisciplinary management and intensive medical and nursing care, and therefore is of considerable health economic relevance.<sup>7</sup>

A healthy diet and a physiological nutritional status are basic prerequisites for the proper healing of wounds.<sup>8,9</sup> A sufficient and balanced supply of the necessary nutrients, including carbohydrates, proteins, fats, and micronutrients, such as vitamins, zinc, and magnesium is beneficial for wound healing, well-being, and ultimately the quality of life of patients. In contrast, a deficiency of these elements leads to deterioration of healing, restrictions in immune functions, and tissue neogenesis.<sup>10-12</sup> An association between the development of decubitus and malnutrition has been proven by numerous studies.<sup>13,14</sup> Data on malnutrition and leg ulcers, although less extensively available, also indicate an increased rate of nutritional problems in affected patients. It has been shown that patients with venous leg ulcers have a significantly increased risk of malnutrition compared with an age-appropriate control group.<sup>15</sup> In addition, it could be shown that older patients with leg ulcers frequently have a deficiency of zinc, carotenes, and vitamins A, E, and C.<sup>16</sup> A study from Germany with 33 patients, showed a risk of malnutrition in one-third of the investigated inpatients with leg ulcers.<sup>3</sup> The proportion of patients suffering from pain is very high in chronic wounds, a negative influence on the quality of life, and wound healing has been described.<sup>6</sup> A risk for malnutrition in chronic pain has also been shown.<sup>17</sup> However, the hypothesised association of malnutrition with chronic pain in wound patients is less well studied. With the ageing process, the risk of malnutrition increases disproportionately due to physical, psychological, social, and economic limitations.<sup>18-20</sup> Current data, for example, show an increasing risk of inadequate tooth status, a basic prerequisite for physiological nutrition.<sup>21</sup> Malnutrition is not only caused by too little or too much food, but also by insufficient intake of certain nutrients.<sup>17</sup>

Overall, it can thus be seen that patients with chronic wounds frequently suffer from malnutrition not only because of the symptoms of the disease itself<sup>3,4,9,17</sup> but also because of the sociodemographic pattern of the disease. Consequently, the assessment of the nutritional status on the one hand and treatment of possible nutritional deficiencies on the other hand are of great importance for patients with chronic wounds; the guideline-oriented care of patients with chronic wounds should therefore take nutrition into account accordingly.

## Key Messages

- the nutritional status has a relevant influence on wound healing; therefore, the diagnosis, therapy, and prophylaxis of malnutrition are important elements of wound therapy
- nutritional status of 90 patients with chronic wounds was prospectively analysed to characterise the potential risk factors of malnutrition in this patient group
- about one-third (31.1%, 28/90) of all patients showed malnutrition or risk of malnutrition
- pain as well as dental health could be identified as significant risk factors for malnourishment in chronic wound patients

Although the connection between malnutrition and chronic wounds, such as *ulcus cruris*, could be shown, the prevalence and the influencing factors are not yet sufficiently clarified.<sup>8</sup> Therefore, the aim of the present study was to analyse the current nutritional status of a larger cohort of patients with chronic wounds, especially with regard to possible influencing factors of malnutrition.

## 2 | MATERIALS AND METHODS

We performed a cross-sectional, non-interventional prospective cohort study. Patients were recruited between January 2011 and December 2013. Inclusion criteria were the presence of a chronic wound of any origin and an age of at least 18 years. Participation in further nutritional studies, gastrointestinal and digestive disorders (severe pre-existing digestive diseases that are not associated with the wound disease, for example, malabsorption syndromes, gastric or intestinal resection), pregnancy and breastfeeding were exclusion criteria. The approval of the local ethics committee was obtained.

### 2.1 | Data collection

Data were collected using a standardised paper-based case report form. Physician's case report form (CRF) comprised data on general health status, anamnesis history, and wound status, eg, age, weight, physician-assessed mobility, comorbidities, medication, and wound size. Patients were asked for sociodemographic information,

patient-assessed mobility, dental health, drink and tobacco consumption, nutritional habits, general health status, and wound pain. The pain was assessed using a visual analogue scale from 0 to 10 (0 = *no pain* to 10 = *maximum possible pain*) in the categories pain at rest, during the change of dressing and movement. Furthermore, walking without pain was quantitated (not possible,  $\leq 10$  minutes,  $\leq 30$  minutes,  $\geq 1$  hour).

For the assessment of nutritional status, several questionnaires were evaluated by an interdisciplinary team of physicians, wound experts, and nutritionists: Subjective Global Assessment (SGA),<sup>22</sup> Instrument for the Nursing Assessment of Malnutrition and Its Causes (PEMU),<sup>23</sup> Nutritional Risk Screening (NRS),<sup>24,25</sup> Malnutrition Universal Screening Tool (MUST),<sup>24,26</sup> and the Mini Nutritional Assessment (MNA).<sup>27</sup> The selected questionnaire was the Nutritional Assessment MNA—Long Form (MNA-LF), included questions on dental status, sociodemography, eating habits, and information on health status. The MNA-LF has proven to be a valid, reliable instrument for identifying malnutrition and the risk of malnutrition, especially in older people.<sup>28</sup> The patient individual result of the questionnaire is a sum score ranging from 0 (worst score in terms of nutritional status) to 30 points (best score in terms of nutritional status). Out of this score, the categories normal nutritional status (24–30 points), risk of malnutrition (17–23.5), and malnutrition (0–16.5 points) can be classified.

Missing data were not imputed. Data management and analysis were performed with SAS 9.3 (SAS for Windows 2000, SAS Institute Inc., New York, New York, German version).

Variables collected, including the primary target criteria MNA-LF, were evaluated exploratively using standard statistical measures: absolute and relative frequencies for categorical data and mean, SD, median, and range for continuous data. The categories (normal nutritional status, risk of malnutrition, malnutrition) of the MNA were correlated with various secondary objective criteria to identify possible factors influencing the nutritional status of wound patients.

The secondary objective criteria include variables from the sociodemographic areas (age, school-leaving certificate, and housing situation), nutrition (nutritional awareness and hunger, eating and drinking habits, preparation of meals), health status (mobility, walking without pain), tooth and mouth status, and wound size (cm<sup>2</sup>). The oral and dental health score was based on the questions of wearing, fit and functionality of a denture, possible inflammation, dryness, or pain in the oral cavity, and pain in the temporomandibular joint. These also included a self-assessment of general health (0 = *worst condition* to

10 = *best possible condition*), wound condition (0 = *worst condition* to 10 = *best possible condition*), and pain (rest pain, dressing change, and movement) (0 = *no pain* to 10 = *maximum pain*). For categorical secondary objective criteria, Pearson's chi-squared test was used, and for the ordinal and continuous influencing variables, the ranking correlation, according to Spearman.

For group comparison, the MNA groups were dichotomised into *not malnourished* and *malnourished, or risk of malnutrition* and a median split was performed for dichotomisation of the variable age. The categorisation was made into under 68 years and 68 years or older.

### 3 | RESULTS

#### 3.1 | Sociodemographic characteristics, wound aetiology, and nutritional status

Out of 102 patients recruited for this study, 90 patients were included in the analysis with a complete data set (Table 1). More than half of the patients (49/90) were men, the mean age was 66.6 years (SD = 13.7). The mean waist-hip ratio was 1.0 (SD = 0.1) for men and 0.9 (SD = 0.1) for women; 93.0% of men and 97.0% of women were overweight or obese (waist-hip ratio  $\leq 0.9$  in men,  $\leq 0.8$  in women). The mean body mass index (BMI) was 29.2 kg/m<sup>2</sup> (SD = 7.7) and did not differ according to gender. Regarding the wound entity, BMI showed only slight differences. In patients with venous ulcers it was 30.6 (39/90, SD = 8.8), in ischaemic wounds 29.0 (SD = 4.5), in diabetic foot wounds 27.0 (SD = 5.2), and in immunological wounds (including pyoderma gangrenosum and vasculitis) 28.0 (SD = 6.7).

About one-third of the patients (28/90, 31.1%) showed malnutrition, or a risk of malnutrition, with 34.9% among patients <68 years and 27.7% of patients  $\geq 68$  years old. With 39.3%, the minority of patients lived alone. The educational status did not differ significantly between age groups; the largest proportion had a secondary school-leaving certificate (66/90, 73.3%), and 10 out of 90 persons (11.1%) had the high school-leaving certificate or the matriculation standard for university entrance. Nearly three-quarters (64/90, 71.1%) of the patients were not employed, of whom 82.0% were retired (50/64). About two-thirds (57/90, 63.6%) stated that they were able to walk pain-free for 30 minutes. In the group of malnourished patients, more patients developed pain within 30 minutes of movement compared with physiologically nourished patients (76.0% versus 64.5%,  $P \leq .05$ ). The analysis of the relationship between housing situation

**TABLE 1** Sociodemographic characteristics of the study population stratified by nutritional status

		Not malnourished		Malnourished/ risk of malnutrition		Total	
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Gender	Male	33	53.2	16	57.1	49	54.4
	Female	29	46.8	12	42.9	41	45.6
	Total	62	100.0	28	100.0	90	100.0
	Missing	0		0		0	
Age	<68 y	28	45.2	15	53.6	43	47.8
	≥68 y	34	54.8	13	46.4	47	52.2
	Total	62	100.0	28	100.0	90	100.0
	Missing	0		0		0	
Housing situation	Living alone	22	39.3	11	39.3	33	39.3
	Not living alone	34	60.7	17	60.7	51	60.7
	Total	56	100.0	28	100.0	84	100.0
	Missing	6		0		6	
Painless walking	0 min	5	8.5	3	12.0	8	9.5
	≤10 min	9	15.3	8	32.0	17	20.2
	≤30 min	24	40.7	8	32.0	32	38.1
	≥1 h	21	35.6	6	24.0	27	32.1
	Total	59	100.0	25	100.0	84	100.0
	Missing	3		3		6	
Education	No degree	3	5.1	1	3.7	4	4.7
	Lower secondary school	23	39.0	11	40.7	34	39.5
	Secondary school	22	37.3	10	37.0	32	37.2
	Advanced technical college	3	5.1	0	0.0	3	3.5
	General qualification for university entrance	5	8.5	2	7.4	7	8.1
	Other	3	5.1	3	11.1	6	7.0
	Total	59	100.0	27	100.0	86	100.0
	Missing	3		1		4	
Working life	Yes	15	25.4	8	28.6	23	26.4
	No	44	74.6	20	71.4	64	73.6
	Total	59	100.0	28	100.0	87	100.0
	Missing	3		0		3	
Reasons for unemployment	Retired	36	85.7	14	73.7	50	82.0
	Housewife/–man	0	0.0	1	5.3	1	1.6
	Job-seeking	3	7.1	1	5.3	4	6.6
	Other causes	3	7.1	3	15.8	6	9.8
	Total	42	100.0	19	100.0	61	100.0
	Missing	20		9		29	

and age group, as well as nutritional status, showed no statistical significance. For the individual subareas of nutrition, mobility, school-leaving qualifications, and

nutritional status, no correlation could be observed either.

### 3.2 | Wound causes

The distribution of wound causes is shown in Figure 1. The wounds were predominantly vascular wounds (54/90, 60.0%), with the proportion of venous wounds (39/90, 43.3%) being greater than that of ischaemic wounds (15/90, 16.6%).

### 3.3 | Information on health and nutritional status and wound status

The patients assessed their state of health with an average of 5.6 points (SD = 1.5; Min = 2.0; Max = 9.0), their wound condition with an average of 4.5 (SD = 2.1; Min = 0.0; Max = 10.0) each on a scale from 0 to 10 (Table 2). The mean score for the dental and oral health of the overall sample was 6.4 (SD = 2), with the two nutritional status groups differing by one score point. Nutritional awareness and hunger showed small differences between the nutritional groups, with a total mean of 3.6 points (SD = 1.0). Assessment of eating behaviour was an average of 8.9 points (SD = 2.2) in the physiologically fed and 8.5 points (SD = 2.0) in the malnourished patient group and at risk patients. The values for drinking behaviour and food preparation did not significantly differ between the two groups. The general health status was indicated by the normally fed group with an average value of 8.7 (SD = 1.8), in the group of malnourished patients and in patients at risk a slightly lower value of 8.6 (SD = 1.6) was observed.

On average, the wounds were 7.9 cm<sup>2</sup> (minimum 0.1 cm<sup>2</sup>, maximum 92.0 cm<sup>2</sup>), the average wound size

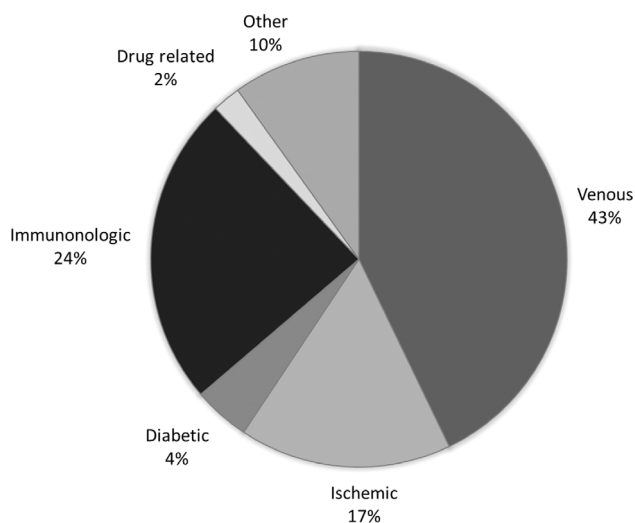
was significantly larger in the group of patients at risk or evident malnutrition (5.4 cm<sup>2</sup> versus 14.2 cm<sup>2</sup>). This is also evident in the variables rest pain, pain during dressing change, and pain during movement. In all cases, the assessment of malnourished patients or patients at risk was on average at least, 1.6 points higher than that of the normally nourished group (Table 2).

### 3.4 | Nutritional status and health and wound characteristics

A significant correlation between the occurrence of pain and malnutrition, as well as lower dental and oral health, and a deficient nutritional situation could be demonstrated. In detail, a significant correlation ( $r_s = 0.303$ ;  $P = .005$ ) with nutritional status was observed in the ranking correlation of the variables dental and oral health ( $r_s = -0.218$ ;  $P = .039$ ), rest pain ( $r_s = 0.339$ ;  $P = .001$ ), pain during dressing change ( $r_s = 0.268$ ;  $P = .014$ ), and pain during exercise ( $r_s = 0.303$ ;  $P = .005$ ). In all other areas, no significant correlations were observed. The mean wound size was slightly larger in the group of malnourished patients, but the difference was not significant. The general state of health, eating behaviour and assessment of wound condition was similar (Table 2).

## 4 | DISCUSSION

A positive nutritional status is a basic prerequisite for the proper healing of wounds.<sup>16</sup> The relationship between malnutrition and chronic wounds, such as leg ulcers, has already been demonstrated,<sup>3,12</sup> although little is known about predictors of malnutrition. The aim of the present study was, therefore, to analyse the nutritional situation of patients with chronic wounds in a university outpatient clinic and to discriminate against possible predictors of malnutrition. Previous data on the incidence of malnutrition in venous leg ulcers are mainly based on analyses of the BMI. In a review, Barber et al showed that 87.2% of all patients were overweight or obese.<sup>29</sup> With a mean BMI of 29.2 kg/m<sup>2</sup> and a rate of 93.0% and 97.0% overweight in males and females, respectively, as measured by the waist-hip ratio, our observations correspond to these data. MNA was used far less frequently as a tool for assessing nutritional status.<sup>29</sup> About one-third (31.0%) of the patients showed a risk or manifested malnutrition based on the MNA. This rate corresponds to Graue et al investigating 41 inpatients who also used MNA as a measuring instrument.<sup>3</sup> For comparison, this rate was 42.0% observed in 122 venous leg ulcer patients by Finlayson.<sup>30</sup>



**FIGURE 1** Wound aetiology, cause of wound healing disorder in  $n = 90$  patients (a total of 91 causes were documented, one patient had several wounds of different genesis)

**TABLE 2** Correlation of the individual variables in the areas of sociodemography, health status, wound characteristics, eating behaviour and pain with nutritional status using the MNA-LF

Variable	Nutritional status	n	Mean	SD	Median	Min	Max	Missing	$r_s(\rho)^a$	P-value <sup>b</sup>
General health condition	Not malnourished	62	<b>8.7</b>	1.8	9.0	0.0	10.0	0	-0.178	.093
	Malnourished/risk of malnutrition	28	<b>8.3</b>	1.6	9.0	4.0	10.0	0		
	Total	90	<b>8.6</b>	1.7	9.0	0	10.0	0		
Education	Not malnourished	56	<b>2.7</b>	1.0	3.0	1.0	5.0	6	-0.043	.703
	Malnourished/risk of malnutrition	24	<b>2.6</b>	0.9	2.5	1.0	5.0	4		
	Total	80	<b>2.7</b>	1.0	3.0	1.0	5.0	10		
Dental health	Not malnourished	62	<b>6.7</b>	1.7	7.0	0.0	8.0	0	-0.218	<b>.039*</b>
	Malnourished/risk of malnutrition	28	<b>5.7</b>	2.4	6.0	0.0	8.0	0		
	Total	90	<b>6.4</b>	2.0	7.0	0.0	8.0	0		
Nutritional awareness and a feeling of hunger	Not malnourished	62	<b>3.7</b>	1.1	4.0	0.0	5.0	0	-0.145	.172
	Malnourished/risk of malnutrition	28	<b>3.5</b>	1.0	3.5	2.0	5.0	0		
	Total	90	<b>3.6</b>	1.0	4.0	0.0	5.0	0		
Nutrition habits	Not malnourished	62	<b>8.9</b>	2.2	9.0	0.0	12.0	0	-0.129	.226
	Malnourished/risk of malnutrition	28	<b>8.5</b>	2.0	9.0	4.0	12.0	0		
	Total	90	<b>8.8</b>	2.2	9.0	0.0	12.0	0		
Drinking habits	Not malnourished	62	<b>1.7</b>	0.5	2.0	0.0	2.0	0	0.034	.750
	Malnourished/risk of malnutrition	28	<b>1.8</b>	0.4	2.0	1.0	2.0	0		
	Total	90	<b>1.8</b>	0.5	2.0	0.0	2.0	0		
Food preparation	Not malnourished	62	<b>5.1</b>	1.1	5.0	0.0	6.0	0	-0.060	.577
	Malnourished/risk of malnutrition	28	<b>5.1</b>	0.9	5.0	3.0	6.0	0		
	Total	90	<b>5.1</b>	1.0	5.0	0.0	6.0	0		
Self-assessment of health status	Not malnourished	59	<b>5.6</b>	1.5	5.1	2.0	8.1	3	-0.017	.874
	Malnourished/risk of malnutrition	28	<b>5.6</b>	1.7	5.1	2.0	9.0	0		
	Total	87	<b>5.6</b>	1.5	5.1	2.0	9.0	3		
Self-assessment of the wound condition	Not malnourished	59	<b>4.8</b>	2.2	4.9	0.0	10.0	3	-0.177	.101
	Malnourished/risk of malnutrition	28	<b>4.0</b>	2.0	3.8	0.0	9.0	0		
	Total	87	<b>4.5</b>	2.1	4.9	0.0	10.0	3		
Wound size	Not malnourished	40	<b>5.4</b>	9.2	2.0	0.1	43.8	22	0.186	.170
	Malnourished/risk of malnutrition	16	<b>14.2</b>	24.1	3.0	0.2	92.0	12		
	Total	56	<b>7.9</b>	15.3	2.1	0.1	92.0	34		
Pain at rest	Not malnourished	58	<b>2.3</b>	2.3	1.5	0.0	8.2	4	0.339	<b>.001*</b>
	Malnourished/risk of malnutrition	28	<b>3.9</b>	2.3	3.9	0.1	8.2	0		
	Total	86	<b>2.8</b>	2.4	2.3	0.0	8.2	4		

(Continues)

TABLE 2 (Continued)

Variable	Nutritional status	n	Mean	SD	Median	Min	Max	Missing	$r_s (\rho)^a$	P-value <sup>b</sup>
Painless walking	Not malnourished	59	<b>3.0</b>	0.9	3.0	1.0	4.0	3	-0.175	.111
	Malnourished/risk of malnutrition	25	<b>2.7</b>	1.0	3.0	1.0	4.0	3		
	Total	84	<b>2.9</b>	1.0	3.0	1.0	4.0	6		
Pain during dressing change	Not malnourished	57	<b>2.3</b>	2.4	1.3	0.0	8.8	5	0.268	<b>.014*</b>
	Malnourished/risk of malnutrition	27	<b>4.0</b>	3.1	4.5	0.0	10.0	1		
	Total	84	<b>2.8</b>	2.7	2.4	0.0	10.0	6		
Pain during movement	Not malnourished	57	<b>3.1</b>	2.5	2.6	0.0	9.0	5	0.303	<b>.005*</b>
	Malnourished/risk of malnutrition	27	<b>4.9</b>	2.7	5.0	0.0	8.8	1		
	Total	84	<b>3.7</b>	2.7	3.6	0.0	9.0	6		

Note: Self-assessment of health (0 = worst condition to 10 = best possible condition), wound condition (0 = worst condition to 10 = best possible condition), wound size (cm<sup>b</sup>) and pain (rest pain, change of dressing and movement) (0 = no pain to 10 = maximum possible pain), painless walking (1 = not possible, 2 = less or equal 10 min, 3 = less or equal 30 min, 4 = equal or more 1 h). The bold values in this table represent Mean Score Value.

Abbreviations: Max, maximum; Min, minimum.

<sup>a</sup>Spearman's rank correlation coefficient.

<sup>b</sup>Security probability  $\alpha \geq 0.05$ .

\*Significant correlation.

Szewczyk showed a significantly higher malnutrition rate of 68.0% in 37 leg ulcer patients, whereas with 35.0% this rate was also high in the comparison group of vascular patients without wounds. Here the heterogeneity in wound aetiologies in our study has to be taken into account regarding generalizability. Due to the heterogeneous morbidity profile of the different wound causes of our cohort, for example, immunological wounds compared with venous ulcers, differences in nutritional status, dental status, and pain profile can be expected. However, in order to be able to discriminate significant differences, the case numbers in the subgroups are too small.

Further studies have also shown that wound patients often have a protein deficiency and a deficiency of micro-nutrients such as vitamins A, E, carotenes, zinc, and iron.<sup>31-33</sup> In comparison to the general population, the rate of one-third of malnourished patients can be estimated to be significantly higher. The data on malnutrition vary, with 1.0% for elderly people, between 17.0% and 60.0% for hospitalised people, and from 37.0% to 85.0% for nursing home residents. With a proportion of over 90.0%, the wound patients of this cohort are predominantly overweight. This corresponds to data from examination of patients with venous leg ulcers but contrasts with that from decubitus ulcer patients.<sup>12</sup> This underlines that overweight patients must also be

classified as malnourished. This aspect is also supported by the study by Renner et al in which venous leg ulcer patients had significantly higher BMI values in combination with relevant lower values for important trace elements compared with the control group.<sup>34</sup> Thus, it could be shown that in patients with venous leg ulcers the proportion of overweight patients was significantly higher, but there was also albumin and vitamin deficiency, in particular of vitamin A, C, and E, as well as zinc.<sup>15,31-33,35</sup> Thus, it is not only the consequences of obesity itself, for example, the impeded venous return flow of blood from the legs, but also the lack of relevant nutrients that favour the development and chronification of wounds. The analysis of potential influencing factors showed a significant correlation between nutritional status and tooth and mouth status as well as the pain profile. The correlation coefficient for these influencing factors varied between 0.268 and 0.339 and was -0.218 for the relationship between tooth and mouth status and nutrition status, which Cohen has described as a light to the medium relationship.<sup>36</sup> In addition, the group of malnourished patients showed a larger, albeit not significant, wound size. It is easy to comprehend that oral and periodontal discomfort has a negative effect on food intake.<sup>21</sup> A disabled food intake due to a chronic intraoral inflammatory process such as, for example, a carious dental status or, however, physical obstacles to

food intake such as a poorly fitting prosthesis, can lead to a reduced supply of nutrients.<sup>21</sup> Recent studies also show poor dental care for people in nursing homes,<sup>37</sup> a group of patients characterised by multiple morbidities, and as well an increased risk of developing chronic wounds.

Pain favours the development of malnutrition, especially through its negative effect on appetite. The association of chronic, non-malignant pain and loss of appetite could be proven by Bosley et al.<sup>17</sup> Both the relatively low mean age of 66.6 years and the distribution of wound causes indicate selection bias despite a large number of patients. The large proportion of immunological wounds, arterial ulcers, diabetic foot wounds, and decubital ulcers are not representative. This may be explained as a result of the recruitment in a university wound ambulance with a dermatological specialisation. On the other hand, in a university outpatient clinic, the proportion of complicated and often long-term diseases is high, which suggests a high malnutrition rate. Consequently, the available data could not confirm the previously observed connection between advanced age and the occurrence of malnutrition.<sup>18,20</sup> The proportion of patients living alone (35.6% of those over 68) and those who can make good self-assessment of health and wound conditions are also remarkably low within our cohort. An association between living alone and the development of malnutrition is described especially in older and isolated persons.<sup>19,20,38,39</sup> Although data collection has already taken place from 2011 to 2013, it is not likely that they have lost any of their topicality, as it is not to be expected that relevant changes in the nutritional status of chronic wound patients in Germany have occurred.

The available data underline the importance of nutrition in wound patients, as well as, the necessity of suitable screening methods. In this group of patients with chronic wounds, which is large when compared with the previous studies, it is shown that wound patients have a significantly increased risk of suffering from malnutrition and that pain and unhealthy dental status favour its occurrence. Although our data are a cross-sectional snapshot, it emphasises the importance of the diagnosis of malnutrition and its influence on wound healing. It has been shown that a sole survey of weight, BMI, or waist-hip ratio is not sufficient to assess the nutritional status of wound patients. In addition to adequate wound therapy and interdisciplinary wound care, a structured diagnostic and therapeutic procedure for the prevention and therapy of malnutrition in patients with chronic wounds will be of decisive importance in the future. Our findings also underline the importance of adequate pain therapy and highlight oral health as a previously neglected aspect. Our data

suggest that the correct and pain-free fit of the denture is important and that oral health, for example, infection detection in these patients should be the focus of attention. Indications of compromised oral health can already be deduced by interviewing the patients. As part of wound management, oral health questionnaires and regular dental consultations should be established. The European guidelines for the management of pressure ulcer emphasise the importance of nutrition on the one hand, but on the other hand, due to the lack of methodological quality of the available studies, no evidence-based recommendations are currently available for various aspects of diagnostics, therapy, and prevention.<sup>40</sup> Future investigations will have to clarify in detail the form and periodicity of suitable screening tools as well as which approaches in therapy and prevention are appropriate and promising.<sup>31</sup>

## CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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