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Prevalence of Malnutrition in Alcoholic and Nonalcoholic Medical Inpatients: A Comparative Anthropometric Study

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ABSTRACT. Available data on the nutritional status of alcoholics is controversial. The present study was conducted to assess the frequency of malnutrition in alcoholic inpatients. The objectives were to (1) compare anthropometric data of hospitalized alcoholic and nonalcoholic patients and (2) evaluate the association between alcoholism and protein-energy malnutrition. It was a cross-sectional comparative study including a stratified analysis to control for potential confounding factors. Alcoholics were identified as patients with a score from the Michigan Alcoholism Screening Test ≥8 among patients admitted consecutively to the general wards of a department of internal medicine; they were matched for sex, age, and time of admission with nonalcoholic patients (Michigan Alcoholism Screening Test score ≤4). Nutritional status was assessed using weight, height, midarm circumference, and tricipital skinfold thickness values, which were then used to determine the Quetelet body mass index and the mid-arm muscle circumference. The study took place in general wards of internal medicine in a 1000-bed city and teaching hospital in Lausanne, Switzerland. The participants were 93 alcoholic patients and 93 controls aged 20 to 75 years, admitted from September 1, 1988, to March 18, 1989. Alcoholics were characterized by a low rate of severe protein-energy malnutrition (<5%); their average body weight was normal, similar to the weight of nonalcoholic inpatients, and not greatly influenced by the presence or severity of concomitant liver disease. However, tricipital skinfold thickness was lower in alcoholics than in nonalcoholics (8 mm *vs* 10 mm, $p < .05$, and 13 mm *vs* 20 mm, $p < .01$, in men and women, respectively). The association between alcoholism and protein-energy malnutrition (odds ratio 3.0, 95% confidence interval 1.6–5.7) remained positive when adjusted for smoking, liver disease, or occupational status. In conclusion, alcoholism was associated with poor nutritional status in hospitalized patients, although severe protein-energy malnutrition was infrequent. The results suggest that alcoholism-related malnutrition exists irrespective of the social and medical situation of the patient and is mostly related to caloric undernutrition. (*Journal of Parenteral and Enteral Nutrition* **17**:35–40, 1993)

Regular alcohol consumption is generally associated with modified diet habits and abnormal metabolic oxidation of nutrients. Calories from alcohol are generally added to the diet without significant modification of the nutrient intake profile.[1–4] Despite this excess energy intake, drinkers' weight is generally not different from nondrinkers' weight,[1–3] which may partly be explained by an inefficient utilization of ethanol.[5] This "noncaloric" thermogenic effect is due to the activation of the microsomal ethanol oxidizing system and is observed in the presence of a high alcohol intake.[5,6] This effect might explain why a significant replacement of nonalcoholic calories by ethanol, as is frequently found in alcohol abusers,[7,8] is associated with weight loss.[5]

Although many studies have shown that anthropometric measurements are lower in alcoholics than in the normal population,[9–12] it is largely unknown whether significant protein-energy malnutrition is frequent in alcoholic patients. Conversely, some studies have shown that alcoholics have an ideal or even excessive weight.[13,14] In a recent review of the association between alcohol intake and adiposity in the general population, the authors did not find convincing evidence to support either view.[15]

Alcohol abuse and dependence, as well as alcohol-related problems and diseases, are frequently encountered in hospitalized medical patients. In previous studies performed in two general hospitals in Switzerland, it was observed that 20% of patients in medical departments were alcoholic.[16] We therefore chose to measure the status of protein-energy nutrition in this specific population. In contrast with previous studies, a standardized identification of alcoholic and nonalcoholic inpatients was conducted using the Michigan Alcoholism Screening Test (MAST).[17]

PATIENTS AND METHODS

This study was primarily aimed at analyzing hospital resource use by alcoholic inpatients, yet it was also designed to gather information about the nutritional status of hospitalized alcoholics. The population studied consisted of patients aged 20 to 75 years consecutively admitted between September 1, 1988, and March 18, 1989, to the general wards of the Department of Internal Medicine of the Centre Hospitalier Universitaire Vaudois in Lausanne, a 1000-bed city and teaching hospital located in the French-speaking part of Switzerland. Patients with private insurance, those directly discharged home from the emergency department, and those who

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came for elective diagnostic procedures or cancer chemotherapy were not eligible for the study. The percentage of ineligible patients was 35%. The study protocol was accepted by the ethical committee of the Department of Medicine.

Eligible patients were administered the French version of the MAST[17,18] within the first 4 days after admission. In order to be screened and included, patients had to be conscious and able to provide informed consent. Patients with a MAST score ≥8 were considered alcoholics and were consecutively included in the survey. This cutoff is known to have a positive predictive value ≥0.9 in this population.[18] Each alcoholic patient was then matched with the first nonalcoholic patient admitted (MAST score ≤4) of the same gender and age (±5 years). All included patients completed a standardized questionnaire investigating socio-occupational status as well as smoking habits. Anthropometric measurements were collected at admission by the same trained observer: weight (kg), height (m), and the average of triplicate measurements of mid-upper arm circumference (MAC) (mm) and triceps skinfold thickness (TSF) (mm). Clinical evidence of ascites or edema was recorded. At the end of the hospital stay, the main or primary diagnoses and all comorbidities were recorded using the ninth revision of the WHO International Classification of Diseases coding system (ICD-9). The actual weight/ideal weight ratio (W/IW, expressed in %) was derived from usual norms of ideal weight.[19] The Quetelet body mass index (BMI) (kg/m^2) and the mid-arm muscle circumference (MAMC) were computed, the latter using the formula: $MAMC = MAC - 3.14 \times TSF\ (mm^2)$.[20]

Data analysis consisted primarily of paired comparisons of anthropometric measurements between alcoholics and nonalcoholics. Comparisons with the general population were made using data from a health survey aimed at assessing the prevalence of cardiovascular risk factors, including nutritional factors, in Switzerland (MONICA study)[21,22] and data from the Health and Nutrition Examination Survey in the United States (NHANES).[23] BMI categories were used as defined by Gray.[24] The fifth percentiles of TSF and MAMC distributions in a normal population (NHANES)[23] obtained for 10-year age groups and sex were used as cutoffs for low TSF and low MAMC. Moderate malnutrition was defined by the presence of either low TSF or low MAMC, and severe malnutrition, or protein-energy malnutrition, by the combination of both. TSF was considered to reflect total body fat, whereas MAMC represented the protein compartment. Neither serum albumin nor other blood indicators of malnutrition were measured for the purpose of this study. However, because serum albumin and mean corpuscular volume (MCV) were often measured routinely in these inpatients, we were able to retrieve these data from the medical records.

The association between alcoholism and malnutrition was analyzed through the distribution of case and control patients using the medians of TSF and MAMC as cutoffs for this particular population. Patients with both TSF and MAMC below the respective medians defined a subgroup with the poorest nutritional status. This condition was used as the cutoff for a Mantel-Haenszel stratified analysis investigating the possible role of smoking, liver disease, and occupational status as confounding factors for malnutrition.

Statistical analysis used the Wilcoxon's signed rank test for comparisons between matched pairs and the Mann-Whitney U test for comparisons between nonmatched pairs, with an α level of significance fixed at 0.05. Ninety-five percent confidence intervals (95% CI) were calculated for the odds ratio (OR) of the association between alcohol abuse and malnutrition. Statistics were performed with the SPSS-X 3.1 statistical package (SPSS Inc, Chicago, IL) running on a Vax 6410 (Digital Equipment Corporation, Maynard, MA).

RESULTS

Seven hundred two eligible patients were admitted during the study period; of those, 11% could not or refused to answer the MAST questionnaire. One hundred three patients (16%) with a MAST score ≥8 constituted the alcoholic group. The control patients were chosen, according to the inclusion criteria, from the 486 patients with a MAST score ≤4. Ten pairs of alcoholic patients and controls were excluded from the analysis because of missing anamnestic information. The study population consisted of 73 male and 20 female pairs. The average age was 53.6 ± 12 (standard deviation) years for the case group and 54.6 ± 12 years for the control group. Table I presents the diagnoses established for the alcoholic and nonalcoholic patients. The case-mix was different for several diagnostic groups; cardiovascular diseases and cancer were more often found in nonalcoholics, whereas gastrointestinal and central nervous system/psychiatric conditions were more common in alcoholics.

Anthropometric measurements and serum albumin of both groups are reported in Table II. Although alcoholic patients were prone to present lower W/IW ratios and BMIs than nonalcoholic patients, the differences were not stochastically significant. However, TSF values were lower in both male and female alcoholics. Serum albumin as significantly lower in women only. Table III confirms that TSF was lower in alcoholic patients than in controls in almost every age group, the difference being noticeably larger in women although the total number of women was small. Globally, the general population presented higher TSF values than the inpatient population, especially men. Anthropometric measurements, serum albumin, and MCV are shown in Table IV for different degrees of liver disease according to the Child classification proposed by Pugh et al.[25] Body weight was not much influenced by the severity of liver disease; MAMC decreased slightly, although not significantly, with increasing liver involvement. Serum albumin was lower and MCV higher in patients who were classified as Child B or C.

The prevalence of malnutrition is shown in Table V. A higher than expected percentage of individuals, particularly women, had a low BMI. The use of anthropometric criteria to assess malnutrition showed that more women than men had low TSF values, whereas the reverse was true for MAMC. Severe protein-energy malnutrition de-

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TABLE 1
Distribution of morbidities in alcoholic and nonalcoholic patients

	Main diagnosis*		All diagnoses†	
	Alcoholics (n = 103)	Nonalcoholics (n = 103)	Alcoholics (n = 103)	Nonalcoholics (n = 103)
Cardiovascular‡	13	31	42	54
Cancer	4	12	14	23
Respiratory	14	18	34	40
Gastrointestinal§	19	11	44	29
CNS/psychiatric	12	3	47	23
Metabolic/nutritional	4	4	18	23
Alcoholism‖	11	1	54	4
Other	26	23	63	55
Total	103	103	316	251

CNS, central nervous system; ICD-9, International Classification of Diseases 9th revision.
* The main diagnosis refers to the cause for hospitalization.
† All diagnoses (including the main diagnosis) refers to all diseases recorded in the final chart of the patient.
‡ Including cerebrovascular diseases.
§ Including liver diseases.
‖ Alcohol dependence syndrome (ICD-9 303) and alcohol abuse (ICD-9 305.0).

TABLE II
Anthropometric measurements, serum albumin, and mean corpuscular volume in alcoholic and nonalcoholic medical inpatients

	Males		Females	
	Alcoholics (n = 73)	Nonalcoholics (n = 73)	Alcoholics (n = 20)	Nonalcoholics (n = 20)
BMI (kg/m²)*	22.1	24.2	20.1	22.0
	(19.6–27.6)	(18.8–28.1)	(16.3–25.9)	(17.1–28.4)
W/IW (%)*	102	109	94	102
	(90–126)	(91–124)	(79–122)	(81–133)
TSF (mm)	8.0[a]	10.0[a]	13.0[b]	20.0[b]
	(5.4–14.0)	(5.0–18.0)	(7.1–28.2)	(8.0–40.0)
MAMC (mm)	256[a]	267[a]	206	218
	(221–293)	(223–313)	(188–255)	(186–257)
Albumin (g/L)	33.0†	33.3‡	31.5§[b]	37.8‖[b]
	(23.4–42.0)	(23.0–45.6)	(20.0–38.0)	(33.7–45.5)
MCV (fL)	97.0[c]	91.0[c]	100[b]	91.5[b]
	(82.0–111.6)	(81.0–97.6)	(89.2–116.9)	(86.0–102.8)

Values are the median with the 10th and 90th percentile values in parentheses. For albumin the parenthetical values represent the minimum and maximum measurements. Between values in the same row: [a] $p < .05$, [b] $p < .01$, [c] $p < .001$ (Wilcoxon's signed rank test or Mann-Whitney U test [albumin]). BMI, body mass index; W/IW, actual weight/ideal weight; TSF, triceps skinfold thickness; MAMC, mid-arm muscle circumference; MCV, mean corpuscular volume.
* Pairs with one ascitic or edematous patient were systematically excluded when dealing with BMI and W/IW comparisons (41 male and 12 female pairs remained).
† n = 49.
‡ n = 21.
§ n = 16.
‖ n = 7.

TABLE III
*Average triceps skinfold thickness (mm) comparison between alcoholic and nonalcoholic inpatients and a normal Swiss population**

Age group (y)	Males			Females		
	Alcoholic patients	Nonalcoholic patients	Swiss population	Alcoholic patients	Nonalcoholic patients	Swiss population
35–44	10.0 (n = 16)	9.9 (n = 7)	15.4	11.5 (n = 2)	22.3 (n = 3)	20.0
45–54	8.1 (n = 23)	10.6 (n = 25)	13.9	13.2 (n = 6)	18.8 (n = 5)	22.2
55–64	8.7 (n = 13)	10.9 (n = 18)	14.1	17.5 (n = 6)	26.8 (n = 5)	25.2
≥65	10.7 (n = 19)	11.7 (n = 18)	14.3	7.0 (n = 3)	20.6 (n = 5)	20.5

* Data provided from the MONICA study.[21]

fined by the combined low TSF and low MAMC index was infrequent, occurring in ≤5% of patients. Whereas the expected proportion of individuals with a BMI >27.8 $kg \cdot m^{-2}$ or >27.3 $kg \cdot m^{-2}$ in men and women, respectively, is 28% according to general population data in the same region (22), the observed proportion of obese patients was much lower in males (7% and 0% in alcoholics and nonalcoholics, respectively) as well as in females (17% in both alcoholics and nonalcoholics).

Median values for TSF in this population of alcoholic and nonalcoholic patients were 9.5 mm and 15.5 mm for men and women, respectively, and corresponded to the 25th to 50th percentile range of TSF for men and the 10th to 25th percentile range of TSF for women of a normal population.[23] The median values for MAMC in men and women studied were 261 mm and 211 mm,

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TABLE IV
Anthropometric measurements, serum albumin, and mean corpuscular volume in 93 alcoholic medical inpatients according to liver disease status (median)

	No liver disease (n = 56)	Liver disease		
		Child A (n = 13)	Child B (n = 11)	Child C (n = 13)
% Males	84	69	64	77
BMI (kg/m^2)*	21.4	23.3	19.5	22.5
W/IW (%)*	98.6	106.3	90.9	103.4
TSF (mm)	8.5	11.0	10.0	6.0
MAMC (mm)	256	248	243	239
Albumin (g/L)	36.1†	36.0‡	28.6§	26.1‖
MCV (fL)	95¶	99**	101	114

Abbreviations are the same as used in Table II.
* Fifty-three alcoholics without ascites or edema.
† n = 31; $p < .001$ *vs* Child B and Child C.
‡ n = 11; $p < .001$ *vs* Child B and Child C.
§ n = 11.
‖ n = 12.
¶ $p < 0.05$ *vs* Child B and $p < .001$ *vs* Child C.
** $p < 0.05$ *vs* Child C.

respectively, and corresponded to the 10th to 25th percentile range for normal men and the 25th to 50th percentile range for normal women.[23] The distribution of alcoholic and nonalcoholic patients in relation to these medians was clearly different, alcoholics being below the median of both measures more frequently than controls. Alcoholic patients accounted for 68% (42/62) of this group. The crude OR between alcoholism and malnutrition was therefore 3.00 (95% CI 1.58–5.71). In a stratified analysis, the strength of this association remained essentially unaffected by the presence or absence of smoking (adjusted OR 3.02, 95% CI 1.93–4.73), liver disease (adjusted OR 2.94, 95% CI 1.87–4.61), or unemployment (adjusted OR 3.03, 95% CI 1.90–4.82). However, unemployment or the presence of a handicap markedly diminished the strength of the association between alcoholism and malnutrition (OR 1.70, 95% CI 0.54–5.38), whereas being employed left the association unaffected.

Finally, a linear regression analysis between BMI and TSF in nonascitic and nonedematous patients showed a good correlation between the two variables (males: $R = 0.64$; females $R = 0.83$).

DISCUSSION

In the present study, a low proportion of obesity and severe protein-energy malnutrition was found in alcoholic and nonalcoholic medical inpatients. However, TSF was lower in alcoholics than in either controls or the general population. Chronic protein malnutrition, as measured by a low MAMC, was infrequent in women but present in one fourth of male alcoholics, whereas reduced total body fat, as measured by a low TSF, was more common in females (ie, in about one half of the female alcoholics) and rare in male patients. In addition, a low BMI (<20 kg/m^2) was present in over 10% of the inpatient population. Reasons for such differences between men and women are unclear, but because of the small number of women in the study the proportions from this subgroup are difficult to interpret. One reason for these sex-related differences could be the reference population chosen.[23]

Among available studies, Hurt et al[7] found a weight below the ideal weight in only 12% of a group of 58 middle-class alcoholics seen at the Alcohol and Drug Dependence Unit of the Mayo Clinic. Using a similar definition, Boyd et al[26] reported malnutrition in 10 (16%) of 61 males and in 0 of 7 female alcoholic patients seen at the medical service of a general hospital in Scotland. These percentages may be compared with the results of Goldsmith et al,[27] who reported 8% malnutrition in middle-class alcoholics and 32% in low-class and skid-row alcoholics. Goldsmith et al, however, used another definition of malnutrition based on a combined index of weight and anthropometric measures. Despite the differences in end points used to define protein-energy malnutrition in these studies, including ours, it is tempting to suggest that significant protein-energy malnutrition is infrequent in alcoholics, except perhaps in skid-row patients.

As already mentioned, the prevalence of malnutrition in alcoholic patients may also depend upon the socioeconomic situation of the country or the region where the study is performed, as well as on the socioeconomic condition of the patient himself. The stratified analysis of the association between alcohol abuse and deficient

TABLE V
Proportion (n(%)) of alcoholic and nonalcoholic medical inpatients with low, normal, or excess weight; anthropometric malnutrition; and low serum albumin

	Males		Females	
	Alcoholics (n = 73)	Nonalcoholics (n = 73)	Alcoholics (n = 20)	Nonalcoholics (n = 20)
BMI (kg/m^2)*				
<20	5 (12)	6 (15)	5 (42)	3 (25)
20–24	24 (59)	18 (44)	5 (42)	5 (42)
≥25	12 (29)	17 (41)	2 (17)	4 (33)
Anthropometric malnutrition				
Low TSF†	2 (3)	3 (4)	9 (45)	4 (20)
Low MAMC†	18 (25)	11 (15)	1 (5)	1 (5)
Low TSF or MAMC	16 (22)	10 (14)	8 (40)	5 (25)
Low TSF and MAMC	2 (3)	2 (3)	1 (5)	0 (0)
Albumin < 28 g/L‡	10 (20)	3 (14)	4 (25)	0 (0)

Abbreviations are the same as those used in Table II.
* BMI was computed only for patients without ascites or edema (41 and 12 pairs of male and female patients, respectively).
† Below the 5th percentile of a normal population.[23]
‡ Serum albumin was measured in 70 males and 23 females.

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nutritional status suggests that the occupational status of the patient has indeed an important influence; unemployment (or being handicapped) diminished the strength of the association, whereas being employed (or retired) left the relationship between alcohol abuse and malnutrition unchanged. Thus, there is an epidemiologic association between alcohol abuse and a below normal nutritional status, even if the full spectrum of protein-energy malnutrition is not frequently found in patients with more favorable socioeconomic conditions. These results agree with those studies that have shown that malnutrition associated with alcohol abuse is mainly present in patients with precarious socioeconomic situations.[12,27] This study shows that alcohol abuse in itself has a deleterious effect on nutritional status independently of the social situation of the patient, which serves mainly as an interaction. In addition, this study demonstrates that the relationship between alcoholism and malnutrition is not influenced by smoking or the presence of liver disease. Other studies have also shown that protein-energy malnutrition is not more prevalent in alcoholics with liver disease.[10,14] Serum albumin decreased with increasing liver disease as indicated by the Child index, but lower albumin values might be due to liver disease itself, malnutrition, or a combination of both.

Inasmuch as nonalcoholic inpatients were used as the control population, the study provides information on the prevalence of malnutrition in general medical patients as well. Although less pronounced than in alcoholics, the distribution of malnutrition indices was relatively similar in nonalcoholics. These results contrast with those of Bistrian et al,[28] who reported that 21%, 69%, and 20% of general medical inpatients were below 80% of the standard of the W/IW index, TSF, and MAMC, respectively.

Limitations of this study should be discussed before generalizations are made. The use of anthropometric measures alone to assess the prevalence of malnutrition might be considered inaccurate; the value of mid-upper arm anthropometry is indeed known to be questionable.[29] However, its use in completing weight measurement or as a surrogate for other biologic measures of protein-energy malnutrition has the advantage of being simple and not limited to patients without ascites or edema, at least in this type of descriptive study. Moreover, comparisons of our data with previously reported anthropometric values from alcoholics are fairly good.[9,10,12,27,30] Last, the correlation analysis between TSF and BMI was good in this population, similar to that reported from normal populations,[31] which suggests reliability of the data. Because this study was not designed to study only nutritional characteristics of alcoholic inpatients, the evaluation of the visceral protein compartment was not routinely performed. However, serum albumin was measured on clinical grounds in about 70% of alcoholics and 30% of nonalcoholic patients. Whereas this information has some validity in alcoholics, it may very well constitute a biased estimator in control patients. In addition, there is a methodologic problem in determining at which moment of the hospitalization serum albumin should be measured. Severe dehydration at entry and renutrition in the hospital are among the several factors that might influence serum albumin to variable degrees during hospitalization.

The systematic use of the MAST allows us to standardize the diagnosis of alcohol abuse and to bypass the numerous risks of selection bias when a clinical approach for the selection of cases and controls is used. The MAST has indeed been shown to be a reliable, sensitive, and specific instrument.[17,32,33] This test did not allow us to distinguish either the pattern of alcohol consumption or the type of alcohol consumed. Such data could serve to make interethnic comparisons or detailed dietary analysis, both of which were beyond the goals of this study. However, this lack of information probably did not influence our results. Last, the selection of patients using the MAST led to differences in case-mix across alcoholics and nonalcoholics. The question arises as to whether these differences could modify the analysis of the association between alcoholism and nutritional status; however, liver disease was not shown to be a confounding variable.

In conclusion, this study suggests that alcohol abuse has in itself a deleterious effect on nutritional status, even if severe protein-energy malnutrition is infrequent in alcoholic medical inpatients. This effect may be related to the reported diet peculiarities and metabolic abnormalities of alcoholics and may explain the apparent depletion of fat storage in such patients. Studies are needed to investigate the prognostic value of caloric undernutrition and its eventual role as a marker for recovery in therapeutic studies. Severe protein-energy malnutrition requiring aggressive therapy appears to be an infrequent finding in this population.

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