

Nutrition and health in an adult urban homeless population in Germany

Kristina Langnäse and Manfred J Müller*

Institut für Humanernährung und Lebensmittelkunde, Christian Albrechts Universität, Düsternbrooker Weg 17, D-24105 Kiel, Germany

Submitted 13 April 2000: Accepted 29 September 2000

Abstract

Objective: To assess the association between nutrition and health in an adult urban homeless population.

Design: Cross-sectional – nutritional state (body mass index (BMI), triceps skinfold (TSF), upper arm circumference), dietary habits (food frequency), socio-demographic data and self-stated diseases were assessed.

Setting: Four sites for homeless people in Kiel and Hamburg, Germany.

Subjects: Sample of 75 homeless people (60 males, 15 females) aged 19–62 years.

Results: A lack of food was not found in the majority of the homeless. Seventy-six per cent of the study population showed a normal dietary pattern. Critical food groups were fresh fruit and vegetables, rice and noodles. However, 52 or 29% of the homeless were malnourished (i.e. they were below the 25th or 5th percentile of arm muscle area). In addition, 22.7% of the homeless were obese (i.e. BMI > 30 kg m⁻² and/or TSF > 90th percentile). Almost two-thirds of the population suffered from at least one chronic disease (prevalence of nutrition-related disorders 33.3%, gastrointestinal disorders 32.0%, dental diseases 22.7%, psychiatric disorders 18.7%, wasting diseases 6.7%). Smoking (prevalence rate 82%), drinking alcohol (51%) and drug abuse (20%) were frequent among homeless people. Food intake was not related to nutritional state, the prevalence of chronic diseases or addiction habits. By contrast, a poor nutritional state was associated with drug abuse and the prevalence of wasting diseases.

Conclusion: Prevention of nutritional problems should be directed to health-related problems such as the prevention or treatment of chronic diseases and addiction habits.

Keywords

Nutrition
Nutritional state
Diseases
Smoking habits
Alcohol and drug abuse

Homeless people are at risk for nutritional problems. Most of them have enough to eat, but the dietary adequacy is low^{1–4}. Nutrient analyses in different homeless populations showed a reduced quality of meals¹ and a dramatic shortage in the intake of certain micronutrients (e.g. calcium, magnesium, zinc, iron, vitamin B₂, vitamin B₆, vitamin A and folic acid) at concomitantly increased fat intake^{2,3}. Physical signs of malnutrition have been frequently observed¹. In contrast, a considerable number of the homeless were considered as obese¹. Poor health habits (smoking, excessive alcohol consumption and drug abuse) were also frequent within homeless populations⁵. All of these factors contribute to increased morbidity as well as malnutrition. In fact, the prevalence of chronic diseases (wasting diseases but also cardiovascular diseases) was high in homeless people, and about 40% report at least one chronic health problem⁶.

The possible associations between nutritional state, nutrition and health problems are poorly understood in

homeless people. This problem is of particular interest for formulating suitable preventive measures for homeless people. Improving shelter and soup line food sources without simultaneous prevention or therapy of health problems may be insufficient to improve their nutritional state. The present study is descriptive and designed to investigate the possible associations between nutritional state, nutrition, addiction habits and health in a homeless population in northern Germany. The study was undertaken to improve preventive measures and to identify subgroups of homeless people who may need special support.

Subjects and methods

This cross-sectional survey was carried out between May and July 1996 at four sites for homeless people in Hamburg (inhabitants: 1,703,800) and Kiel (inhabitants: 247,700). A written questionnaire focusing on

socio-demographic data, food frequencies, nutritional habits and health status was conducted. The nutritional state of all participants was determined. Each participant received 20 Deutsche Mark (≈ 10 Euro) as an expense allowance. The study was approved by the ethical committee of Kiel University. Written consent was obtained from all participants.

Subjects

In 1995 about 200,000 single homeless people were estimated in Germany. Homeless people were defined as single people who have no permanent address but who are temporarily accommodated at shelters, hotels or with relatives and friends⁷. The sample was collected at two centres for homeless people respectively in Hamburg and Kiel. One of each site in Hamburg and Kiel was only accessible to homeless women. Apart from one site in Hamburg at which two meals per day were served, the other centres were daytime drop-in centres. All available volunteers – up to a sample of 78 homeless people – at the four sites were collected. Three were excluded from the sample because they did not meet the requirements of homelessness. The total sample consisted of 75 homeless of which 60 were males and 15 were females. The low proportion of homeless females within the sample corresponds with data of the German statistics report of the national working group for homelessness⁸. Women tend to stay in their married or wedded-like state of dependence, even though they might experience verbal or physical violence, before they leave home and become homeless. Reasons for this are very often fear and shame⁹. The majority of the study population had German nationality.

Nutritional state

Wearing light clothing and no shoes, participants were weighted to the nearest 100 g on a bathroom scale (Soehnle, No. 7306.00.700). Height was recorded to the nearest centimetre. Body mass index (BMI; weight (kg)/height (m^2)) was calculated for each subject. Triceps skinfold (TSF) and upper arm circumference (AC) were measured with a 'Lafayette' skinfold calliper using standard techniques (Lafayette Instruments, IN, USA). The coefficient of variation for repeated measurements ($n = 3$) of TSF in 75 homeless people was 2.6%. Upper arm muscle area (AMA) and upper arm fat area (AFA) were calculated according to the method described by Frisancho¹⁰. The values of BMI, TSF, AC, AMA and AFA were compared with percentiles derived from the first and second National Health and Nutrition Examination Surveys data¹⁰. Unfortunately, there were no appropriate and actual data on TSF, AC, AMA and AFA in a German adult population. The sample was divided into malnourished ($n = 40$), normal ($n = 18$) and obese ($n = 17$) homeless. Criteria of the malnourished group were either $BMI < 20 \text{ kg m}^{-2}$, $TSF < 25\text{th percentile}$ or $AMA < 25\text{th}$

percentile. Criteria of the obese group were either $BMI \geq 30 \text{ kg m}^{-2}$ or $TSF \geq 90\text{th percentile}$. Wasting was defined as a weight loss of more than 10% (5%) of body weight during the last six months (three months) prior to this investigation.

Nutrient intake

A qualitative food-frequency questionnaire (22 items) similar to that used in previous studies on nutritional habits in Germany was applied¹¹. Intake was reported in the following frequency categories: (almost) every day, several times per week, once a week, less and never. The frequencies were compared with results of the German National Food Consumption Study (NVS) 1985–89¹² and the MONICA Augsburg Survey 1989/90¹¹. To evaluate the dietary pattern of the homeless a 'Dietary Pattern Index (DPI)', developed and validated by Winkler and Döring¹³, was calculated based upon recommendations of the German Society of Nutrition (DGE). Consumption frequencies were evaluated by a three-stage scale according to the recommendations of the DGE: optimal consumption frequencies received a score of two, normal consumption frequencies a score of one and adverse consumption frequencies a score of zero. Scores of each food group were summed up; thus a maximum score of 24 could be obtained¹³. Subjects were divided into groups of beneficial dietary pattern (score between 24 and 16), of normal dietary pattern (score between 15 and 8) and of adverse dietary pattern (score between 7 and 0) according to the recommendations of the DGE. Critical food groups that deviated from the recommendations were expressed as a relative proportion of optimal food consumption frequency for each food item, according to the recommendations of DGE. Frequency of inadequate diet was determined as a relative proportion of adverse food consumption frequency for each food item based upon the DGE's recommendations. Additionally, social aspects of the diet of homeless people were investigated using a scheme of food insecurity¹⁴. Quantitative, qualitative, psychological and social constructs contribute to food insecurity. In this study meal patterns, lack of food, access to cooking facilities and conventional food sources were assessed.

Assessment of diseases

Heart rate and blood pressure were determined. Prevalence of diseases was self-reported. Nutrition-related diseases consisted of diabetes, myocardial infarction, hypertension, hypercholesterolemia and gout. Gastro-intestinal disorders included disorders of the stomach, intestine and liver. Under dental disorders missing teeth were reported. Psychiatric disorders were not differentiated. Wasting diseases included tuberculosis, cancer and HIV infection.

Table 1 Characterisation of the homeless population ($n = 75$)

	Sample population	General German population
Sex	60 males (80%) 15 females (20%)	48.7% ⁷ 51.3%
Age: mean (range)	41 years (19–62 years) 18–34 years: $n = 22$ (29.3%) 35–49 years: $n = 38$ (50.7%) 50–65 years: $n = 15$ (20.0%)	25–44 years: 31.9% ⁸ 45–65 years: 25.1%
Duration of homelessness	≤1 year: 33.9% 1–5 years: 51.8% >5 years: 14.3%	
Education	<8 years: 69.3% 10 years: 24.0% 13 years: 6.7%	<8 years: 54.3% ⁷ 10 years: 27.2% 13 years: 18.5%
Addiction	Smoking: 82.7% Alcohol ¹ : 50.7% Drug abuse: 20.0%	Smoking: 28.3% ⁹ /10 Drug abuse: 21.6% ¹¹
Disorders	Total: 62.7% Nutrition-related disorders ² : 33.3% Gastrointestinal disorders ³ : 32.0% Dental disorders ⁴ : 22.7% Psychiatric disorders ⁵ : 18.7% Wasting diseases ⁶ : 6.7%	/12 /12 /12 /12 /12

¹ Daily intake of alcohol.² Diabetes mellitus, myocardial infarction, stroke, hypertension, hypercholelism, gout.³ Disorders of the stomach, intestine and liver.⁴ Missing teeth.⁵ No differentiation.⁶ Tuberculosis, cancer, HIV infection.⁷ Data of 1996 published by the Statistisches Bundesamt Deutschland.⁸ Data of 1995 published by the Statistisches Bundesamt Deutschland.⁹ Data of the 1995 Mikrozensus; smoking behaviour by the German population older than 15 years of age.¹⁰ No qualitative data available.¹¹ Data of the 1995 Mikrozensus, illegal drug abuse by the German population between 18 and 39 years of age; data are comparable with the sample population, as drug users within the sample were between 25 and 44 years old.¹² No data available because of different classification of diseases in the sample population.

Statistical analysis

Data were processed using the SAS Statistical Program. All group data are presented as the mean \pm standard deviation (SD). Student's *t*-test, analysis of variance (ANOVA) and chi square tests were used to analyse the data. Statistical significance was ascertained with $P < 0.05$ unless otherwise noted.

Results

Table 1 presents the main characteristics of the study population. Almost two-thirds suffered from at least one chronic disease, of which nutrition-related disorders and gastrointestinal disorders predominated. Homeless people aged 35–49 years suffered significantly more often from gastrointestinal diseases than the other two age groups. Within the nutrition-related diseases high blood pressure (13.3%) and high cholesterol (8%) were most frequent in the study population. Diseases of the stomach and intestine (17.3%) and diseases of the liver (14.7%) were nearly equally distributed among gastrointestinal disorders. Dental disorders were seen significantly more often in the oldest homeless. The main characteristics of the homeless population differ from those in the general German population (Table 1).

Nutritional state

About half of the sample obtained values of AMA below the 25th percentile (Fig. 1). AMA showed significant gender differences ($P < 0.01$, Fig. 1). In addition AFA differed between genders ($P < 0.0001$, data not shown). About 15% of the homeless had triceps skinfold below the 25th percentile (Fig. 1). About 20% of the study population had triceps skinfold above the 90th percentile (Fig. 1). The association between nutritional state and chronic diseases revealed a significant difference between homeless suffering from wasting disease and homeless without wasting disease according to triceps skinfold ($P < 0.01$, data not shown) as well as upper arm circumference ($P < 0.05$, data not shown). Homeless adults with wasting disease had distinctly lower values than the group without wasting disease. The association between nutritional state and addiction habits showed that smoking and non-smoking homeless subjects differed significantly with regard to BMI, whereas lower BMI values were obtained in smokers ($P < 0.05$, data not shown). Values of BMI and triceps skinfold varied significantly between drug addicts and non-addicts ($P < 0.05$, data not shown). Drug addicts were more often malnourished, i.e. had lower BMI values and triceps skinfolds, than the corresponding non-addicted group.

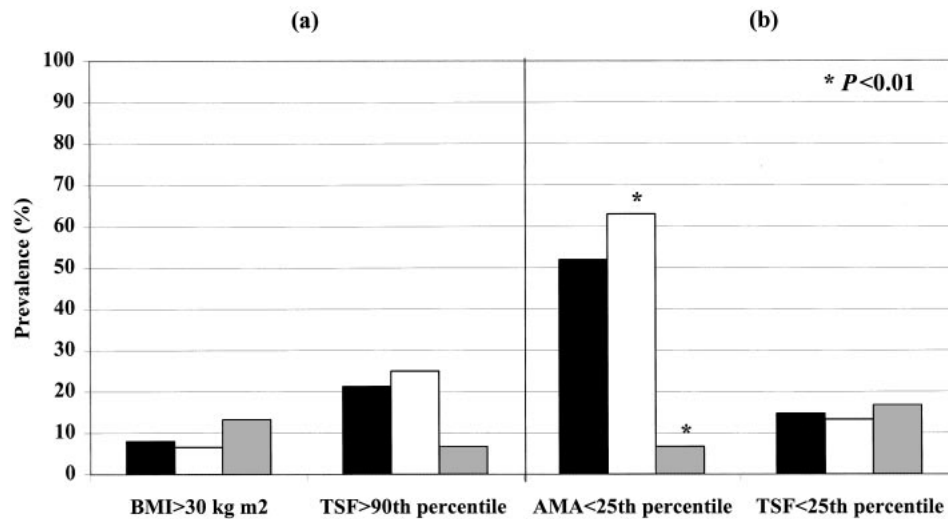


Fig. 1 Prevalence of obesity (a) and malnutrition (b) in the study population ($n = 75$). Black bars: total study population ($n = 75$); white bars: males ($n = 60$); grey bars: females ($n = 15$)

Nutrition quality

The majority of our study population showed a normal dietary pattern (76%) according to the recommendations of the DGE. Adverse and beneficial dietary patterns were equally distributed (12%). Critical food groups for which the optimal consumption frequency did not achieve 33.3% of the recommendations were noodles, rice, fresh fruit and fresh vegetables (Fig. 2). Eggs obtained an optimal consumption frequency above two-thirds of the recommendations. Regarding the consumption frequencies between malnourished and obese homeless there

was no significant difference. Critical food groups below one-third of the optimal consumption frequency within the malnourished corresponded with those of the whole study population, whereas for the obese consumption of fish and fresh vegetables was below one-third of the recommendations (Fig. 2). The consumption frequencies of the homeless population differed from those of the general German population. The homeless consumed fruit and vegetables less often. On average, the monthly consumption of fresh fruit was 11 days per month lower in the homeless than in the sample of the MONICA

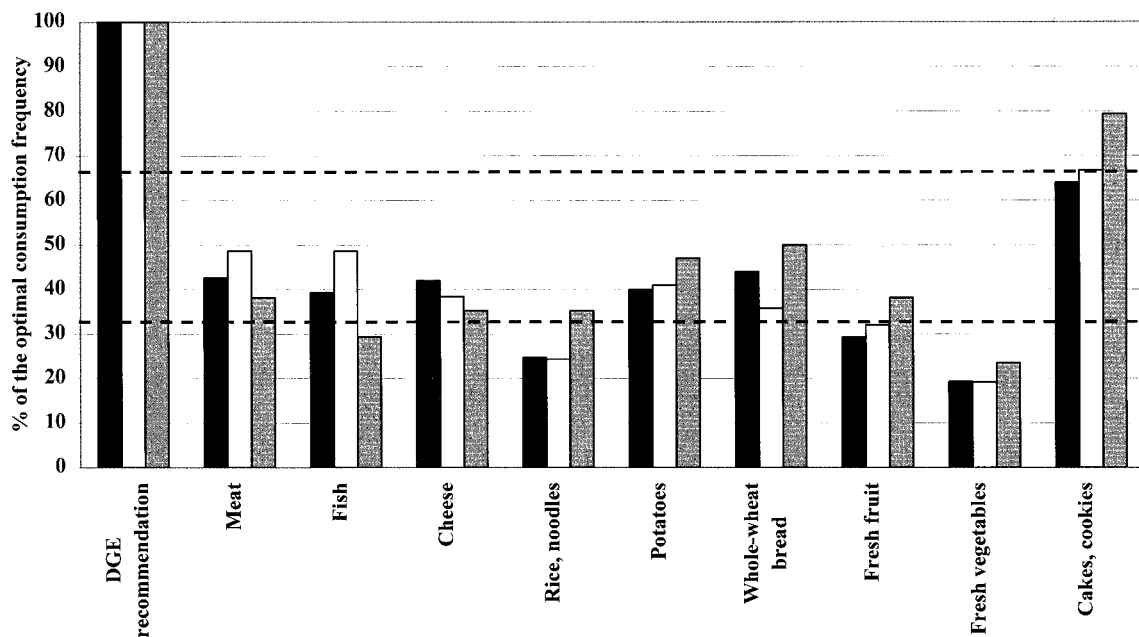


Fig. 2 Critical food groups (relative proportion of the recommended food consumption frequency) in the diet of the study population ($n = 75$). Black bars: total study population ($n = 75$); white bars: malnourished (BMI < 20 kg m⁻² and/or TSF < 25th percentile and/or AMA < 25th percentile; $n = 40$); grey bars: obese (BMI ≥ 30 kg m⁻² and/or TSF ≥ 90th percentile; $n = 17$). Lower and upper lines indicate one-third (33.3%) and two-thirds (66.6%) of the recommended food frequency, respectively

Table 2 Quantity and social quality of nutrition (%) in the study population with reference to Feichtinger¹⁴

Dimensions	Characteristics	Total (n = 75)	Males (n = 60)	Females (n = 15)	Malnourished ¹ (n = 40)	Normal (n = 18)	Obese ² (n = 17)
Quantity	Regular meals ³ :						
	Never	4.0	0.0*	20.0	0.0	16.7	0.0
	1–3 times	37.3	40.0	26.7	30.0	61.1	29.4
	4–7 times	54.7	55.0	53.3	62.5	22.2	64.7
	> 7 times	4.0	5.0	0.0	7.5	0.0	5.9
	Satiation ⁴ :						
Material quality	Almost/mostly	69.3	73.3	53.3	75.0	50.0	88.2
	Partially	25.3	21.7	40.0	20.0	38.9	11.8
	Rarely/never	5.3	5.0	6.7	5.0	11.1	0.0
	Cooking facilities ⁵ :						
	Yes	64.0	58.3*	86.7	65.0	61.1	70.6
	Conventional food sources ⁶ :						
Social quality	At my shelter	29.3	21.7**	60.0	30.0	33.3	35.5
	Soup kitchen	85.3	90.0*	66.7	82.5	83.3	94.1
	On the road	24.0	26.7	13.3	27.5	33.3	11.8

* Chi² test indicates differences between genders; $P < 0.05$.

** Chi² test indicates differences between genders; $P < 0.01$.

¹ Meeting at least one of the following criteria: BMI $< 20 \text{ kg m}^{-2}$, TSF $< 25\text{th}$ percentile or AMA $< 25\text{th}$ percentile.

² Meeting at least one of the following criteria: BMI $\geq 30 \text{ kg m}^{-2}$ or TSF $\geq 90\text{th}$ percentile.

³ Question: 'How often do you usually have a warm meal during a week?'

⁴ Question: 'Do you think that you usually have enough to eat?'

⁵ Question: 'Do you regularly have access to cooking facilities?'

⁶ Question: 'Where do you usually take your meal?' (percentages do not add to 100%, because more than one answer was possible).

Augsburg survey. Table 2 presents social aspects of the diet of the sample. About half of the population took between four and seven warm meals per week. A significant difference between genders existed. The majority of the homeless were provided with sufficient food. Homeless women had access to cooking facilities significantly more often than homeless males. Soup kitchens were the preferred place for taking meals. Homeless men had their meals significantly more often at soup kitchens and less often at their shelters when compared with homeless women (Table 2).

Nutritional state, nutrition quality and disease

Nutrition of the homeless represented by the DPI was not significantly related to nutritional state, addiction habits or prevalence of chronic diseases. However, a poor nutritional state was associated with drug abuse as well as prevalence of wasting diseases. Although not significant, the group of obese homeless adults had a higher prevalence of nutrition-related diseases (42.9%) than non-obese homeless people (31.0%). High blood pressure (17.6% versus 12.1%), high cholesterol (17.6% versus 5.2%) and diabetes mellitus (11.8% versus 3.4%) were more frequent within the obese group.

Discussion

Apart from one qualitative work on nutrition of homeless people¹⁵ and a few studies on health of the homeless^{16,17}, this work was the first one in Germany that investigated quantitative as well as qualitative aspects of the diet of homeless adults and related them to nutritional state,

addiction habits and diseases. As in Germany official statistics of homelessness are missing, a representative sample of the German homeless population in a statistical sense cannot be obtained⁸. However, the demographic data of our study corresponded well with data of the German statistics report of the national working group for homelessness⁸. In this report, 91% of the homeless were males. We found 80% of homeless males. Most homeless persons were between 30 and 39 years old in the statistics report as well as in our study population. Both populations included 95% of homeless with German nationality. Most homeless people attended less than eight years of school, although this proportion was 10% higher in the German statistics report⁸.

A poor nutritional state was seen in about half of our study population. Malnutrition was characterised by reduced muscle mass (Fig. 1): 30% of the homeless had an upper arm circumference below the 5th percentile (data not shown) and more than 50% of the population had an arm muscle area below the 25th percentile (Fig. 1). This is in accordance with Wolgemuth *et al.*⁴ who found that over 20% of homeless men obtained arm circumferences below the 5th percentile and almost 50% values of upper arm muscle mass below the 25th percentile. Gender (Fig. 1), smoking, drug abuse and wasting diseases were associated with malnutrition in our homeless population (data not shown). BMI and triceps skinfold were significantly lower in drug addicts than in non-addicts. These data are in agreement with those obtained by other authors^{4,18}. In addition to malnutrition, more than 20% of our homeless had triceps skinfold above the 90th percentile (Fig. 1). These numbers were

lower than those reported by Luder *et al.*^{1,5}, but higher than those observed by Wolgemuth *et al.*⁴.

Nutrition reflected as DPI was not significantly related to nutritional state, addiction habits or prevalence of diseases in our cross-sectional study. However, when compared with the recommended healthy diet, nutrition of homeless people showed significant shortages of various food groups (Fig. 2). Critical food groups of the homeless were noodles, rice, fresh fruit and fresh vegetables (Fig. 2). Since the intake of fresh fruit and vegetables was low, our data suggested shortages of vitamins, minerals and other nutrients in most homeless adults. This is in accordance with data of other authors^{2,4,5,19}. A lack of food was not found in the majority of the homeless, but the social quality of the diet was restricted (Table 2): basic prerequisites such as access to cooking facilities and storage of food did not exist for many homeless people. These people were dependent on soup kitchens for their meals, which results in a reduction of optional food choice¹⁴. In our study population, the frequency of warm meals was less often than in the German population. Although from the nutritionist's point of view there is no need for warm meals, homeless people subjectively perceive a lack of warm meals as deprivation¹⁵.

Homeless people have an increased morbidity. In our population a high prevalence of nutrition-related disorders was found (Table 1). Increased prevalence of hypertension, coronary heart diseases and diabetes mellitus in the homeless was also reported by other authors^{20–22}. At present the association between nutrition and health problems is poorly understood in homeless people. In one study drug abuse was one of the major predictors of malnutrition among the homeless¹⁸. In another study wasting was found in homeless patients with AIDS, alcohol and drug abuse⁴. By contrast, there was no clear association between energy intake and the anthropometric variables³. In another study, shelter meals and diet records showing a high level of saturated fat and cholesterol intake were associated with elevated plasma cholesterol levels and a high prevalence of cardiovascular diseases in the study population⁵. These heterogeneous data give first evidence for at least two different entities of nutritional problems in the homeless. First, the low anthropometric values could not be attributed solely to shortcomings in the diet but also to illness and drug abuse. Second, obesity and the high prevalence of cardiovascular disease were more closely linked to nutrition quality. In the present study, food intake showed no association with the nutritional state, prevalence of chronic diseases and addiction habits. By contrast, a poor nutritional state was seen more frequently in homeless people with drug abuse and those suffering from wasting diseases, while the prevalence of obesity was associated with cardiovascular and psychiatric diseases.

Conclusion

The results of our study imply two different but complementary strategies to improve the nutritional state of homeless adults. First, strategies to improve food intake should be directed to obese homeless adults and those suffering from nutrition-related disorders. Soup kitchens should try to improve their meals according to a balanced diet and to meet the different needs of their clients within their financial resources. They should offer more fresh fruit, fresh vegetables, salads and healthy snack foods. An educational programme for food providers such as that developed by 'Health Care for the Homeless', Inc. of Maryland²³ would support these ideas. Food intake should be improved and shortages of different food groups (i.e. fruits, vegetables) should be avoided.

Second, since malnutrition is also related to underlying disease, prevention or treatment of the disease will also improve the nutritional state. Intervention should be directed to health-related problems (such as prevention or treatment of addiction habits and chronic disorders). There is evidence from our data that improving only the diet of the homeless will not satisfactorily improve the nutritional state of homeless people.

References

- 1 Luder E, Boey E, Buchalter B, Martinez-Weber C. Assessment of the nutritional status of urban homeless adults. *Public Health Rep.* 1989; **104**: 451–7.
- 2 Stitt S, Griffiths G, Grant D. Homeless and hungry: the evidence from Liverpool. *Nutr. Health* 1994; **9**: 275–87.
- 3 Drake MA. The nutritional status and dietary adequacy of single homeless women and their children in shelters. *Public Health Rep.* 1992; **107**: 312–9.
- 4 Wolgemuth J, Myers-Williams C, Johnson P, Henseler C. Wasting malnutrition and inadequate nutrient intakes identified in a multiethnic homeless population. *J. Am. Diet. Assoc.* 1992; **92**: 834–9.
- 5 Luder E, Ceysens-Okada E, Koren-Roth A, Martinez-Weber C. Health and nutrition survey in a group of urban homeless adults. *J. Am. Diet. Assoc.* 1990; **90**: 1387–92.
- 6 Plumb JD. Homelessness: care, prevention and public policy. *Ann. Intern. Med.* 1997; **127**: 973–5.
- 7 Evers J, Ruhstrat EU. *Wohnungsnotfälle in Schleswig-Holstein im Spannungsfeld zwischen Sozial-, Ordnungs- und Wohnungspolitik* [Housing Shortages in Schleswig-Holstein in the Context of Social, Order and Housing Policy]. Kiel, 1994 (in German).
- 8 Bundesarbeitsgemeinschaft Wohnungslosenhilfe eV. *Statistikbericht 1992/93* [Statistics Report 1992/93]. Bundesarbeitsgemeinschaft Wohnungslosenhilfe eV: Bielefeld, 1995 (in German).
- 9 Bundesarbeitsgemeinschaft Wohnungslosenhilfe eV. *Weibliche Wohnungsnot* [Homelessness of Women]. Bundesarbeitsgemeinschaft Wohnungslosenhilfe eV: Bielefeld, 1995 (in German).
- 10 Frisancho AR. *Anthropometric Standards for the Assessment of Growth and Nutritional Status*. Ann Arbor, MI: University of Michigan Press, 1990.
- 11 Schaeffler V, Döring A, Winkler G, Keil U. Trends in food consumption in a South German population from 1984/85 to

- 1989/90: results from the WHO MONICA Project Augsburg. *Ann. Nutr. Metab.* 1991; **40**: 129–36.
- 12 Projektträger Forschung im Dienste der Gesundheit, ed. *Materialien zur Gesundheitsforschung – Die Nationale Verzehrsstudie: Ergebnisse der Basisauswertung* [The National Food Consumption Study: Results of the Basic Evaluation]. Schriftenreihe zum Programm der Bundesregierung Forschung und Entwicklung, Series 18. Bonn: Projektträger Forschung im Dienste der Gesundheit, 1991 (in German).
 - 13 Winkler G, Döring A. Kurzmethoden zur Charakterisierung des Ernährungsmusters: Einsatz und Auswertung eines Food-Frequency-Fragebogens [Shortened methods for characterizing dietary patterns: evaluation of a food frequency questionnaire]. *EU* 1995; **42**: 289–91 (in German).
 - 14 Feichtinger E. Armut und Ernährung im Wohlstand: Topographie eines Problems [Poverty and food in welfare societies: topography of a problem]. In: Barlösius E, Feichtinger E, Köhler BM, eds. *Ernährung in Armut* [Poverty in Welfare Societies]. Berlin: Edition Sigma Rainer Bohn Verlag, 1995 (in German).
 - 15 Kutsch T. Berber-Kost – Ernährungs- und Überlebensmuster von Nichtseßhaften [Nutrition of the homeless – dietary and surviving patterns of homeless people]. In: Barlösius E, Feichtinger E, Köhler BM, eds. *Ernährung in Armut* [Poverty in Welfare Societies]. Berlin: Edition Sigma Rainer Bohn Verlag, 1995 (in German).
 - 16 Locher G. *Gesundheits-/Krankheitsstatus und arbeitsbedingte Erkrankungen von alleinstehenden Wohnungslosen* [Health Status and Work-related Disorders of Single Homeless]. Bielefeld: VSH Verlag Soziale Hilfe GmbH, 1990 (in German).
 - 17 Trabert G. *Gesundheitssituation: Gesundheitszustand und Gesundheitsverhalten von alleinstehenden, wohnungslosen Menschen im sozialen Kontext ihrer Lebenssituation* [Health Status and Health Behaviour of Single Homeless People in Relation to their Life Situation]. Bielefeld: VSH Verlag Soziale Hilfe GmbH, 1985 (in German).
 - 18 Gelberg L, Stein J, Neumann CG. Determinants of undernutrition among homeless adults. *Public Health Rep.* 1995; **110**: 448–54.
 - 19 Winick M. Nutritional and vitamin deficiency states. In: Brickner P, ed. *Health Care of Homeless People*. New York: Springer, 1985.
 - 20 Breakey WR, Fischer PJ, Kramer M, Nestadt G, Romanoski AJ, Ross A, *et al.* Health and mental health problems of homeless men and women in Baltimore. *JAMA* 1989; **262**: 1352–7.
 - 21 Gelberg L, Linn LS. Assessing the physical health of homeless adults. *JAMA* 1989; **262**: 1973–9.
 - 22 Institute of Medicine, Committee on Health Care for Homeless People. *Homelessness, Health and Human Needs*. Washington, DC: National Academy Press, 1988.
 - 23 Strasser JA, Damrosch S, Gaines D. Nutrition and the homeless person. *J. Community Health Nurs.* 1991; **8**: 65–73.