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Nutritional status and related factors in nursing home residents:
Comparative study in elderly migrants and native Germans

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Abstract: Nutritional status and related factors in nursing home residents: Comparative study in elderly migrants and native Germans

Introduction: Elderly migrants represent an ever increasing portion of German nursing home residents. However, the nutritional status of elderly migrants and related problems are still largely unknown. The primary aim of this comparative study was to investigate the nutritional status and related health factors of elderly migrants living in German nursing homes in comparison to a matched group of native German residents living in the same nursing homes. The specific objectives were to find out the prevalence of undernourishment, identify nutritional issues and to assess the dependency in daily activities, in order to reveal if there are specific needs of elderly migrants living in nursing homes.

Methods: All migrants (>65 y) living in two German nursing homes were enrolled. A group of non migrants living in the same nursing homes, matched in age and gender, was selected for comparison. Nutritional status was assessed by using the body mass index (BMI, <22 kg/m²), calf circumference (CC, <31 cm) and mid-upper arm circumference (MUAC, <22 cm). As a summarising screening, the Mini Nutritional Assessment (MNA, <17 points) was used for not tube fed residents. Information about health and functional status, dietary habits, nursing care level and nutritional problems of the residents were gathered in a comprehensive questionnaire, completed by care staff. Daily energy and nutrients intake was evaluated with 3-consecutive day weighed/estimated food records.

Results: Twenty-three migrants took part in the study and the majority of them (87%) had a Turkish background. A group of 37 non migrants was matched (migrants; mean age 76 ±6 y, 52% female, non migrants; 78 ±7 y, 59% female). Almost half of the migrants were seriously in need of care (48% vs. 11%), one third of them were bedridden (30% vs. 8%) and five of them were tube fed (22% vs. 3%). The prevalence of undernourishment was significantly higher among migrants than non migrants by almost every method applied. The prevalence was the highest in both groups according to CC (migrants; 57%, non migrants; 22%), followed by BMI (39% vs. 11%) and MNA (22% vs. 3%). Only one of the non migrants had a low MUAC level. 83% of the migrants had 3 or more nutritional problems (non migrants; 27%). The main problems in migrants and non migrants were eating noticeably little (61% vs. 21%), refusal to eat (56% vs. 25%) and loss of appetite (56% vs. 19%). Nutritional problems were highly correlative with a low BMI as well as with the activities of daily living (ADL-score). The majority of the migrants were more dependent than non migrants in ADL (61% vs. 24%). Dementia was the most common diagnosed disease (48%) in migrants whereas in non migrants was hypertension (49%). Consumption of pureed diet was higher in migrants (17%) compared to non migrants. Participants from both groups did not reach the recommended energy intake of 6.9 MJ (women) and 8.3 MJ (men) for individuals of 65 y and older. Proportion of carbohydrate intake was lower (44 E% and 42 E%) and of fat intake was higher (40 E% and 43 E%) than the recommended in both groups. More than 50% participants fall below D-A-CH's reference values for vitamin B_1, B_6, C, D, E, folate, calcium, iron and magnesium. Additionally, 61% of the migrants had a low B_{12} intake.

Conclusions: The group investigated in this study was relatively small and restricted to two nursing homes. Therefore, our findings can not be generalized to the broader community and are less representative for the whole population. Nevertheless, the results indicated that undernourishment was more frequent in elderly migrants and associated with more nutritional problems and decreased functional ability than in matched non migrants. By increasing attention to the nutritional status and dietary habits of elderly migrants, it might be possible to reduce the prevalence of their undernourishment and increase their quality of life. Individualizing residents'

care by serving food they want and enjoy or familiar ethnic food can also help to improve nutritional status.

Abstract: Ernährungsstatus und beeinflussende Faktoren bei Altenheimbewohnern in Deutschland: Eine vergleischende Studie bei Senioren mit und ohne Migrationshintergrund

Einleitung: Die Zahl der Bewohner mit Migrationshintergrund in deutschen Einrichtungen der Altenpflege nimmt stetig zu. Über den Ernährungszustand älterer Migrantinnen und Migranten und die damit zusammenhängenden Probleme sind nur wenige Informationen verfügbar. Das Ziel dieser vergleichenden Studie war daher, Daten über den Ernährungs- und Gesundheitszustand dieses Personenkreises zu erheben und mit denen von deutschen Bewohnern von Altenheimen zu vergleichen. Im Vordergrund stand dabei, die Prävalenz von Unterernährung zu ermitteln, Ernährungsprobleme zu erkennen, sowie die Fähigkeiten zur Bewältigung alltäglicher Aktivitäten zu beurteilen, um zu untersuchen, ob ältere Migranten hier spezifische Bedürfnisse aufweisen.

Methoden: Alle Bewohner (>65 J.) mit Migrationshintergrund in zwei deutschen Altenheimen wurden in die Studie aufgenommen. Bewohner mit deutscher Nationalität wurden als Vergleichsgruppe in Alter und Geschlecht angeglichen ausgewählt. Der Ernährungszustand wurde durch die Messung folgender Parameter erhoben: Body Mass Index (BMI, <22 kg/m²), Wadenumfang (WU, <31 cm) und Oberarmumfang (OAU, <22 cm). Als Summenscore wurde für Bewohner ohne Sondenernährung das Mini Nutritional Assessment (MNA, <17 Punkte) erhoben. Informationen über Gesundheit und körperliche Konstitution, Ernährungsgewohnheiten, Pflegestufe und Ernährungsprobleme der Bewohner wurden durch einen Fragebogen erhoben, der unter Beteiligung des Pflegepersonals beantwortet wurde. Die tägliche Energie- und Nährstoffaufnahme der Probanden wurde durch ein konsekutives 3-Tage-Wiege/Schätzprotokoll ermittelt.

Ergebnisse: 23 Bewohner mit Migrationshintergrund nahmen an der Studie teil, die Mehrheit (87%) war türkischer Herkunft. Die Gruppe der deutschen Probanden umfasste 37 Personen (Migranten: 76 ±6 Jahre, 52% weiblich; deutsche Probanden: 78 ±7 Jahre, 59% weiblich). Nahezu die Hälfte der Migranten war stark pflegebedürftig (48% vs. 11%), ein Drittel war bettlägerig (30% vs. 8%). Fünf wurden über eine Sonde ernährt (22% vs. 3%). Fast mit allen Untersuchungsmethoden ergab sich für die nicht-deutschen Probanden eine höhere Prävalenz von Unterernährung: einen niedrigen WU zeigten 56% der Migranten und 22% der nicht Migranten, BMI: 39% vs. 11%; sowie MNA: 22% vs. 3%. Nur einer der deutschen Probanden hatte einen geringen OAU. 83% der Zuwanderer hatten gleichzeitig 3 oder mehr Probleme bei der Nahrungsaufnahme (deutsche Probanden: 27%). Die wesentlichen Probleme in beiden Gruppen waren die Aufnahme zu geringer Mengen bei den Mahlzeiten (61% vs. 21%), das Verweigern des Essens (56% vs. 25%) oder Inappetenz (56% vs. 19%). Die Probleme der Nahrungsaufnahme korrelierten deutlich mit einem niedrigen BMI und eingeschränkter täglicher körperlicher Aktivität (ADL Score). Die Hilfsbedürftigkeit bei alltäglichen Aktivitäten war bei den Zuwanderern größer als bei der Gruppe der deutschen Senioren (ADL 61% vs. 24%). Die Diagnose Demenz war bei den Migranten die häufigste (48%), bei den deutschen Probanden war es Bluthochdruck (49%). Der Verzehr pürierter Nahrung war bei der Gruppe der Zuwanderer höher (17%). Die Teilnehmer beider Gruppen erreichten im Mittel die für Personen im Alter von 65 Jahren und älter empfohlene Energieaufnahme von 6.9 MJ (Frauen) und 8.3 MJ (Männer) nicht. In beiden Gruppen war der Anteil von Kohlenhydraten an der Energieaufnahme niedriger (44 E% und 42 E%) und der von Fett höher als empfohlen (40 E% und 43 E%). Mehr als die Hälfte der Teilnehmer unterschritt bei der Aufnahme von Vit. B_1, B_6, C, D, E, Folat, Calcium, Eisen und Magnesium die D-A-CH Referenzwerte. Hinzu kam bei den Zuwanderern ein niedriger Wert bei der Aufnahme von Vit. B_{12}.

Schlussfolgerung: Die für diese Untersuchung zur Verfügung stehende Personengruppe war relativ klein. Nur in 2 Einrichtungen konnten die Erhebungen durchgeführt werden. Daher können unsere Ergebnisse nicht verallgemeinert und als repräsentativ angesehen werden. Die Ergebnisse weisen jedoch darauf hin, dass bei den betagten Migranten Unterernährung häufiger vorkommt und mit Problemen bei der Nahrungsaufnahme und täglichen Routinetätigkeiten einhergeht, als es bei vergleichbaren einheimischen Senioren der Fall zu sein scheint. Durch eine intensivere Beachtung des Ernährungszustands und der Essgewohnheiten älterer Migranten sollte es möglich sein, das Vorkommen von Unterernährung zu reduzieren und deren Lebensqualität zu verbessern. Eine persönlichere Betreuung der Bewohner mit Migrationshintergrund durch das Anbieten von Speisen, die in Zusammensetzung und Zubereitung auf deren ethnische Zugehörigkeit Rücksicht nehmen, kann dazu beitragen, deren Ernährungssituation zu verbessern.

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Abbreviations

ADL	activities of daily living
AMA	arm muscle area
AMC	arm muscle circumference
BF%	body fat percentage
BMI	body mass index
bw	body weight
CAMA	corrected arm muscle area
CC	calf circumference
CHO	carbohydrate
CS	care staff
D-A-CH	Germany-Austria-Switzerland
G	gender
e.g.	for example
E%	energy percent
ESPEN	European Society of Clinical Nutrition and Metabolism
FFM	fat-free mass
FM	fat mass
IOM	International Organization for Migration
i.e.	“id est”, in other words
nm	non migrants
m	migrants
Max	maximum
MDK	Medizinischer Dienst der Krankenkassen
Min	minimum
MNA	mini nutritional assessment
MUAC	mid-upper arm circumference
MUFA	monounsaturated fatty acid
n	number of participants/residents
NH	nursing home
PAL	physical activity level
PUFA	polyunsaturated fatty acid
Ref	reference

SFA	saturated fatty acid
SD	standard deviation
TSF	triceps skinfold thickness
Vit	vitamin
vs.	versus
WHO	World Health Organization

1 Introduction

Migration within Europe is an on-going social phenomenon on a large scale. It affects the health of individual migrants as well as that of the host population (1, 2). According to the World Migration Report 2008 by the International Organization for Migration (IOM) in Geneva, Germany was hosting 10.1 million migrants in 2005. This was an increase from 9.8 million in 2000 and kept Germany the principal country of destination for migrants (3).

Since the 1950s, millions of people temporarily migrated to Germany looking for work. More or less healthy guest workers came to Germany, attracted to the country by an acute manpower shortage after World War II. Not only were those potential working migrants young and healthy, but they also had to pass medical check-ups in their home countries (4, 5). Turkish labor migration to Western Europe started to arrive in Germany with the signing of the recruitment agreements between Turkey and Germany in 1961. Turkish workers, a substantial part from rural areas such as Anatolia, were invited as guest workers (Gastarbeiter) particularly to work in factories and places which are characterised by a high intensity of work in a stressful environment (2). The Gastarbeiter, as the name says, were supposed to return to their country of origin once the job was done. However, most of them stayed and many of them had their wives and children join them (6).

While there were 6800 Turkish people living in Germany in 1961, with the arrival of new migrants the number went up to over 1 million in 1975 and climbed to over 2 million in 1998. Presently, the Turkish population has reached 2.7 million continuing immigration involving arrival of families and marriages. Those who arrived in the country in their youth in the 1960's are now over the age of 70. Turkish citizens became the largest group of migrants in Germany (7).

At the end of 2002 the 60-year and older foreigners in Germany were more than 700.000 with a share of 3.6% of all 60 year and older. The share of migrants in elderly population in Germany is estimated to increase between 1.6 - 1.7 million by the year 2020 (7). A third of the group lives in the region of Nordrhein-Westfalen (8).

Presently there is no nursing home run by a Turkish administration in Germany. The only active nursing home that offers services under the name of “Turkish Nursing Home” is in Berlin-Kreuzberg and is guided by Germans. It opened in January 2007 and offer beds for 155 residents. Other nursing homes in Nordrhein-Westfalen and Hessen are so-called “International and Multi cultural” and have 8-10% of migrant residents. There are some nursing care centers owned by Turkish people in Bönen (near Dortmund), in Gelsenkirchen, Essen, Hamburg and Berlin (9).

Relatively few data concerning either health status (4, 10-14) or eating habits (15, 16) of migrants are available in Germany and in other European countries. The nutrient intake of elderly migrants living in Germany has not been investigated so far.

Migrant’s use of home care

There are indications that some groups of non-native older persons have difficulty accessing home care services. In particular older Turkish people are often not aware of the existence of these services. This finding is all the more striking giving that not more than 45% of Turkish older persons with severe limitations receive any help whatsoever, either formal or informal. Another factor for the low take-up care appears to be that many migrants have difficulty in applying for the service. Apart from language problems, a small portion of elderly migrants consider the services too expensive (17).

A major reason for the low take-up of home services is that elderly migrants receive more informal help. Among other things this has to do with their different opinions of care, with a preference for help given by children rather than by home care professionals. In addition some older ethnic minority groups can call on a larger “pool” of informal care persons, such as parents and children.

The problem here again, is missing or inadequate migration data of sensitive health-care coverage for current and future needs assessment (18).

Elderly care in Turkish society

Turkey has a population of rather young people compared to other countries (19). The number of people over 65 years is about 7% of the whole population (20) whereas in Germany it is 17% (21). According to the WHO report, life expectancy at birth in Turkey is 71 years for men and 75 years for women (22). In Germany, the average life expectancy is 77 years for men and 82 years for women.

Turkey is a society which takes care of their elderly within their traditional social structure and customs. The big majority of elderly people lives with their children, those who are living alone are in close contact with them. The children share the task of caring for their elder parents. Care is given to and by the whole family unit, including spouses, uncles and aunts, brothers and sisters. Taking care is a family obligation. Turkish elders expect help from their children without having to ask. Family care, care as an obligation, care as a sign of respect and care learning by doing were described in a study of the care constructs of Turkish families in the Netherlands (23).

However, this cultural expectation is changing due to internal rural-to-urban migrations in Turkey because of the economic and political changes (24). Although elderly individuals are traditionally inclined to live with their family and children, the number of those living at nursing homes increases.

Compared with elderly Germans, first generation migrants generally have more children and more often live with them (25, 26). Most elderly migrants focus their expectations on family and children for aid and assistance. In cases when families' potential to assist is insufficient, institutionalization, however, may be unavoidable.

Factors affecting dietary intake and nutritional status in elderly

There is a variety of factors which may influence dietary intake and nutritional status of the elderly. The causes of nutritional deficiency in older people are likely to be multifactoral and reflect physical and physiological impairments, as well as psychosocial influences (27). Table 1.1 shows a summary of the factors that contribute to poor nutritional status in elderly (28-30).

Table 1.1: Selected risk factors for undernutrition in older people (30)

Risk factors	Examples
Clinical factors	Poor appetite
	Poor dentition
	Loss of taste and smell
	Disability and limited mobility
	Drug interactions
	Disease/ health conditions (cancer, diabetes, stroke, etc)
Life style and social factors	Isolation and loneliness
	Poverty
Psychological factors	Depression
	Confusion
	Anxiety
	Dementia
	Bereavement

Undernutrition is a frequent and serious problem in the elderly of developed countries, nevertheless, a routine assessment of nutritional status in homes is frequently not performed (31). Thus, reliable data on prevalence of undernutrition (i.e. malnutrition) in nursing homes are scarce. According to the few studies available undernutrition occurs within a range of 15-60% for institutionalized elderly (27, 31, 32). The great variance can be explained by the different criteria used to assess nutritional status.

Elderly migrants from other European countries represent an increasing portion of German nursing homes residents. It can be hypothesized that the dramatic change in life style (compared

with Turkish family traditions) and the offer of “German food” may increase the risk for a poor nutrition.

According to our knowledge there is no available data about nutrition and health status of elderly migrants living in German nursing homes.

2 Aims of the study

The aim of this comparative study was to investigate the nutritional status and related health factors of migrants of 65 years and older living in German nursing homes in comparison to a gender and age matched group of native Germans living in the same nursing homes. The analysis was conducted by the use of anthropometry, dietary records and a questionnaire involving nutritional intake and health status.

The specific aims were to

- present the nutritional and health status
- assess nutritional intake
- measure functional ability and dependency
- identify the factors associated with nutritional issues
- compare all parameters to them of a group of matched groups in order to identify the differences in nutritional needs.

3 Methods

3.1 Study design and inclusion criteria

The compilation of this comparative study data was performed from August to November 2006 in Germany. Two, “International and Multi cultural” nursing homes were chosen out of the 10 recruited for ErnSTES (Ernährung in stationären Einrichtungen für Senioren and Seniorinnen) in the federal states of Hessen and Nordrhein-Westfalen as a sub study of ErnSTES. In these nursing homes a significant number of ethnic minority residents were available to participate in the study. Also from these two nursing homes a group of non migrants (n=37) matched in age and gender was selected for comparison. First of all, the participants were scaled into 3 age groups: a) 65-74 years b) 75-84 years c) over 85 years. Prior to matching, first the age and gender distribution of persons with migration background from the two nursing homes were taken into consideration. A similar number of non migrants from each of the two nursing homes were taken into account regarding match criteria. Then non migrants were randomly selected from each age group until an equal proportion of males and females were obtained. Thus, the design ensured that the two groups were comparable and the distribution of matched groups (in %) was not statistically significant (proof by Chi-square test) between the groups.

The following general inclusion criteria were defined for participation in the study:

- Age: ≥ 65 years
- Informed consent (agreement to participate)
- Resident of a nursing home ≥3 months

Seniors with severe psychological disorders and terminal disease were excluded.
Prior to the launch of the study written information about aims and the procedure of the study were sent to the nursing homes by letter or email. Approximately one week later the nursing home managers were contacted by telephone. During the first visit of the researchers, detailed verbal information about the study was given to the care staff, the residents and/or their relatives prior to requesting their participation and permission to ask them questions.
If necessary, explanations were given again to individual residents and/or the relatives of the migrants in their own language (mothers tongue). They were informed that participation was

voluntary, that they could discontinue participation whenever they wanted without giving any explanation and how data would be used. The managers and researchers obtained individual written consent from the residents and/or their relatives. For residents with cognitive dysfunctions and those who were bedridden, the next of kin were also informed, and their consent was obtained.

Ethical considerations and financing

The data were collected and every participant received an individually specific code to anonym the data. ErnSTES was approved by the Ethical Committee of Ärztekammer Westfalen-Lippe und der Medizinischen Fakultät der Westfälischen Wilhelms-Universität Münster and Faculty of Medicine, Bonn University, Germany. ErnSTES was financed by a grant from BMELV/BLE, 05HS017/1-2.

3.2 Data collection

3.2.1 Basic characteristics of participants

Within the study, a specific questionnaire on characteristics of the residents was designed and validated in a pilot study. It consisted of four parts and was completed by the care staff.

The first part included “basic characteristic information” like date of birth, gender, care level and life style habits such as smoking, frequency of alcoholic beverage consumption. The second part included questions regarding chronic diseases, oral medication, gastrointestinal problems (health status). The third part was designed to obtain information concerning “functional ability and mobility”. The fourth part, focused on nutritional habits and problems, included questions such as difficulties in chewing, swallowing, loss of appetite.

The original questionnaire is presented in the appendix. If any of the questions was not completed properly, the researchers asked the care staff once again.

Nursing care level

Participants’ care levels and different degrees of dependency were considered according to the recommendation given by the Medical Service of Health Insurance (Medizinischer Dienst der Krankenkassen [MDK]) (33). The definition of the Federal Health Monitoring system (Gesundheitsberichterstattung des Bundes [Gesundheit, Statistik, GBE]) was used to establish the care needs of the participants (34). These three care levels were as follows:

Care level I-substantially in need of care

Persons in the nursing "care level I" are persons, who need help at least once a day with body care, food or mobility. On average this must take at least 90 minutes per day, of this, more than 45 minutes must be dedicated to basic care.

Care Level II -severe in need of care

Persons in the nursing "care level II" are persons, who need help at least three times per day at different times of day with body care, food or mobility, with more than 120 minutes to be basic care accounts.

Care Level III-severest in need of care

Persons in the nursing "care level III" are persons, who are in long-term care dependency and need help daily round the clock, also at night, on body care, food or mobility. On average this must take at least five hours per day and of this, at least four hours must be dedicated to basic care.

3.2.2 Nutritional status

Nutritional status was evaluated using anthropometric measurements and daily dietary intake. When the residents were not able to stand the procedure and/or uncooperative during the anthropometric measurement process, the measurements were taken at another time within a one-week period.

3.2.2.1 Anthropometric measurements

Measurements involved body weight, body height, knee height, mid-upper arm circumference, triceps skinfold thickness, calf circumference and hand grip strength, were collected from the residents in the mornings. Severely demented or bedridden residents were measured with the help of care staff.

The following cut-off anthropometric markers were used to define undernutrition which are widely used values for assessing nutritional status (35-38). Anthropometric measures were also considered as normal values when above 10th percentile (P10-reference value) for age and gender.

All residents were classified according to these markers and comparisons were made.

- Calf circumference: <31 cm
- Mid-upper arm circumference: <22 cm
- Triceps skinfold thickness: male<8, female<12 mm
- Arm muscle area: male<41, female<30 cm^2
- Arm muscle circumference: male<23.5, female<20 cm

Body weight and height

The measurements were performed in the morning between breakfast and lunch after morning's care, in light clothing and without shoes to the nearest 0.1 kg by chair and/or wheelchair scales which were available in the nursing homes. The weight of the light clothes was not substracted from the observed weight. Any extreme signs of edema were also noted. Weight upon admission was collected from the medical records of the participants.

Standing body height was measured by using a portable digital stadiometer (Soehnle, Germany) and with the head positioned in the Frankfort Horizontal Plane without shoes, feet close together. For the residents who did not want to remove their shoes, the height of the shoe was deducted from the measured height.

Knee height measurements

A portable knee height calliper (AKE, Austria) was used for the measurements and the procedure outlined by Chumlea et al (39) was followed.

The knee height was measured for each resident of their left leg (unless the leg was paralyzed or otherwise injured) in the sitting position and the knee bended 90 degree from the heel to appoint 5 cm proximal to the patella. The same procedure was performed for bedridden residents in supine position.

For the residents who were bedridden and chair bound or were not able to stand straight because of mobility problems and kyphosis, knee height measurement was used to estimate stature.

Arm anthropometry

By means of measurements of skinfold thickness and mid-upper arm circumference provide an indirect measure of quantity of body mass and body fat (40).

Measurement of upper arm was made on the non dominant arm (i.e. mainly the left) unless it had been affected by disease or disability. The mid point of the upper arm was identified by measuring the arm from the acromion to the olecranon while the subject held the forearm in horizontal position (41).

Triceps skinfold thickness (TSF) was then measured using a calliper at the mid point of the non dominant arm over the triceps muscle and the dial was read at the nearest 1 mm. Calliper applications were made two times and the average value was analyzed.

Reference value for TSF was related to age and a value below the 10th percentile was considered as subnormal (42). Mid-upper arm circumference (MUAC) was measured at the same level as TSF to the nearest 0.1 cm using a plastic measuring tape. The measurement was taken mid point of the arm process following standard procedures (42, 43). The mean value of two repeated measurements was evaluated.

Calf circumference (CC)

Calf circumference was measured either in sitting or recumbent position on their left leg (unless it had been affected by disease or disability) bent at 90° angle at the knee. The plastic tape measure was positioned at the widest part of the calf. The measurements were repeated two times and the largest one was evaluated. All the measurements were taken nearest to 1 mm and severe edema was noted.

Muscle strength

Muscle strength in each hand was measured by using the Martin Vigorimeter which consists of a manometer connected to a compressible rubber bulb and is available in three different sizes depending on the size of the hand (44). Air pressure introduced into the system, upon exertion of maximum force, is measured in kilopascals (kPa). The medium bulb was used for the Martin vigorimeter and before each test the subjects were instructed verbally “to squeeze as hard as possible”. Dominant hand measurement was evaluated. The residents with severe cognitive and physical impairments were excluded.

Core indicators for nutrition status

Additionally, together with anthropometric markers (BMI [<22 kg/m²], CC [<31 cm], TSF [male<8, female<12 mm], AMC [male<23.5, female<20 cm]) and loss of appetite were used as core indicators for nutritional status in this study. Because they are considered to be appropriate

for assessment of nutritional state in difficult-to-sample populations (45). A resident was classified as being undernourished if two or more of the nutritional variables were subnormal.

3.2.2.2 Calculations

Estimation of height from the knee height measurements (46)

Females: Height (cm) = 82.21 + (1.85* knee height [cm])-(0.21*age [years])

Males: Height (cm) = 78.31 + (1.94*knee height [cm])-(0.14*age [years])

Body mass index (BMI kg/m²)

Body mass index was calculated by dividing the measured weight in kilograms by the square of the body height in meters and categorized into four weight classes; >20 (very low), 20-<24 (low), 24-<29 (desirable), and ≥29 (high) (47). Additionally, BMI <22 kg/m² considered as cut-off for undernutrition (48).

Body fat percentage (BF%)

Body fat percentage was predicted from BMI, age and gender using the Deurenberg equation developed and validated in Caucasians (49).

% body fat=1.20 BMI-10.8G + 0.23age-5.4

(In which BMI is kg/m² and age in years and G=gender for male: 1, for female: 0).

Fat-free mass (FFM)

Fat-free mass was calculated as the difference between body weight and fat mass.

Fat mass (FM) = BF%*body weight (BW)

FFM=BW-FM

Arm anthropometry

Arm muscle circumference (AMC), arm muscle area (AMA) and bone-free or corrected arm muscle area (CAMA) were calculated according to the following equations (50, 51).

Arm muscle circumference (cm) and area (cm²) were calculated:

AMC (cm) = MUAC (cm)-0.1 [π x TSF (mm)]

AMA (cm²) = AMC²/4π

Corrected Arm Muscle Area (CAMA): Correction factors (51) were applied to give corrected arm muscle area.

CAMA (cm^2) =AMA cm^2-10 (males)

CAMA (cm^2) =AMA cm^2-6.5 (females)

Weight loss within past 3 months

Weight loss of within the past three months was calculated by looking up the weight of the individuals before three months from the residents' documentation. If the documented period was less or more than three months, weight change was extrapolated to 3 months.

Nutritional problems

The questions about present nutritional problems such as difficulties in chewing, swallowing, cutting a piece of meat, loss of appetite and refusing to eat, whether the resident eats only on request or eats noticeably little, were completed by the care staff with the only possible answers "yes" or "no". The number of nutritional problems per participant was also classified as "0-2" and "≥ 3" for the evaluation.

3.2.2.3 Food, energy and nutrients intake

Dietary record

Dietary intake was assessed using 3 consecutive week days (mostly the first days of the week) by weighed food records using a digital scale (firm: Dr.Oetker, Germany) with a resolution of one gram within the interval of 0-3 kg. The food was weighed per portion using household measures (e.g. slice and spoon) before they were served and the amount of leftovers -if any- were estimated for each resident and recorded. This procedure was done for the 3 main meals and 1-2 snacks to record current food intake as well as energy containing beverages, by the researchers.

The additional snacks eaten by the residents during the study period were also weighed and recorded. In addition, visitors were asked whether they had given the residents anything to eat when visiting. Nutrients intake of the residents was also evaluated according to gender for both groups.

In order to evaluate, food items were classified into 20 groups as shown in table 3.1. The detailed list is in appendix, table 9.1.

Table 3.1: Food groups used for evaluation

• meat	• potatoes
• meat products and sausages	• vegetables
• fish	• fresh vegetables
• eggs	• vegetable products, legumes
• milk and yoghurt	• fresh fruit
• cheese and curd	• fruit products
• butter	• sugar
• oil and margarine	• confectionary
• bread and bakery products (pastries)	• spices and ingredients
• grain products, rice, noodles	• sauce

Evaluation of dietary intake

The food intake data was computerized and energy and nutrient content was calculated using the software EAT-2006 (52). This software is based on the Official German nutrient data base (BLS version II.3; Bundeslebensmittelschlüssel).

Analyses were based on the daily intake of energy, macro, micronutrients, cholesterol, and fibre. Percentages of energy derived from protein, carbohydrates and fat were calculated (E%). Intake of protein was also expressed per kg body weight. Dietary adequacy was assessed on the basis of percentage deviation of median intakes from reference values for adults aged 65 years or older published by the German, Austrian and Swiss Nutrition Societies (53).

Additionally, consumed daily amount and type of the formulas were recorded and analyzed in the same computer program to evaluate nutrients intake of tube fed residents.

3.2.3 Health status

Questionnaire about 17 single chronic diseases was completed by care staff according to the physician diagnosis. Number of concurrent chronic diseases was calculated and classified as “1-3”, “4-5” or “6 or more chronic diseases” for the evaluation.

Symptoms such as diarrhea, constipation, nausea, vomiting and edema were inquired with an answer “yes” or “no”.

Daily oral intake of medication was asked with four answer possibilities and classified for analysis as “none”, “1-3”, “4-5” or “6 or more medicaments a day”.

3.2.4 Functional ability and mobility

The functional ability in terms of activities of daily living (ADL) was evaluated by the Barthel Index (54) and the information was collected on the basis of observation by the care staff. The Barthel Index test establishes the degree of functional independence from any help in ten categories: bathing, feeding, grooming, dressing, bowels and bladder control, toilet use, transfers (bed to chair and back), mobility (on level surfaces) and stairs mobility. It is scored from 0-100, with higher score indicating greater function/less dependency. ADL was classified into three groups for the evaluation; independent (100-65 points), in need of assistance (64-35 points) and dependent (34-0 points). The lowest score, 0, represents a totally dependent bedridden state.

Physical activity

For an assessment of daily physical activity and mobility of the residents, the following questions were asked to care staff:

- Frequency of leaving nursing home for shopping, taking a walk or visiting were inquired (“How often does the resident leave the nursing home?”) with five possible answers (“daily”, “several times in a week”, “weekly”, “monthly”, “never”).
- The use of mobility assistive was asked with five possible answers
(“ none“, “care staff”, “walking stick”, “walker”, “wheelchair”).

3.2.5 Mini Nutritional Assessment (MNA)

MNA is a widely used validated international questionnaire to evaluate the nutritional state of seniors (55). The anthropometric area of MNA consists of BMI, MUAC, CC and weight loss during the last three months. The general area assessments (questions related to living, medication use, physical and mental status and mobility), and the dietary area assessments

(questions related to dietary intake and eating problems), weight loss were collected by interviewing care staff who knew the resident well.

To assist in judgment to complete the MNA form accurately and consistency, a user guide has been developed. In the user guide, each question in the MNA is explained in turn and the scoring described. The maximum MNA score is 30 points and the sum classifies the residents in the following manner: A good condition of nutrition was considered above 23 points; well-nourished (MNA 1), at risk of malnutrition; 23 to 17 points (MNA 2), malnourished; < 17 points (MNA 3) (56). MNA was not evaluated for totally tube fed participants.

3.2.6 Care staff's assessment

Additionally, care staffs' subjective assessment about the residents' health and nutritional status were asked in questionnaire. Answers were given in form of "under", "well"- and "overnourished" for nutritional status and "good", "average", "poor", "stable" and "unstable" for health status.

3.3 Statistical Analyses

Continuous variables (anthropometry, nutrients intake) were given with arithmetic mean, standard deviation, minimum (min), maximum (max), and percentiles (nutrients intake: P25, P50 [median] and P75; anthropometry: P10, P25, P50, P75, P90). Normal distributions of continuous variables were tested with Kolmogorov - Smirnov Test. In order to analyze differences between the two groups for normal distributed variables, the t-test was used. For not normally distributed variables the Mann Whitney- U test was used. The paired t-test was used for repeated measurements (weight upon admission and current).

Categorical variables are presented as percentages. Differences between independent groups for categorical data were determined by using Chi-square-Fisher's exact test and Cochran Armitage's test for trend to get reliable statistical data. The Cochran Armitage's test is a method of directing Chi-square tests toward narrow alternatives (57, 58).

Pearson's correlations analyze and Kendall-Tau-b was used in order to test inter-class correlation coefficient. Differences were considered statistical significant at two-sided p-values ≤ 0.05. Statistical analyses were performed using the Statistical Package of Social Sciences (SPSS, version 15.0, München) for Microsoft Windows.

4 Results

A hundred and forty five residents fullfilled the inclusion criteria and participated in the study from two nursing homes between August and November 2006. Out of 145 residents, 15.9% (n=23) of them were migrants. Among the migrants 87% (n=20) had a Turkish background, and the rest were from other non Western countries. Table 4.1 shows matched groups according to age and gender.

Table 4.1: Matched groups according to age and gender

Age (years)		Female		Male	
		migrants (n=12)	non migrants (n=22)	migrants (n=11)	non migrants (n=15)
65-74	%	33.3	31.8	54.5	53.5
75-84	%	58.3	59.1	36.4	33.3
≥85	%	8.3	9.1	9.1	13.3

The equal distribution of the matched groups (in %) was confirmed by Chi-square test and there was not a significant difference between the groups.

4.1 Participants: Basic characteristics

The basic characteristics of the participants are summarized in table 4.2. Significant differences in basic characteristics between the two groups were as follows;

The length of stay in nursing home was shorter (36.7 ± 28.6 months) in migrants compared to non migrants (61.7 ± 60.7 months, $p<0.05$). Seven migrants (31%) were bedridden and 5 (22%) of them were tube fed ($p<0.05$). Two of the migrants in addition to oral nutrition were receiving tube feedings. The majority of the residents participating in the study either migrants (100%) or non migrants (62%) never consumed alcohol containing beverages ($p<0.01$).

Table 4.2: Comparison of basic characteristics of the participants

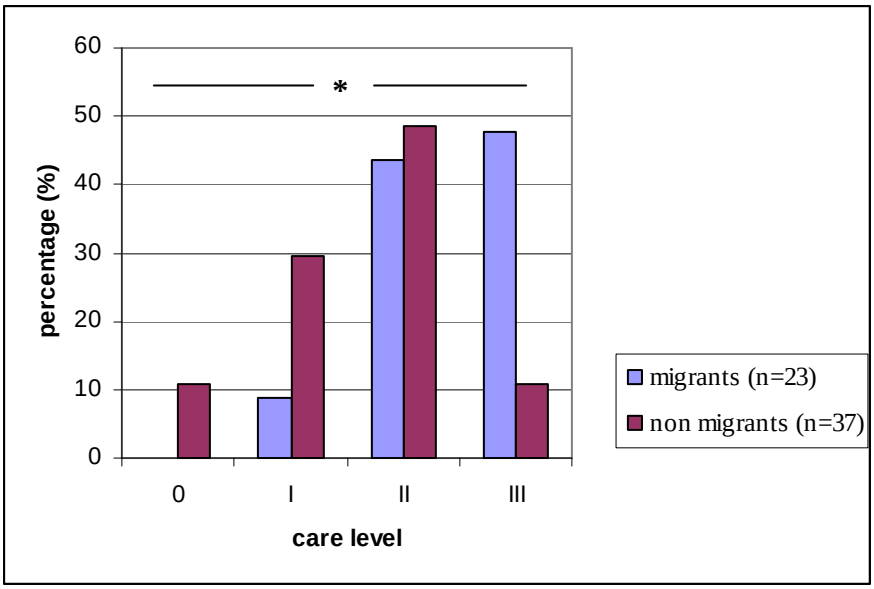
Characteristics	migrants (n= 23) n (%)	non migrants (n= 37) n (%)	p value
Gender			
Female	12 (52.2)	22 (59.5)	ns
Age (years)[a]	75.9 ± 6.1	78.4 ± 6.8	ns
Length of stay in NH (months)[a]	36.7 ± 28.6	61.7 ± 60.7	<0.05[b]
Bedridden	7 (30.4)	3 (8.1)	<0.05[c]
Tube fed	5 (21.7)	1 (2.7)	<0.05[c]
Smoking status			ns[c]
non-smoker	22 (95.7)	34 (91.9)	
current-smoker	1 (4.3)	3 (8.1)	
Alcohol consume			<0.01[c]
never	23 (100)	23 (62.2)	
seldom	-	8 (21.6)	
a glass a day	-	3 (8.1)	
more than a glass a day	-	3 (8.1)	

NH=nursing home, [a]Mean ± SD, [b]t-test, [c]Chi²-Fisher's exact test

Nursing Care level

As presented in figure 4.1 (Appendix, Tab. 9.2) there were significant differences between the groups according to their care level ($p < 0.05$).

Almost half of the migrants were severest in need of care (level III, n=11, 48%), 44% (level II, n=10) were in severe in need of care. The corresponding values for non migrants were 11% (level III) and 49% (level II). Four (11%) of the non migrants did not belong to any care level (care level 0) in the sense of care defined by MDK.



*Cochran-Armitage's trend test; p< 0.05

Figure 4.1: Distribution of the residents according to nursing care level

4.2 Nutritional status

4.2.1 Anthropometry and body composition

Body height, weight and BMI (kg/m²)

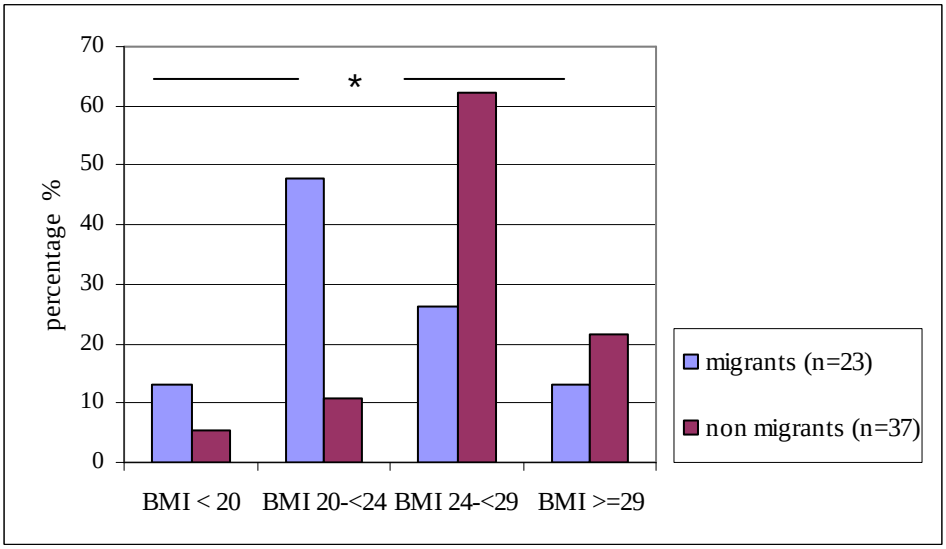
Descriptive statistics for anthropometric measurements are shown in table 4.4. Including bedridden residents 27 (73%) of non migrants' and 20 (87%) of migrants' current height (stature) estimated through the knee height measurements. The weight of the residents differed significantly in between the groups ($p<0.05$). When body weight is expressed by gender, male migrants had significantly lower weight (64.5 ± 9.4 kg) than non migrants (80.1 ± 14.5 kg, $p<0.01$, Appendix, Tab 9.3). No difference was observed between female groups. Thus, on average non migrants were 9.5 kg heavier and 2.4 cm taller than migrants.

Current body weight of the all participants was weighed. Weight data upon admission to calculate BMI was missing for seven individuals (3 migrants and 4 non migrants).

The average BMI of the migrants, both upon admission (25.3 kg/m²) and current (24.5 kg/m²) were lower than non migrants (around 27 kg/m², $p<0.05$). This accordance with the classification of the National Research Council and the WHO can be evaluated as satisfactory (Tab 4.4).

Figure 4.2 presents the classification of the residents according to BMI categories. More than half of (62%) the non migrants had a desirable weight (BMI 24 -< 29) whereas only 26% of the migrants had this value. Fourty eight percent (n=11) of the migrants had a BMI 20-< 24 kg/m² and 11% (n=4) of the non migrants had this BMI value. Thirteen percent (n=3) of the migrants and 5% (n=2) of the non migrants had a BMI below 20 kg/m² and again 13% of the migrants had high values defined as ≥ 29 kg/m². The corresponding value was 22% for non migrants. There were significant differences between the groups (Appendix, Tab. 9.5).

When BMI was expressed by gender, male migrants had significantly lower BMI both current (22.6 kg/m²) and upon admission (22.5 kg/m²) than male non migrants ($p<0.05$, Appendix, Tab. 9.3). The mean BMI values for both migrant and non migrant females were around 27 kg/m² (Appendix, Tab. 9.4).



*Cochran-Armitage's trend test; $p<0.05$

Figure 4.2: Nutritional status of the residents according to BMI (kg/m²) in four categories

A considerable percentage (more than two-thirds) of the migrants (39%) was assessed as being underweight according to cut-off BMI <22 kg/m² (Tab. 4.3). The corresponding percentage for non migrants was 10.8% and the difference was significant.

Table 4.3: Nutritional status of residents according to BMI reference cut-off value for elderly*

BMI Ref. value	migrants (n=23)		non migrants (n=37)	
	n	%	n	%
BMI <22 kg/m²	9	39.1	4	10.8
BMI ≥22 kg/m²	14	60.9	33	89.2

*Chi²-Fisher's exact test; $p<0.05$

Arm anthropometry and calf circumference

From each group one of the bedridden residents' arm anthropometric measurements did not succeed. Results and distribution of data are presented in table 4.4.

Mid- upper arm circumference (MUAC) and arm muscle area (AMA) representing somatic body protein content were for migrants 24.9 ± 2.0 cm, 49.6 ± 7.8 cm² and for non migrants 25.6 ± 3.1 cm, 52.9 ± 12.3 cm². There were no statistical differences between the groups.

The evaluation of anthropometric results according to gender showed that there was difference appearing in the male groups. Although there was no difference between female migrants and non migrants, the differences was significant between male groups except for body height, MUAC and AMA (Appendix, Tab. 9.3). The average MUAC for male migrants was around 29 cm and for non migrants 32 cm ($p<0.01$). Eighty percent of male migrants between 10th and 90th percentiles had their MUAC less than or equal to 33 cm but greater than 23.8 cm.

The mean triceps skinfold thickness (TSF) for female migrants was 17.9 ± 3.3 mm. Eighty percent of them between 10th and 90th percentiles had their skinfold measurements less than or equal to 41.5 mm but greater than 7.7 mm. The mean TSF value of non migrant females was 18.0 ± 1.5 and corresponding percentiles were 11.3 mm (10th) and 30.4 mm (90th). Among the males, there was a slight lowering of the mean TSF which was for migrants around 11 mm and for non migrants 14 mm ($p<0.01$). Eighty percent of migrants between 10th and 90th percentiles had their skinfold measurements less than or equal to 15.1 mm but greater than 6.5 mm. The percentile distributions for anthropometric measurements are shown in appendix (Tab. 9.7-9.10).

Calf circumference (CC)

As presented in table 4.4, the average CC was significantly lower in migrants (31.9 ± 6.2 cm), than non migrants (34.6 ± 4.4 cm). The same significance has been observed when CC was considered as optimal cut-off which is <31 cm for elderly people. Thirteen of migrants (57%) and 8 (22%) of non migrants had a CC lower than 31 cm ($p<0.05$, Tab. 4.5).

Concerning gender, the average CC was around 31 cm for male migrants and the corresponding value was 36 cm for non migrants. Eighty percent of male migrants' 10th and 90th percentiles had their CC measurements less than or equal to 37.9 cm but greater than 24.7 cm. Significant difference was observed in males ($p<0.05$), but not in females. In appendix, tables 9.7-9.10 show the frequency of distribution of the measurements for 10th and 90th percentiles.

Body fat percentage (BF%) and fat free mass (FFM)

The average estimated BF% as well as FFM were lower in male migrants than in male non migrants ($p<0.01$). The difference was not important between the female groups (Tab. 4.4, Appendix Tab. 9.3, 9.4).

Muscle strength

Muscle strength was measured by hand-grip test which identifies elderly people at risk of disability. In both groups, the residents with mental and/or physical impairment met difficulties in performing this test and were therefore excluded. The majority of the migrants (80%) and almost half of the non migrants (43%) were not able to succeed in this test. No significant differences were observed between the rests of the groups.

Table 4.4: Anthropometric measurements of the participants (mean ± SD)

	migrants (n=23)	non migrants (n=37)	p value	missing value m/nm
Weight (kg)	62.7 ± 13.5	72.2 ± 15.0	<0.05[a]	
Height (cm)	160.4 ± 9.1	162.8 ± 9.6	ns[a]	
BMI (kg/m²)-upon admission	25.3 ± 7.3	26.9 ± 4.3	<0.05[a]	3/4
BMI (kg/m²)-current	24.5 ± 5.4	27.1 ± 4.5	<0.05[a]	
CC (cm)	31.9 ± 6.2	34.6 ± 4.4	<0.05[a]	
MUAC (cm)	29.4 ± 3.9	30.8 ± 3.9	ns[b]	1/1
TSF (mm)	14.8 ± 9.1	16.4 ± 6.1	ns[b]	1/1
AMC (cm)	24.9 ± 2.0	25.6 ± 3.1	ns[b]	1/1
AMA (cm²)	49.6 ± 7.8	52.9 ± 12.3	ns[b]	1/1
CAMA (cm²)	41.5 ± 7.6	45.0 ± 11.6	ns[b]	1/1
FFM (kg)	42.9 ± 5.8	46.8 ± 7.5	<0.05[b]	1/1
Body Fat %				
Female	32.9 ± 8.0	34.8 ± 6.1	ns[b]	
Male	28.2 ± 2.9	33.6 ± 4.9	<0.05[b]	
Hand grip strength (kPa)†	33.6 ± 21.7	47.7 ± 22.5	ns[a]	17/16

m= migrants, nm= non migrants, BMI= body mass index, CC= calf circumference, MUAC= mid-upper arm circumference, TSF= triceps skinfold, AMC= arm muscle circumference, AMA= arm muscle area, CAMA= corrected arm muscle area, FFM= fat free mass, †non dementia, [a]Mann-Whitney U test, [b]t-test

Comparison of the groups according to reference anthropometric values

As presented in table 4.5, migrants had frequently significant lower CC and TSF values than non migrants. Concerning gender, there were no significant differences between female groups but CC, MUAC and TSF were significantly lower in male migrants than in male non migrants (Appendix, Tab. 9.3, 9.4).

Table 4.5: Prevalence of low anthropometric values in migrants and non migrants

Indicative of undernutrition	migrants (23) n (%)	non migrants (37) n (%)	p value*
CC <31 cm	13 (56.5)	8 (21.6)	<0.05
MUAC <22 cm	none	1 (2.7)	ns
TSF male <8, female <12 mm	6 (26.1)	2 (5.4)	<0.05
AMA male <41, female <30 (cm^2)	2 (9.1)	3 (8.3)	ns
AMC male <23.5, female <20 (cm)	2 (9.1)	3 (8.3)	ns

CC=calf circumference, MUAC=mid-upper arm circumference, TSF=triceps skinfold thickness AMA=arm muscle area, AMC=arm muscle circumference, *Chi^2-Fisher's exact test

4.2.2 Weight changes

A recent weight loss for a period of 3 months is regarded as nutritional indicator of high predictive value for mortality. It is also a part of the nutritional evaluation of the MNA, thus it was included as an independent screening question. Over half of the migrants' (83%) and non migrants' (65%) body weight were stable during the last 3 months. As shown in figure 4.3 (Appendix, Tab. 9.11) only one of the migrants (4%) and 5 of non migrants (14%) had a decrease of more than 5% of body weight. Two of the migrants (9%) and three of non migrants gained weight. The rest remained stable. No difference was observed between the groups.

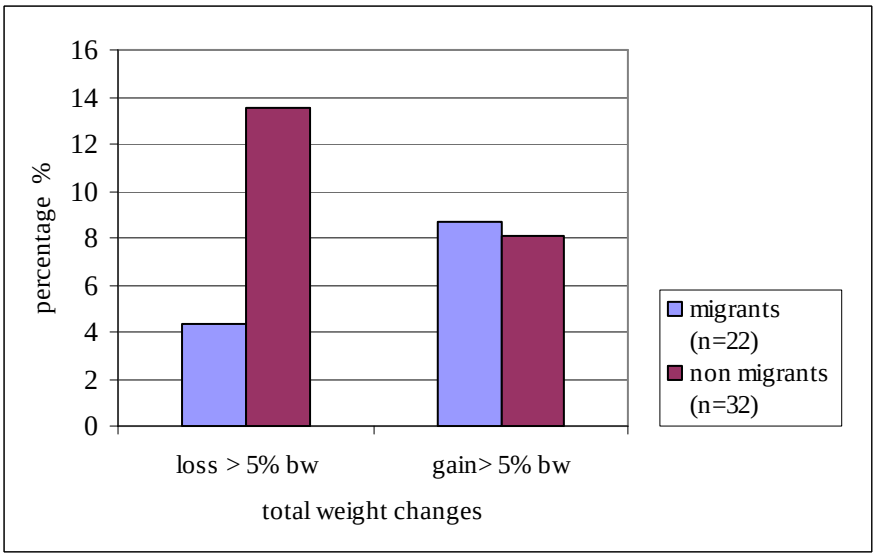


Figure 4.3: Prevalence of weight changes of the participants in the last 3 months

4.2.3 Nutritional habits and problems

Nutritional habits

As presented in table 4.6, 67% of the migrants and 86% of non migrants consumed regular diet (whole) menus (i.e. food served). Pureed diet consumption was higher (16.7%) in migrants than in non migrants ($p < 0.05$).

Table 4.6: Nutritional habits of the participants†

Nutritional habits	migrants (n=18) n (%)	non migrants (n=36) n (%)	p value*
Regular diet	12 (67)	31 (86)	ns
Pureed diet			
Always	3 (16.7)	none	<0.05
Some food	1 (5.6)	2 (5.6)	ns
Black tea	17 (94.4)	5 (13.9)	<0.001
Herbal tea	4 (22)	18 (50)	<0.05
Coffee	11 (61.1)	34 (94.4)	<0.01

†Participants with tube fed excluded, *Chi²-Fisher's exact test

Black tea was the preferred beverage (94%) among the migrants whereas coffee (94%) was mostly chosen by non migrants. Daily prescript vitamin and mineral supplementation was not considerably important. None of the migrants and only 1 (3%) of non migrants was taking vitamin tablets either daily or every other two days. There was also similarity in the taking of mineral supplements. One migrant and 3 (8%) non migrants were taking either daily or every other day minerals. Use of oral nutritional supplementation (ONS) was irrelevant as only 1 (3%) non migrant sometimes received nutritional supplement.

Nutritional problems

The frequency of nutritional problems in migrants was three times higher as in non migrants. Among migrants 72% needed help to cut their food, 61% were eating noticeably little. The other most common problems affecting food intake were loss of appetite (56%) and refusal to eat (56%).

Table 4.7: Subjective variables affecting food intake‡

Variables	migrants (n=18) n (%)	non migrants (n=36) n (%)	p value*
Loss of appetite	10 (55.6)	7 (19.4)	<0.01
Chewing difficulties	7 (38.9)	8 (22.2)	ns
Swallowing difficulties	1 (5.6)	1 (2.9)	ns
Need help for cutting	13 (72.2)	16 (44.4)	ns
Refusal to eat	10 (55.6)	9 (25)	<0.001
Eat noticeably little	11 (61.1)	9 (25)	<0.01
Drink noticeably little	9 (52.9)	6 (17.1)	<0.001
Need drinking assistance	7 (39.1)	2 (5.4)	<0.001
Drink only when requested	8 (43.5)	7 (18.9)	<0.05

‡Participants with tube fed excluded, *Chi^2-Fisher's exact test

Drinking with assistance was also significantly more common in migrants compared to non migrants and these residents only drank more frequently when requested. The residents on exclusive tube feeding are not included in the evaluation.

4.2.4 Core indicators of nutritional status

Table 4.8 shows the nutritional core indicators for migrants and non migrants. Four of the five nutritional core indicators were higher for migrants than for non migrants, especially, BMI, CC and loss of appetite.

Table 4.8: Nutritional core indicators of participants

Variables		migrants (n=23) %	non migrants (n=37) %	p value*
BMI (kg/m²)	<22	39.1	10.8	<0.05
CC (cm)	<31	56.5	21.6	<0.05
TSF (mm)[a]	male < 8, female <12	26.1	5.4	<0.05
AMC (cm)[a]	male < 23.5, female <20	8.7	8.1	ns
Loss of appetite†		55.6	19.4	<0.01

CC=calf circumference, TSF=triceps skinfold, AMC=arm muscle circumference, [a]one missing value from each group, †Participants with tube fed excluded, *Chi²-Fisher's exact-test

Classification of the nutritional status into two classes (Tab. 4.9) based on the presence of the five indicators shows that 36% of the migrants were undernourished ($p<0.05$). Of the non migrants group only 6% showed signs of undernourishment.

Table 4.9: Undernourished residents on the basis of nutritional core indicators*

	migrants (n=22)		non migrants (n=36)	
Number of core indicators	n	%	n	%
≤2	14	63.6	34	94.4
≥3	8	36.4	2	5.6

*Chi²-Fisher's exact test, $p<0.05$

4.2.5 Food, energy and nutrient intake

Food group's intake

The residents were served three main meals and 1-2 in between meals/snacks per day. In both nursing homes one cooked warm lunch, so-called "international" and "Muslim cuisine," was served, especially to migrants, according to their traditional eating habits. Concerning their habits, some food such as olives and fresh vegetables (i.e. tomatoes) were also available for breakfast and dinner.

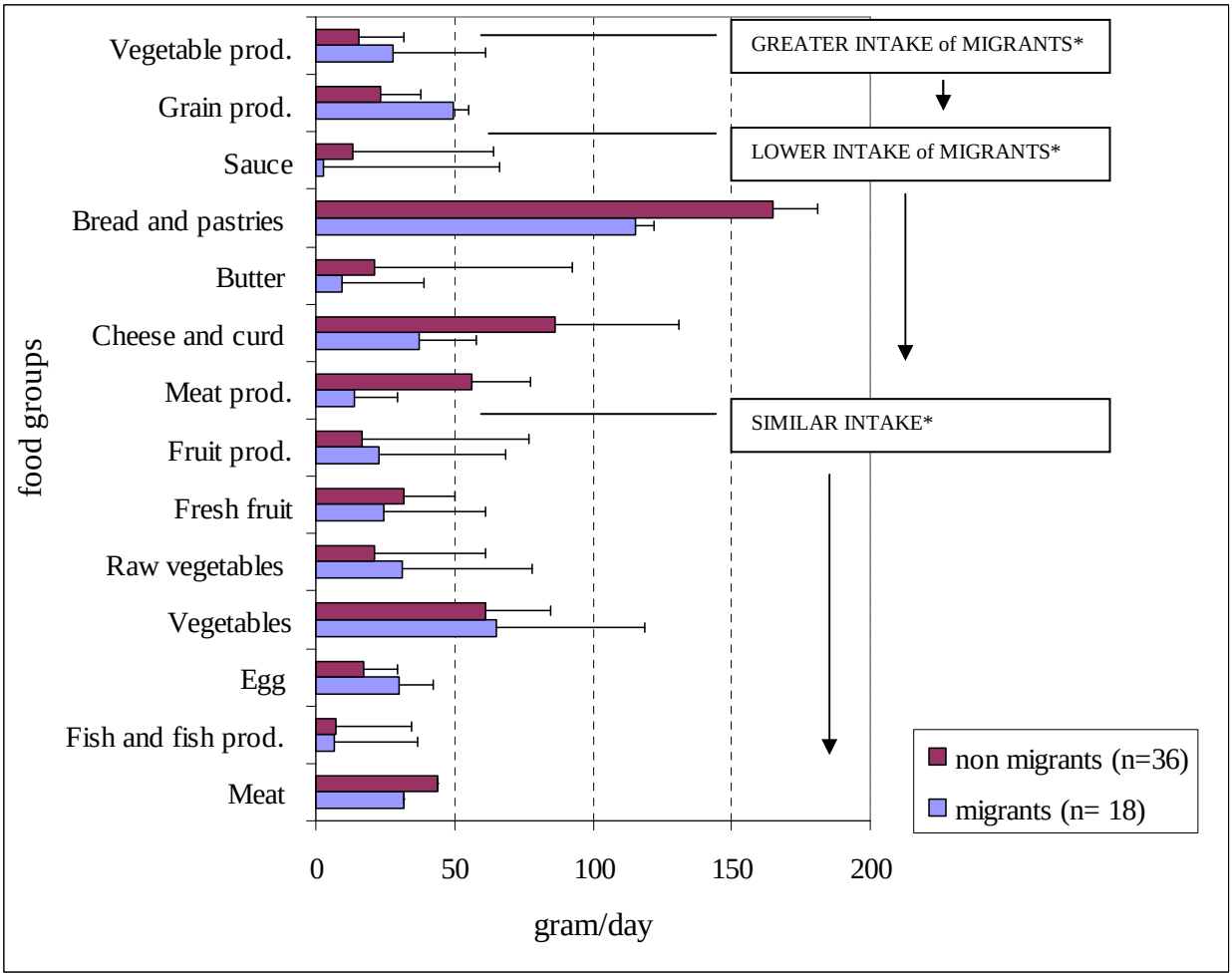
We examined the daily consumption of food to investigate which food sources could explain the observed differences in energy, macro and micronutrient intakes. Differences in absolute intake of food items between migrants and non migrants are summarized in table 4.10 and in appendix, Tab. 9.14).

Migrants had a daily greater intake of grain (49.7±33.4 g) and vegetable products (28.1±25.2 g, $p<0.05$) and a lower intake of meat products (13.7±20.5 g, $p<0.001$), cheese and curd (37.5±30 g, $p<0.05$), butter (9.2±6.4 g, $p<0.05$), bread and pastries (115.5±63.1 g, $p<0.01$) and sauce (3.0±5.4 g, $p<0.001$) compared to non migrants (Fig 4.4).

Consumption of daily meat and meat products was about 100 g among non migrants, and migrants consumed less than half of this amount (45.6 g/day). The recommended intake of (59) for this food group (68 g/day) was not reached by migrants.

The average consumption of fish was of 6.8 and 7.3 g/day among migrants and non migrants, respectively. Both groups did not reach the recommendation which is 2 weekly servings, and about 150 g/week (59). Fish was served mainly once a week on Fridays. Due to the distribution of our protocol schedule, Fridays were not covered.

The average consumption of milk and yoghurt was adequate in both groups but migrants consumed less than the recommended intake of cheese (60 g/d). Daily recommended intakes for bakery products which are 150-200 g (59) were also not reached by the migrants.



*Mann Whitney-U test

Figure 4.4: The mean daily intake of food groups and differences between migrants and non migrants

Table 4.10: Comparison of daily food intake (g/day) of migrants and non migrants (percentiles)

Food groups	migrants (n=18)				non migrants (n=36)				p value*
	P25	median	P75	maximum	P25	median	P75	maximum	
Meat	10.6	20.6	53.8	98.1	21.6	46.8	61.7	93	ns
Meat products (sausages, salami)	0	0.2	28.6	54.3	23.5	47.8	72.6	202.3	<0.001
Fish	0	0	12.5	41.2	0	0	17	47.3	ns
Eggs	2.3	8.3	36.7	219.9	0.7	7	19.5	104.7	ns
Milk and milk products	112.3	255.4	581.4	1216.5	82.6	168.6	258.2	718.5	ns
Cheese and curd	16.6	28.5	48.1	111.7	24.8	72.9	136.3	283.7	<0.05
Butter	4	9.3	14.1	23.6	6.3	18	32.3	63.9	<0.05
Fats (oil and margarine)	3.5	22.2	27.8	42.9	7.1	18	30.1	59.3	ns
Bread and pastries	70.9	118.2	164.5	224.0	120.5	171.6	210.2	254.5	<0.01
Grain products	23.8	45.5	73.5	126.6	12	19.5	32.0	73	<0.05
Potatoes	18.7	57.5	109.8	186.3	62.4	96.3	124.9	196.1	ns
Vegetables	25.0	67.2	101.1	168.1	28.4	55.2	94.7	171.9	ns
Fresh vegetables	5.6	23.4	43.0	144.1	2.7	21.7	31.2	66.7	ns
Vegetable products	2.9	26.3	54.1	71.5	0.9	5.7	28.6	61.9	<0.05
Fresh fruit	0	0.9	33.6	168.2	0	6.1	46.5	315.2	ns
Fruit products	2.4	26.9	32	46.7	0	1.7	30.7	68.3	ns
Sugar	2.6	5.5	9	28.8	2	3.9	8.0	27.2	ns
Confectionary	0	0	3.4	21.0	0	0.2	3.1	40	ns
Sauce	0	0	4.2	14.0	1.6	9.6	21.8	52.8	<0.001

*Mann Whitney-U Test, ns; not significant

Energy and nutrient intake

The energy intake was calculated in form of calories (kcal) as well as in mega joules (MJ). Table 4.11 provides mean energy intake and percentages of energy derived from macronutrients. The average daily intake of energy was 1527 kcal (6.4 MJ) and 1635 kcal (6.8 MJ) for migrants and non migrants, respectively. The variation was considerable, with a mean energy intake ranging from 1008 kcal (4.2 MJ) to 2160 kcal (9 MJ) for migrants and from 875 kcal (3.6 MJ) to 2589 kcal (10.8 MJ) for non migrants. There was no difference in energy intake between the groups.
Gender related difference was prominent in the male migrants, for which the average daily energy intake was 6.6 MJ lower than for non migrants (7.7 MJ, $p<0.05$). In contrast, there was no difference between the female groups. But when daily energy intake is expressed per kg body weight, the difference becomes obvious in female groups. Female migrants had significantly higher energy intake per kg body weight than non migrants (32 kcal vs. 27 kcal, $p<0.05$, Appendix, Tab. 9.17).

According to the D-A-CH, the daily recommended energy intake for elderly people with sedentary life style (PAL 1.2) is 1400 kcal/day (5.9 MJ) in females and 1700 kcal/day (7.1 MJ) in males (53). The daily energy intake of the participants from both groups met these recommendations (Appendix, Tab. 9.17 and 9.19). Daily recommended energy intake for elderly with strenuous physical activity level (PAL 1.4) is 1600 kcal (6.9 MJ) in females and 2000 kcal (8.3 MJ) in males. Taking these recommendations into consideration, daily energy intake was low in both groups. Table 4.12 shows further the percentage of the migrants and non migrants with an energy intake below these values. 87% of migrants and 70% of non migrants had an energy intake below the recommendations given for this age group.

The average protein intake was 54.8 g and derived 14.5% of daily energy in migrants. Non migrants had similar intake in which the protein intake was 63 g and derived 15.5% of daily energy. Protein intake per kg body weight (0.9 g) was the same in both groups. 57% of migrants and 83% of non migrants reached the recommended level (Tab. 4.12). Gender-dependent daily protein intake was significantly lower in migrant males than in non migrants (62 g vs. 73 g, $p<0.05$).

Daily mean carbohydrate intake was 159.5 g providing 44% of energy for migrants and 166 g providing 42% of energy for non migrants. Neither migrants nor non migrants reached the recommended energy intake of from total carbohydrates which is 50% of the daily energy. There

was no difference between the groups. In terms of dietary guidelines both groups had lower intake of carbohydrates and higher intake of fat.

As shown in appendix table 9.15 as well as table 4.11, migrants consumed 64 g of fat, providing 40% of daily energy whereas non migrants had 76 g, providing 43% of energy. This exceeds in both groups the upper limit for fat intake (related to light or moderate work) set by the Guiding Values of D-A-CH. Differences were significant between the groups ($p<0.05$). The average daily saturated (34.2 g) and monosaturated fat (27.3 g) intake was higher in non migrants ($p<0.05$).

Daily cholesterol intake was higher in non migrants than migrants (283 mg vs. 219 mg, respectively, $p<0.01$). There was a wide variation of intake within both groups. Gender-dependent daily cholesterol intake was higher in non migrant males (327 mg) than in male migrants (207 mg) as well as the recommendations (300 mg/day, Appendix, Tab. 9.19).

Daily fiber intake was below the recommendations (30 g) in both groups (Tab. 4.11).

Table 4.11: Daily mean intake of energy, macronutrients, fibre and cholesterol in participants† (mean ± SD)

	migrants (n=23)	non migrants (n=37)	p value	DACH
Energy (kcal/day)	1527 ± 329	1635 ± 380	ns[a]	
Energy (MJ/day)	6.4 ± 1.4	6.8 ± 1.6	ns[a]	6.9[1] 8.3[2]
Prot E %	14.5 ± 2.4	15.8 ± 2.7	ns[a]	8-10
CHO E %	43.6 ± 14.4	41.5 ± 9.0	ns[a]	>50
thereof disaccharide	16.7 ± 13.8	12.7 ± 6.7	ns[b]	<10
Fat E %	39.6 ± 8.6	43.0 ± 6.8	<0.05[b]	30-35
thereof SFA	15.4 ± 5.7	18.8 ± 6.4	<0.05[b]	max.10
thereof MUFA	13 ± 3.6	15.0 ± 4.3	<0.05[a]	13
thereof PUFA	6.4 ± 4.5	5.3 ± 2.8	ns[a]	7-10
Fibre (g)	12.5 ± 3.6	14.5 ± 4.7	ns[a]	>30
Cholesterol (mg)	219.2 ± 176.3	283.3 ± 109.4	<0.01[b]	<300

†rounded values= do not sum up exactly to 100%, E%= % of total energy, SFA=saturated fatty acid MUFA= monounsaturated fatty acid, PUFA= polyunsaturated fatty acid
[1]6.9 MJ/day applies to women aged 65+ with BMI in the normal range and PAL of 1.4 (53)
[2]8.3 MJ/day applies to men aged 65+ with a normal range and PAL 1.4 (53)
[a]Mann Whitney-U test, [b]t-test

Figure 4.5 and 4.6 present the percentage deviation of median energy, macro and selected micronutrients intake and the comparison of each with its respective recommended daily intake values by gender between the groups.

We evaluated the percentage of individuals with inadequate intakes of selected energy, macro and micronutrients. The results suggest that both groups consume inadequate levels of several key nutrients. For most nutrients, the percentage of participants with an inadequate intake was higher in the migrants group (Tab. 4.12).

Table 4.12: Percentage of participants who fall below the D-A-CH reference values for energy and nutrient intakes

	migrants (n=23)	non migrants (n=37)	p value*
Energy (PAL 1.4)	87	70.3	ns
Energy (PAL 1.2)	56.5	40.5	ns
Protein	43.5	16.2	<0.05
Fibre	100	100	ns
Vitamin A	73.9	25	<0.001
Vitamin D	86.4	97.3	ns
Vitamin E	69.6	86.5	ns
Thiamine	69.6	63.9	ns
Riboflavin	43.5	38.9	ns
Niacin	27.8	5.6	<0.05
Vitamin B6	60.9	56.8	ns
Pantothenic acid	73.9	94.6	<0.05
Vitamin B12	60.9	32.4	<0.05
Folate	100	94.4	ns
Vitamin C	82.6	86.5	ns
Calcium	60.9	81.1	ns
Phosphorus	26.1	16.2	ns
Magnesium	95.7	97.3	ns
Iron	73.9	67.6	ns
Zinc	47.8	55.6	ns
Potassium	60.9	62.2	ns

*Chi²-Fisher's exact test

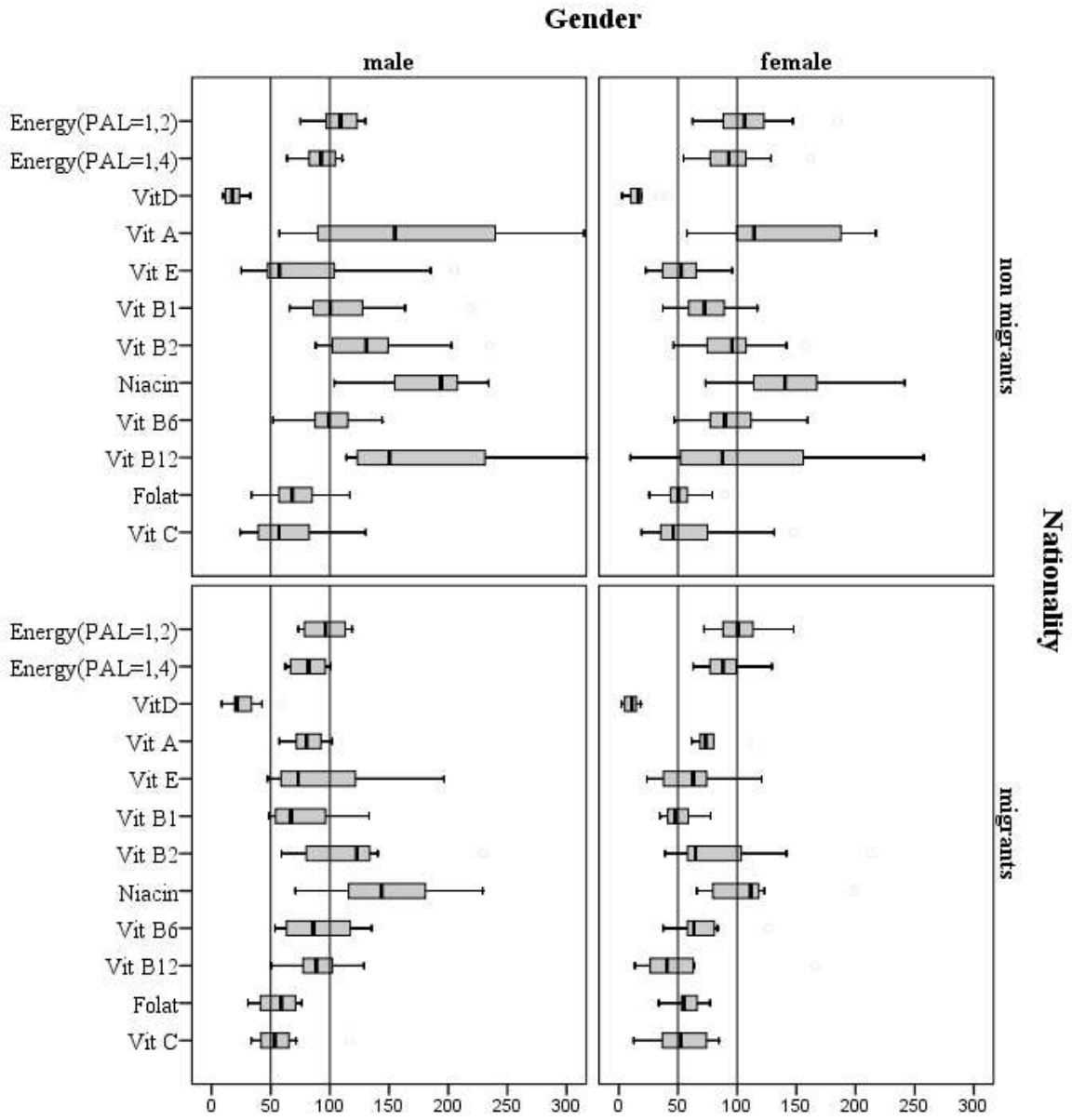


Figure 4.5: Energy and vitamin intake in comparison to the D-A-CH reference values (median, gender, outliers excluded)

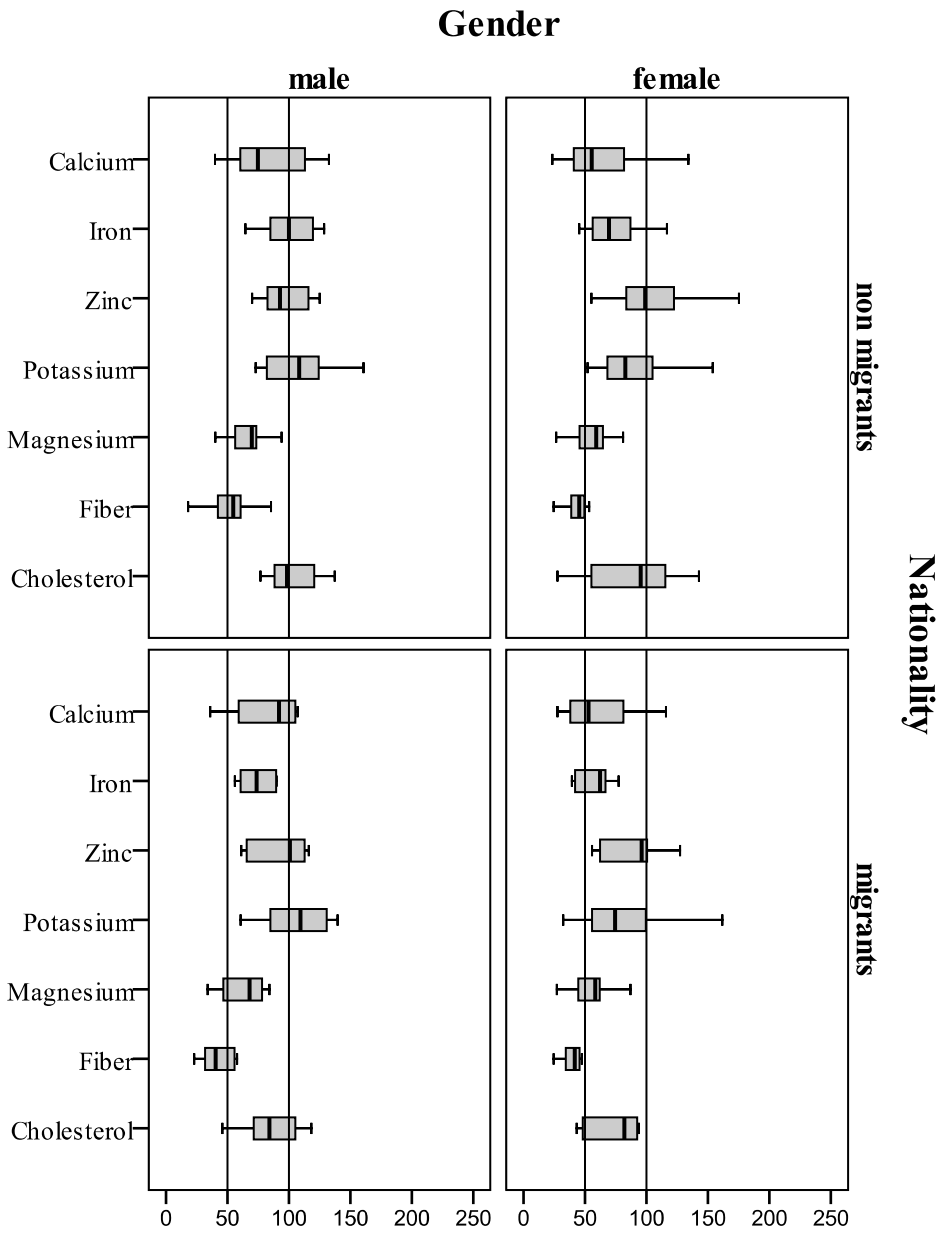


Figure 4.6: Minerals, fiber and cholesterol intake in comparison to the D-A-CH reference values (median, gender, outliers excluded)

Micronutrients

Vitamin A was chosen as total vitamin A (retinol equivalent) and evaluated separately for retinol and beta-carotene. 74% of migrants and 25% of non migrants did not reach the recommended intake of vitamin A. There were significant differences in total vitamin A intake as well as retinol and beta-carotene between the groups (Tab. 4.13).

The daily median intake of vitamin E (tocopherol equivalents) was higher in migrants than in non migrants (8.5 mg vs. 6.2 mg, $p<0.05$). 70% of the migrants' and 87% of non migrants' intake of vitamin E did not meet with the recommendation (Tab. 4.12).
Although the vitamin K intake was significantly higher ($p<0.05$) in non migrants, over 95% of the participants in both groups reached the recommendations.

A low intake of some nutrients generally occurred in both groups. For some nutrients average intake was below 60% of the recommended intake, which means half of the individuals had even lower intakes of vitamins B1, B6, C, pantothenic acid, magnesium, calcium and iron. The average intake of vitamin B12 (2.6µg/day) was lower than recommended (3 µg) in migrants and 61% of them did not reach a daily intake of B12 (Tab. 4.12). The difference was significant between the groups ($p<0.01$).

Folate comes off worse in both groups. Neither the migrants (100%) nor 94% of non migrants met the recommendation of 400 µg per day. The mean intake of folate was 222 µ in migrants and 246 µ in non migrants. There was a similar result in vitamin D intake. 86% of migrants and 97% of non migrants did not meet half of recommended 10 µg per day.

The daily mean intake of magnesium and calcium was clearly less than recommended. 61% of migrants and 81% of non migrants did not meet the recommendation of calcium intake. Gender-related daily zinc and iron intake reached to the recommendation in both male groups (Appendix, Tab. 9.20).

Table 4.13: Comparison of daily vitamins intake of participants

Vitamins	migrants (n=23)					non migrants (n=37)					p value*
	min	P25	median	P75	max	min	P25	median	P75	max	
Vit A (mg RE)	0.5	0.6	0.7	0.9	1.7	0.5	0.8	1.0	1.7	5.2	<0.001
Retinol (mg)	0.2	0.4	0.4	0.5	0.8	0.2	0.5	0.7	1.5	5.0	<0.001
Beta-carotene (mg)	0.6	0.8	1.2	1.7	3.0	0.2	1.0	1.6	3.2	5.4	<0.01
Vit D (µg)	0.2	0.9	2.1	6.7	21.6	0.3	1.1	1.7	2.4	10.8	ns
Vitamin E (mg TE)	2.6	5.8	8.5	17.3	32.7	2.5	4.5	6.2	9.0	25.7	<0.05
Vit K (µg)	54	106.7	135.7	212	424.1	60.5	126.7	200.8	242.4	381.4	<0.05
Vit B1 (mg)	0.3	0.5	0.6	1.2	2.6	0.4	0.7	0.9	1.1	2.2	ns
Vit B2 (mg)	0.5	0.8	1.5	1.8	3.5	0.6	1	1.3	1.7	2.8	ns
Niacin (mg NE)	8.6	11.8	15.1	19.8	29.8	9.5	17.4	20.3	25.2	31.4	<0.05
Pantothenic acid (mg)	1.7	2.9	4.2	6.4	13.6	1.5	2.9	3.6	4.6	11.1	ns
Vit B6 (mg)	0.5	0.8	1.0	1.8	3.5	0.6	1	1.2	1.5	3.0	ns
Biotin (µg)	14.2	23.1	34.7	53.5	129.6	11.6	23.5	27.8	40.0	71.4	ns
Folate (µg FE)	113.1	176.1	220.2	272.2	308.7	103.5	175.5	222.4	316.0	467.7	ns
Vit B12 (µg)	0.4	1.3	2.4	4	5	0.3	2.4	3.5	5.7	11.5	<0.01
Vit C (mg)	12.6	42.5	55.5	83.4	163.5	19.3	35.9	50.4	80.7	147.9	ns

P=percentile, RE= retinol-equivalents; TE=tocopherol-equivalents, NE=niacin-equivalents, FE=folate-equivalents, *****Mann Whitney- U test, ns= not significant

Table 4.14: Comparison of daily micronutrients, fibre and cholesterol intake of participants

	migrants (n=23)					non migrants (n=37)					p value*
	min	P25	median	P75	max	min	P25	median	P75	max	
Potassium (mg)	649	1440.2	1683.7	2483.3	3233.5	1043	1451.7	1829.6	2192.6	3214	ns
Calcium (mg)	277.2	492.9	811.4	1090.0	1868.2	233.8	448.9	608.8	905.1	1340.3	ns
Magnesium (mg)	81.3	147.1	186.1	254.8	475.2	79.6	149.2	194	244.1	328.9	ns
Phosphorus (mg)	470.5	657.4	836.9	1188	1667.4	493.9	796.2	1023.9	1205.3	1609.1	ns
Chloride (mg)	1110	1824.8	2311.2	2956.0	18156.6	1146.9	2629	3587.0	4419.9	11818.3	<0.05
Iron (mg)	3.9	5.9	6.7	10.8	24.5	4.5	6.7	8.7	11.1	21	ns
Zinc (mg)	3.9	6.3	7.3	11.6	23.8	3.9	6.6	8.4	10.1	16.6	ns
Sodium (mg)	826.4	1155.2	1471.5	1828.7	12006.6	650.3	1634.7	2220.4	2819.7	7665.3	<0.05
Fluoride (µg)	172.9	270.5	324.2	425.7	3456	186	295.9	349.2	450.2	1728	ns
Iodine (µg)	24.4	36.7	69.7	120.1	259.2	22.5	38.0	60.4	81.5	207.9	ns
Fibre (g)	6.9	9.8	12.5	14.8	19.9	5.4	11.6	14.5	16.6	26	ns
Cholesterol (mg)	0	131.9	233.4	278.3	841.9	0	221	290.3	355.1	559.5	<0.05

*****Mann Whitney -U test, ns= not significant

4.3 Health Status

4.3.1 Chronic diseases

The most common diseases diagnosed by physicians are presented in table 4.15. Dementia was the most frequent disease (48%). Other higher frequent chronic diseases were hypertension (35%), depression (30%), heart disease and stroke (26%) among the migrants. In non migrants, arthritis was significantly more common than it was in migrants ($p<0.05$).

Table 4.15: Comparison of diagnosed chronic diseases in migrants and non migrants

Chronic diseases	migrants (n=23)		non migrants (n=37)	
	n	%	n	%
Dementia	11	47.8	14	37.8
Hypertension	8	34.8	18	48.6
Depression	7	30.4	5	13.5
Heart disease	6	26.1	14	37.8
Stroke	6	26.1	12	32.4
Diabetes mellitus	5	21.7	16	43.2
Osteoporosis	4	18.2	8	21.6
Arthritis	4	17.4	16	43.2*
Hypothyroidism	2	8.7	0	0
Gastritis	2	8.7	3	8.1
Kidney disease	2	8.7	2	5.4
Respiratory disease	1	4.3	6	16.2
Hyperthyroidism	1	4.3	1	2.7
Arterioscleroses	1	4.3	1	2.7
Bowel disease	0	0.0	1	2.7
Liver disease	0	0.0	1	2.7
Tumor/cancer	0	0.0	3	8.1
Other chronic diseases	9	39.1	19	51.4

* Chi^2-Fisher's exact test; $p<0.05$

The most common health problem was hypertension (49%), followed by diabetes mellitus and arthritis (43%) among the non migrants. 65% of migrants and 43% of non migrants had at least 1-3 diagnosed chronic diseases.

4.3.2 Nutrition related health conditions

Compared to non migrants, migrants had frequent diarrhea (17%) and exsiccosis (17%). The difference was significant between the groups ($p<0.05$ vs. $p<0.01$). 30.4% of migrants and 14% of non migrants received 6 or more prescribed medication. There was no difference in daily medicine intake.

A significant higher number of migrants (83%) had at least 3 or more nutritional problems (Tab. 4.16 and Tab. 4.7 for details) such as loss of appetite, refuse to eat, chewing difficulties. The difference was considerable between the groups ($p<0.001$).

Table 4.16: Nutrition related health conditions

Health conditions	migrants (n=23)		non migrants (n=37)		p value*
	n	%	n	%	
Exsiccosis	4	17.4	0	0	<0.01
Nausea	2	8.7	1	2.7	ns
Diarrhea	4	17.4	1	2.7	<0.05
Constipation	7	30.4	5	13.5	ns
Skin ulceration	1	4.3	3	8.1	ns
Daily medicine intake					ns
None	1	4.3	2	5.4	
1-3	7	30.4	15	40.5	
4-5	8	34.8	15	40.5	
6 and more	7	30.4	5	13.5	
Number of chronic diseases†					ns
1-3	15	65.2	16	43.2	
4-5	4	17.4	14	37.8	
6 and more	2	8.7	6	16.2	
Number of nutritional problems					<0.001
0-2	3	16.7	24	66.7	
3 and more	15	83.3	12	33.3	

†missing values: migrants (n=2), non migrants (n=1), *Chi²-Fisher's exact test

4.4 Functional ability and mobility

Mobility

In both groups, the majority of residents were using a wheelchair (Tab. 4.17). The only difference between the groups was in the use of a walker which was higher among non migrants (38%).

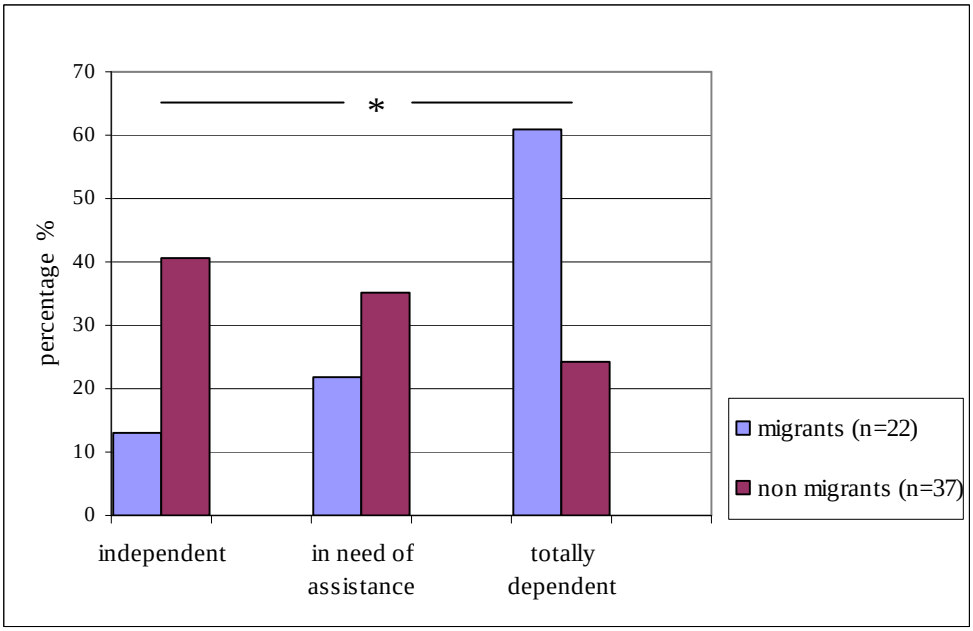
Table 4.17: Prevalence of using mobility assistive†

	migrants		non migrants	
Mobility assistive	**n**	**%**	**n**	**%**
Wheelchair	13	56.5	16	43.2
Walker	2	8.7	14	37.8*
Walking stick	1	4.3	3	8.1
Human aid	0	0	1	2.7
Without aid	3	13.0	7	18.9

†bedridden residents were excluded, *Chi²-Fisher's exact test; $p<0.05$

Activities of daily living (ADL)

As shown in figure 4.7 (Appendix Tab. 9.12) more than half of the migrants (n=14, 61%) were totally dependent in their daily activities (0-34 points ADL-score). Five (22%) of them needed assistance-human aid (35-64 points) and 13% (n=3) of them were independent (65-100 points). Corresponding values for non migrants were 24% dependent, 35% needed assistance and 41% independent. The average ADL-score was 27.7 ± 32 and 55.7 ± 30.8 points for migrants and non migrants, respectively. The difference between the groups was significant ($p<0.01$). 39% of migrants were unable to feed themselves (non migrants; 8%), 35% needed help for cutting, spreading butter or required modified diet (non migrants; 32%). Sixty five percent (n=15) of migrants and 22% (n=8) of non migrants were either immobile or not able to walk 50 meter. Considering each item in ADL, most of the residents in both groups were dependent while bathing and using stairs (Apendix, Tab. 9.13).



*Cochran-Armitage's trend test; p <0.01

Figure 4.7: Classification of the residents according to the Barthel Index (ADL)

Physical activity

The number of residents participating to social or physical activities did not show any differences between the groups (Tab. 4.18). Occupational activities offered by the nursing homes, e.g. art theraphy, memory training and reading hours, were joined by half of the non migrants whereas only by a quarter of the migrants (p<0.05). Half of the migrants left the nursing home either never (44%, n=10) or once a month (9%, n=2) for shopping and/or visiting. Non migrants were daily more active (60%, n=22) than migrants (22%, n=5) in the nursing home (p<0.05).

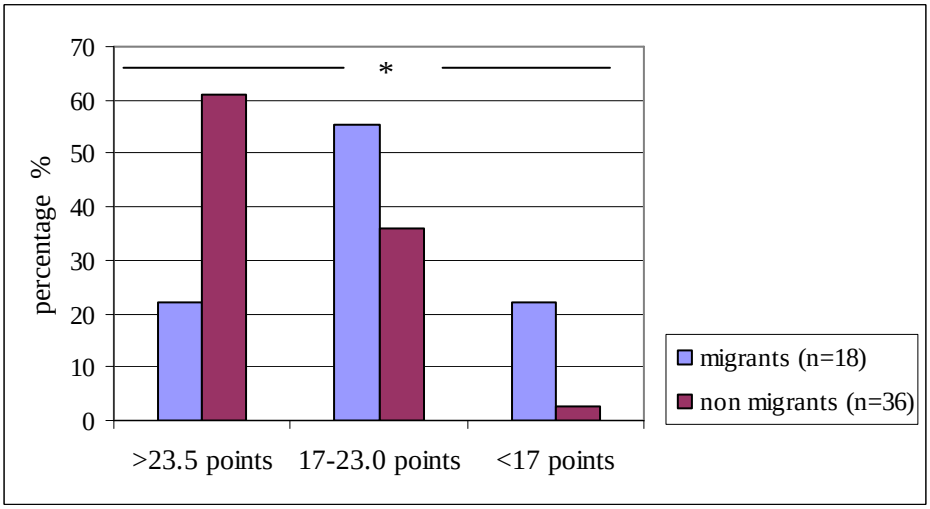
Table 4.18: Residents' participating in activities in nursing home†

	migrants		non migrants		
Type of the activity	**n**	**%**	**n**	**%**	**p value***
Physical training	4	17.4	11	29.7	ns
Occupations	6	26.1	20	54.1	<0.05
Home economics	2	8.7	1	2.9	ns

† bedridden [migrants; 7 (30.4%), non migrants; 3(8.1%)] excluded, *Chi²-Fisher's exact test

4.5 Mini Nutritional Assessment (MNA)

Nutritional status of the residents was also assessed according to Mini Nutritional Assessment. The average MNA score was 20.2 ± 4 (n=18) for migrants and 23.7 ± 3.3 (n=36) for non migrants. According to MNA, 22% (n=4) of migrants were regarded (classified) as malnourished, scoring less than 17 MNA points. 56% (n=10) were at risk for malnutrition (17-23.5 points) and 22% (n=4) of them were well nourished (MNA ≥23.5 points). These percentages were 3% (MNA 3, n=1), 36% (MNA 2, n=13) and 61% (MNA 1, n=22) for non migrants. The difference was significant (p <0.01).



*Cochran-Armitage's trend test; p<0.01

Figure 4.8: Nutritional status of participants according to MNA

4.6 Care staffs' assessment of the residents' health and nutritional status

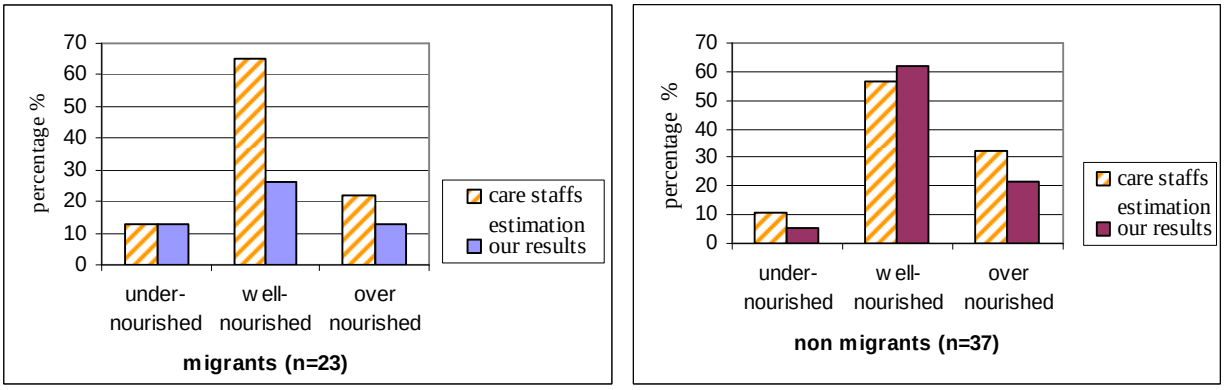
As presented in table 4.19 and figure 4.9, care staff considered the majority of the migrants (65%) and non migrants (57%) as well nourished. The care staff considered 11% of the non migrants to be undernourished although our evaluation according to BMI (<20) showed that 5% were undernourished (Appendix Tab. 9.5). This estimation was similar to concerning a BMI <22 kg/m². For migrants, according to BMI<20, 13% of the migrants were undernourished and showed similarity to care staff's opinion. But we found higher results concerning a BMI <22 kg/m² (Tab. 4.3).

Table 4.19: Nutritional and health status of participants according to care staffs' estimations

	migrants		non migrants	
	n	%	n	%
Nutritional status				
undernourished	3	13.1	4	10.8
well-nourished	15	65.2	21	56.8
overnourished	5	21.7	12	32.4
Health status†				
good	5	21.7	22	59.5
average	11	47.8	14	37.8
poor	7	30.4	1	2.7
stable	14	60.9	35	94.6
unstable	9	39.1	2	5.4

†values do not always add up exactly to 100% because of missing data

Care staffs' assessment for migrants as well-nourished was approximately 3 times more than our results. The care staff' considerations about overnourished residents for both groups were higher than our findings (BMI>=29). According to their estimation more than half of the migrants (61%) had a steady health status.



Undernourished; BMI<20 kg/m², well-nourished; BMI 24-<29 kg/m²; overnourished; BMI>=29 kg/m²

Figure 4.9: Care staff's estimation of nutritional status among the residents grouped by the BMI

4.7 Factors associated with nutritional status

BMI and selected variables

Table 4.20 shows an association of selected parameters with BMI. The strongest correlations were found between BMI and anthropometric markers (measurements) in both groups as expected. Additionally, significant correlations were also obtained between BMI and the number of subjective nutritional problems (Fig. 4.10). BMI also independently associated with refusal to eat and loss of appetite in migrants.

The correlations were weaker between percentage of daily energy derived from protein and BMI in migrants. No correlation was found between BMI and the other parameters (age, gender and energy intake, health status) in both groups.

Table 4.20: Intraclass correlation coefficient (r‡) between BMI and selected variables in residents

Variables	migrants		non migrants	
	r	p value	r	p value
I. Socio demographic characteristics				
Age	-0.155	ns	-0.009	ns
Gender†	0.230	ns	-0.021	ns
II. Functional ability				
ADL-score	-0.054	ns	-0.110	ns
III. Nutritional problems[a]				
Number of subjective nutritional problems	-0.603	<0.01	-0.055	ns
Loss of appetite†	-0.651	<0.01	-0.159	ns
Chewing difficulties†	-0.083	ns	-0.197	ns
Swallowing difficulties†	-0.294	ns	0.127	ns
Refusal to eat†	-0.560	<0.01	0.120	ns
IV. Anthropometric measurements				
CC (cm)	0.888	<0.01	0.664	<0.01
TSF (mm)	0.835	<0.01	0.686	<0.01
AMA (cm²)	0.542	<0.01	0.559	<0.01
MUAC (cm)	0.537	<0.05	0.788	<0.01
BF%	0.976	<0.01	0.960	<0.01
V. Energy and protein intake				
Energy intake (kcal/day)	0.118	ns	0.247	ns
Protein (E%)	-0.417	<0.05	0.260	ns
VI. Health status				
Number of chronic diseases	-0.111	ns	-0.185	ns
Dementia†	0.100	ns	-0.086	ns

[a]tube fed residents excluded, †Kendall-Tau-b test, ‡Pearson's correlations coefficient

Calf circumference (CC) and selected variables

Some anthropometric markers of undernutrition have been chosen to test intrinsic values of CC. Significant correlations were obtained between CC and the various anthropometric markers (Tab. 4.21). The Pearson correlation coefficients indicated for migrants and non migrants a clear association (r= -0.609, p<0.01 vs. r= -0.354, p<0.05) between CC and nutritional problems in two groups (Fig. 4.11).

Table 4.21: Intraclass correlation coefficient (r‡) between CC and selected variables

	migrants		**non migrants**	
Variables	r	p value	r	p value
TSF (mm)	0.779	<0.01	0.454	<0.01
AMA (cm²)	0.607	<0.01	0.535	<0.01
AMC (cm)	0.592	<0.01	0.525	<0.01
BF%	0.876	<0.01	0.636	<0.01
ADL-score	0.030	ns	0.251	ns
Number of subjective nutritional problems[a]†	-0.609	<0.01	-0.354	<0.05

[a]tube fed residents excluded, †Kendall-Tau b test, ‡Pearson's correlations coefficient

MNA and selected variables

When testing the MNA subgroup questions related to anthropometric markers, we found a good correlation between MNA-score and CC in both groups. Loss of appetite showed an effect on total MNA-score. Mid-upper arm circumference did not associate with MNA-score while body fat percentage and TSF presented a significant correlation. We found a better correlation between the number of nutritional problems and MNA-score (migrants; r= -0.864, non migrants; r= -0.662, p<0.01) as well as with functional status (Tab. 4.22, Fig. 4.13).

Table 4.22: Intraclass correlation coefficient (r) between MNA and different variables

	migrants		non migrants	
Variables	r	p value	r	p value
ADL-score	0.671	<0.01	0.479	<0.01
CC (cm)	0.687	<0.01	0.502	<0.01
TSF (mm)	0.599	<0.05	0.409	<0.05
AMA (cm²)	0.346	ns	0.171	ns
MUAC (cm)	0.347	ns	0.185	ns
BF%	0.636	<0.01	0.501	<0.01
Loss of appetite†	-0.629	<0.01	-0.298	<0.05
Number of subjective nutritional problems[a]†	-0.864	<0.01	-0.662	<0.01

[a]tube fed residents excluded, †Kendall-Tau-b test

Cognitive status and selected variables

Some variables were chosen to establish the effect of cognitive impairment on nutritional status and physical disability. Dementia was associated with functional ability, as well as with eating dependency only in non migrants and did not show any correlation with MNA score in both groups.

Table 4.23: Intraclass correlation coefficient (r) between dementia and different variables

	migrants		non migrants	
Variables	r	p value*	r	p value*
Eating dependency	-0.325	ns	-0.377	<0.05
ADL-score	-0.102	ns	-0.382	<0.01
MNA	-0.129	ns	-0.279	ns

*Kendall-Tau-b test

Number of nutritional problems and correlations

Nutritional problems were associated with nutritional status according to calf circumference (migrants; r= -0.609, p<0.01, non migrants; r= -0.354, p<0.05, Fig. 4.12) in both groups. This association also observed with BMI (r= -0.603, p<0.01) only in migrants (Tab. 4.20).

As presented in figure 4.10, a negative correlation was found between ADL-score and subjective nutritional problems in both groups (migrants; r= -0.708, p<0.01, non migrants; r= -0.539, p<0.01).

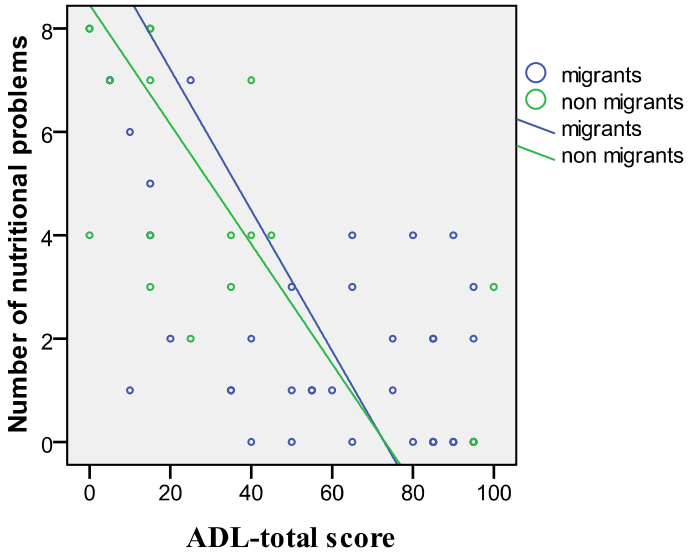


Figure 4.10: Correlation between ADL-score and number of nutritional problems

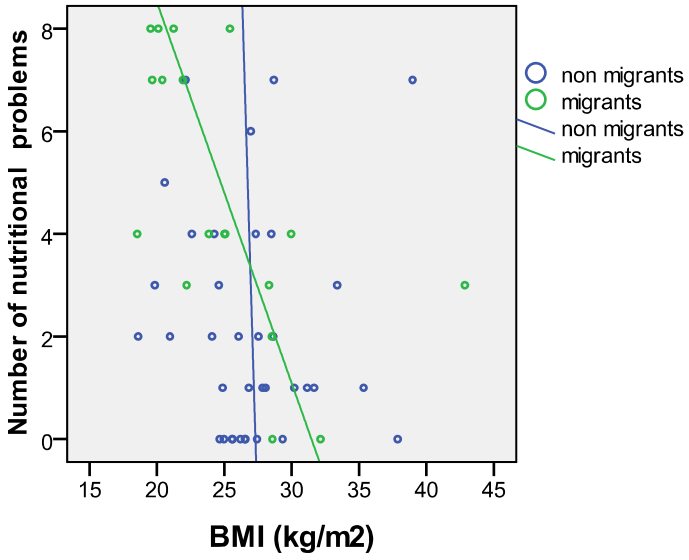


Figure 4.11: Correlation between BMI and number of nutritional problems

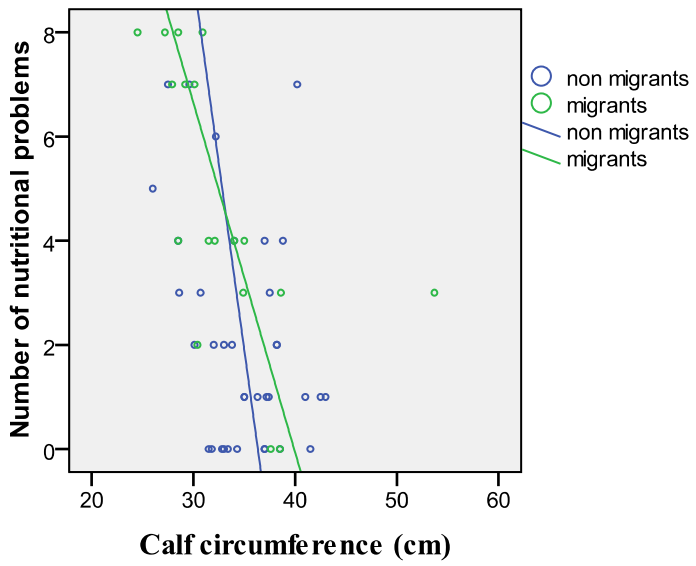


Figure 4.12: Correlation between CC and number of nutritional problems

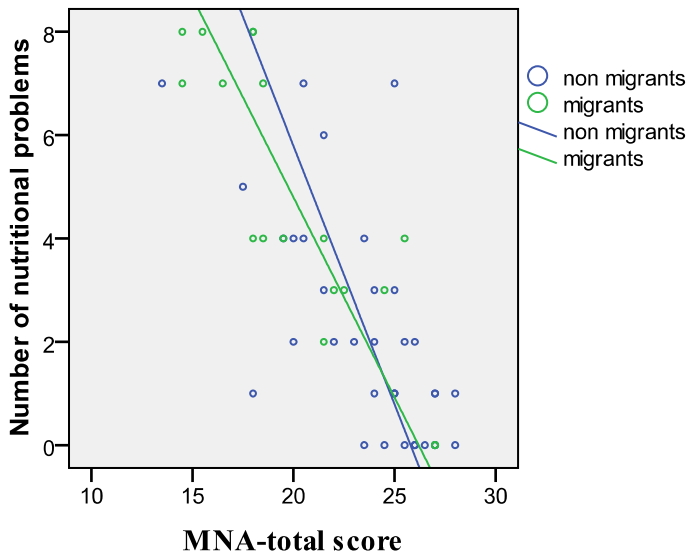


Figure 4.13: Correlation between MNA-score and number of nutritional problems

Daily energy intake and nutrients

A lower intake of calories can contribute to a lower intake of essential nutrients. Table 4.24 shows the relationship between daily energy intake and nutrients. Most of the nutrients correlated significantly to the daily energy intake. We found a better correlation for magnesium in both groups.

Table 4.24: Intraclass correlation coefficients (r*) between energy intake and nutrients

	migrants		**non migrants**	
Variables	r	p value	r	p value
Vit A (mg RE)	0.538	<0.01	0.153	ns
Vit D (µg)	0.162	ns	0.269	ns
Vit E (mg TE)	0.097	ns	0.331	<0.05
Thiamine (mg)	0.354	ns	0.590	<0.01
Riboflavin (mg)	0.692	<0.01	0.513	<0.01
Niacin (mg)	0.763	<0.01	0.669	<0.01
Vit B6 (mg)	0.455	<0.05	0.609	<0.01
Biotin (µg)	0.500	<0.05	0.357	<0.05
Folate (µg FE)	0.699	<0.01	0.437	<0.01
Vit B12 (µg)	-0.024	ns	0.164	ns
Vitamin C (mg)	0.329	ns	0.401	<0.05
Jod (µg)	0.556	<0.01	0.410	<0.05
Iron (mg)	0.305	ns	0.508	<0.01
Zinc (mg)	0.537	<0.01	0.626	<0.01
Calcium (mg)	0.771	<0.01	0.568	<0.01
Magnesium (mg)	0.756	<0.01	0.709	<0.01
Mono-di saccaride (g)	0.735	<0.01	0.493	<0.01

*Pearson’s correlations coefficient

5 Discussion

The purpose of this study was to contribute to the understanding of the nutritional and health status of elderly migrants in two German nursing homes in comparison to a matched group of native German residents in the same institutions. Knowledge about the nutritional status of late life in elderly migrants may help deciding whether special care or prevention (intervention) programs are necessary. Furthermore, specific risk groups were also identified.

Although all residents of migrant background over 65 years were willing to participate, the study sample remained small. The number of migrants was one of the potential limitations for randomization and creation of one to one basis matched pairs. We identified and controlled confounding variables (age and gender) for participants. Matching the groups, we paid attention to having an equal distribution of the participants from both nursing homes in order to augment comparability between the groups. Eleven migrants (47.8%) and twenty two non migrants (59.5%) participated in our study from an “international” nursing home and the rest were from a “multi cultural” one.

In the discussion, study results are ranked in view of the present literature. Since the country of origin of the majority of the migrants in our study was Turkey, the results are also compared with studies conducted on institutionalized and community-dwelling elderly in this country.

Participants and nursing homes

During daytime, most residents taken into consideration spent their time in shared facilities such as the dining or the living rooms. The residents mostly had their lunch together in dining rooms. One of these nursing homes offered free choice buffet meals, so that the residents were able to decide what and how much to eat. Some of the residents, for instance, could ask for one more slice of bread or cheese. Even if this could be seen as an advantage some of them refused to have a normal standard portion and got less in their plates. The native Turkish speaking care givers were present in both nursing homes. Some social activities were available for migrants such as organized traditional breakfast once a month. Holy days of migrants’ celebration were also organized with the participation of relatives. The cultural needs were so far taken into account in the two nursing homes.

The length of residence in a nursing home (ranged 8- 65 months) was shorter among migrants compared to non migrants. On the other hand the number of bedridden (30%) and as well as tube

fed residents (22%) was higher among migrants (Tab. 4.2). This also explains the differences in need of care between the groups (Fig. 4.1). The main reason for tube feeding was swallowing difficulties in both groups. It has been shown that in an institutionalized elderly population tube feeding was associated with increased mortality after one year (60).

Most of the participants were currently non smokers. Smoking is a well known risk factor for a shorter life expectancy. Thus, the percentage of smokers in older home residents must be lower (61). On the other side, Stuck et al. (62) suggested that smoking in the elderly associates with functional decline among those living in the community and can be one of the reasons for institutionalization. The result of a study conducted in Turkey showed that 32% of the institutionalized elderly were smokers (63) and 20% (the amount is not given) of them consumed alcohol. We did not calculated energy percentage derived from alcohol in our study. The reason is that it was hard to get reliable data on alcohol consumption. On the other hand the prevalence of alcohol consumption was low among non migrants and migrants never consumed.

Nutritional status

Body composition and anthropometry

The assessment of body composition is an important factor to determine the nutritional status of an individual. Simple anthropometric measurements can provide practical and valid indices of nutritional status (64). It is the single most universally applicable, inexpensive, and non-invasive method to assess the size, proportions, and composition of the human body (50) and the most reliable, specific indicator of malnutrition in the older population (37). On the other hand, accurate anthropometric measurements in older adults might be difficult to obtain because of changes in body composition, posture and mobility, which occur during the ageing process.

Height, weight and BMI

Height is an important parameter to calculate BMI. However, there are difficulties to measure height in the elderly. Measuring reliable height in older individuals is one of the most problematic areas of anthropometry (65). The decrease in stature is another well-known change that occurs while aging (66, 67). Many older adults are kyphotic (an abnormality of the vertebral column) or have some form of disability that prevents the accurate measurement of stature (36, 50, 68), making calculation of BMI prone to error (65). A number of studies have demonstrated that other skeletal measurements might be taken into consideration to assess the nutritional status in older age groups (68, 69). Additionally, the length of the long bones is believed not to change

and remains stable (46) or change less with aging (70). Therefore, some authors suggest an arm span is a reliable substitute for measurements of height in nursing home patients (71, 72) and it may offer an alternative to height in calculating BMI in older population (68). Chumlea et al. (39), showed that knee height highly correlated with stature more than arm length measurements. It has been also suggested from other authors as an alternative measure of stature in the severely physically handicapped and in case of stature deformities and may be a reliable predictor for recumbent length (73, 74).

In this study, we tried to solve this problem by using alternative measurements such as knee height in order to estimate stature when standing height could not be measured. We chose knee height rather than arm length because of two factors: first, reduced joint mobility in the shoulder, elbow, or wrist can introduce age related errors into the measurement of arm length; second, the reliability of knee height is superior to that of arm length (74) and highly correlates to the stature in both genders (39, 75). High accuracy of evaluated knee height equalizations for stature estimation has been also shown for Turkish adults (76).

Comparing our results with a nursing home study conducted in Turkey, the mean height of 151.9 cm for women was similar to the female migrants in our study but men were 2 cm shorter than male migrants (77). Comparing the average female height, we found that women in both our groups were 3-6 cm shorter (159.2 cm) than women living in the nursing home in Heidelberg (78).

Comparing our results with the same age group of elderly living in nursing homes in Turkey, the average body weight of both female and male was higher than the migrants, being respectively of 69.3 kg and 70.8 kg (77). On the other hand, the other study conducted in Turkey showed that institutionalized elderly have less body weight than those living with their families or alone (79). In our study sample, four (17.4%) of the migrants had exsicossis and diarrhea which can be one of the reasons of low body weight.

Some countrywide survey studies show weight decreases with age in both genders (36, 80, 81). Generally, the total body weight tends to peak in the fifth and sixth decade, remains stable until the age of 65-70 years, and then slowly decreases (82).

Comparing with the National Health and Nutrition Examination Survey (NHANES III;1988-1994) data (37), the average weight of male migrants was similar to 15th percentile values for men value being 64.2 kg for age 70-79 years while in non migrants this was similar to 50th percentile for men being 77.9 kg.

Body Mass Index (BMI)

Among all anthropometric measurements, BMI (the conventional index) represents the easiest and most frequently used index to identify subjects at risk for under- or overnutrition (50, 65, 81, 83). In general body mass increases during adulthood and decreases progressively with old age (84). However, there is no consensus about adequate and uniform BMI classification for the elderly. Studies on elderly population show different BMI thresholds for malnutrition which range between 18.5 and 25.6 kg/m² (36, 61, 81, 85-87). Some of the authors have indicated that BMI thresholds could be modified for the elderly population (88-90).

The World Health Organization (WHO) recommends <18.5 (kg/m²) as cut-off for low BMI for adults. However, the possible influence of age on the cut-off point discussed by WHO states that the recommendation may be relevant for the elderly, at least for 60-69 years, but whether different cut-offs are appropriate in individuals of 70 or more years of age is uncertain (50). When BMI is used as an indicator of nutritional status according to WHOs classification (Appendix, Tab. 9.6), 61% of migrants and 30 of non migrants were in the range of 18.5-<25 kg/m², none of the non migrants and only one of the migrants could be considered undernourished.

Some authors have agreed that (91) “normal range” of BMI, suggested by the WHO report should be shifted upwards because of observation of higher prevalence of mortality in this “normal range” than in the lower “pre-obese” category.

Some suggest a BMI<20 kg/m² as reliable threshold for defining an underweight elderly person at high risk (61). When a BMI of 20 kg/m² as is indicating a great risk of malnutrition was chosen 13% of migrants and 5% of non migrants were defined as being underweight. In a similar study in Turkey, they found only 8.5 % of residents with this critical value (63). On the other hand, this prevalence is lower than elderly living in Scandinavian nursing homes (BMI<20, 30%) probably due to higher age (average; 82.4 years) groups in these studies (92, 93).

Studies from different countries show that the prevalence of a low BMI is a common problem among nursing home residents and home–care clients. Pauly et al. (94), conducted an analysis of all published reports of malnutrition in nursing homes. According to that 10-50% of residents had a BMI below 20 kg/m².

The National Research Council of the USA (47) suggests BMI values of 24-29 kg/m² as reference range for the elderly aged 65 years and more. Beck et al. (88) also suggested that a BMI reference range between 24 and 29 would be more appropriate for the elderly, especially those living in institutions. According to other study results, these values are associated with the lowest morbidity, mortality and functional dependency among elderly (89, 95).

These reference ranges therefore were chosen for the evaluation in this study. Following these criteria, more than one third of the migrants had a BMI value below 24 which indicates that there are subjects who are at possible risk of undernutrition or who are already undernourished (Fig 4.2, Appendix 9.5). Comparing non migrants result, the prevalence of a BMI >24 was similar to the study enrolled in Heidelberg (60%) (78).

It is not always clear to comparing anthropometric data between the studies, as different researchers use different standards of acceptability. Therefore, in this study the ranges proposed by the European Society of Clinical Nutrition and Metabolism (48) were used with a BMI below 22 for an additional classification. This value corresponded to the 10th percentile of healthy elderly population in the NHANES III study.

Use of a BMI cut-off value of <22 kg/m², the prevalence of undernutrition became naturally higher among migrants and non migrants (39 vs. 11%) than by BMI<20. Some other study results conducted in different countries have shown that 20-39% of the residents have a BMI below 22 (94). A recent Swedish study, including 100 nursing home residents, showed that 25% of residents living in nursing homes had BMI values below 22 (96). In the study of Crogan et al. (97) 23% of the residents were classified underweight by using cut-off BMI value <22 kg/m². In the present study the percentage was nearly double in migrants' group. A possible explanation for this could be the higher number of bedridden residents among the migrants.

The average BMI was in normal range (25 kg/m², 27 kg/m² for migrants and non migrants, respectively) in both groups. However, the mean value of BMI was slightly lower being 22.5 kg/m² in male migrants (Appendix, Tab. 9.3).

In our study sample, the mean value of females' BMI from both groups were similar to non-institutionalized Italian elderly women (>65 years, 27.5 ± 5.3 kg/m²) (61).

Comparing our results with the study conducted in Turkey, the average BMI value of non-institutionalized elderly was higher in women and men (29.3 vs. 26.9) than in our study (98). A similar higher result has also been seen in another cross-sectional study (99) with a total number of 350 elderly, living in an urban district of Turkey (Tab. 5.1). Institutionalized elderly in Turkey showed also higher BMI values (females; 29.9 ± 4.9, males; 25.5 ± 1.8) compared to migrants (77).

Few normative data exist for the elderly in developing countries. Different elderly populations show large geographic and ethnic variation in height, weight, and BMI, much of which reflects differences in lifestyle, environment, genetic differences and health status. For those countries

that have no local data or that lack the resources to develop them, the Expert of Committee of the World Health Organization recommends to use data from the NHANES III for comparisons between different population groups (50).

Compared with NHANES III data (37), the median BMI value of male migrants was similar to American 15th percentile value this being 22.3 kg/m², whereas female migrants located between 25-50th percentile, for aged 70-79 years. The median BMI values of both female and male non migrants corresponded to American 50th -75th percentiles.
In the Survey Europe on Nutrition in the Elderly (SENECA) study (80), the authors did not show the distribution of BMI percentiles, they only indicated the prevalence of BMI<20 in each center. Although the mean BMI value of non migrants were similar to SENECA results (25.2 to 27.4 kg/m²), the BMI value of migrants was slightly lower (Appendix, Tab. 9.3).

Low and high BMI

Undernutrition is a very well-known predictor for mortality (81). Many publications have dealt with the connection between BMI and mortality (85, 95, 100, 101) together with poorer functional status among older community-dwelling persons (102, 103).
The relationship to mortality rate in elderly through out the range of BMI has been described as J shaped and U shaped (91, 95, 104). Several studies have reported a U shaped relation which indicates an elevated mortality risk among those with very low BMI and those with high BMI (105-107) especially with advancing age (108). Obesity is less common in nursing home residents but it is very well known that being obese as well as being underweight has been associated with disability (108, 109) poor physical function and a decline in muscle mass in elderly population (110-112). Anyhow, it is generally agreed that older people who have higher BMI values (>30 kg/m²), have a lower mortality risk than younger and middle-aged persons with the same value (113-115). The NHANES II data indicate that the prevalence of overweight decreases in elderly males, although it increases in elderly females (116).
With respect to over weight assessed through BMI, the rates among migrants were low. Three (13%) of the migrants and seven (19%) of the non migrants had high BMI (≥30kg/m²). A similar prevalence found (14%) in a study conducted on institutionalized elderly in Turkey, (63). Among migrants and non migrants as well, there was only one extremely high BMI with 42.8 kg/m² and 39 kg/m², respectively.

It has been shown that BMI strongly correlates with total body fat tissue and is a good indirect measurement of adiposity, although this correlation decreases in older age (117). In our study BMI is also highly correlated with estimated BF% but not with age in both groups.
In general, overweight is a risk factor more for women and children among migrants (14, 15, 118).

Our findings suggest that the nutritional status of migrants according to BMI is poorer than that of non migrants. We also estimated BMI value of participants' upon admission with an available weight data. It showed that 45% of the migrants already had BMI below 22 upon admission while the prevalence was only 9% among non migrants. There are two possible explanations for this; either elderly migrants were dehydrated on admission or the migrants' families were potentially not sufficiently able to assist them.

Despite the wide use of BMI, there is also a disagreement about whether BMI is a sufficiently sensitive indicator of nutritional status (119, 120). BMI is sometimes overestimated in elderly due to decrease in height or body weight with age potentially co founded by dehydration and edema or ascites. That is why BMI is not always reflects nutritional status properly (66). Therefore, other anthropometric measurements have also been used to evaluate nutritional status of the participants.
The following anthropometric values, compared mainly with available data from European studies on elderly or elderly country of origin and NHANES III data. The anthropometric component of NHANES III provides reference data for non institutionalized older adults, aged 60 years and older in United States. Alike for BMI, the WHO suggests the use of NHANES III data for comparisons, if local reference data are not available (50).

Data of upper arm

Measurements of triceps skinfold thickness, mid-upper arm circumference and arm muscle area are suggested as useful indicators of muscle mass and assessment of nutritional status (35, 50, 65). They are rapid, inexpensive and non-invasive methods of obtaining information on the amount and location of body muscle and fat. The advantages of these measurements are that they are less affected by the state of hydration than body weight and they are relatively independent of height (64). On the other hand it has been suggested that subcutaneous tissue, contributing increased tissue compression, dehydration or edema, can result underestimation of body fat or

over estimation of calculated muscle area (37, 121). In table 5.1, some of the anthropometric results of the studies we compared our results with are summarized.

Triceps skinfold thickness (TSF)

It is assumed that TSF indicates the calorie reserves stored in form subcutaneous of fat and the arm muscle size reflects the reserves of muscle protein (35, 50, 65). The loss of fat and muscle with age found in studies, especially in women, suggesting that they are more liable to lose fat than are the men (36, 43).

It is however important to point out that skinfold thickness may not be a reliable indicator of body fat stores in elderly people, since in this age group a higher proportion of body fat is often stored internally in the trunk and abdomen, compared to younger adults (122).

According to our study, there is no difference observed between migrants' and non migrants' mean TSF values (Tab. 4.4). However, the evaluation according to gender showed that male migrants have significantly lower TSF values than non migrants (Appendix, Tab. 9.3). When we compared our results with 50th American percentile value, a TSF of 12.4 mm was similar to the males' TSF values in our study. But the American women had higher TSF values than the females in our study (Appendix, Tab. 9.4).

Compared to the data of an Irish study sample (36) of 874 non-institutionalized individuals (65 years or older), the 50th percentile of TSF being 10.8 mm, was quite similar to male migrants, whereas male non migrants had a higher TSF value. Females from our study group showed lower TSF values than those in this study sample.

Mean TSF value of migrant males was similar to that (10.8 mm) assessed in a French study conducted on 626 non institutionalized elderly (121). Non migrant males had higher (13.9 mm) ones and females from both groups had lower mean TSF values than the French elderly population.

Burr et al. (43), analyzed the data of 1500 individuals included a small proportion of institutionalized aged 65 years and older in United Kingdom in South Walles. Compared with this study group, we found the 50th percentile TSF of males from both groups' higher and female non migrants' similar, but female migrants lower than in British populations.

The TSF values (mean as well as median values) of males from both groups were below the mean values assessed in the Cincinnati Anthropometric Survey for the elderly (CASE) (40) these values being 22.5 mm for 60-89 years.

The mean as well as median TSF values of females from both groups were lower, as being 18 mm, than for the female elderly living in old people's houses in Heidelberg (78).

The studies we compared our results with were conducted on healthy community-living elderly. Small changes in TSF with geographic variation were shown in the SENECA study (80). Different elderly population also show ethnic variation in height, weight and BMI, much of which reflects differences in life style and environment over the life course and genetic differences (50). Not only regional differences but also lack of accepted reference ranges for elderly people living in nursing homes makes it difficult to read our results.

Mid –upper arm circumference (MUAC)

MUAC is a part of nutrition evaluation of the Mini Nutritional Assessment, thus it was in our study included as an independent screening (<22 cm as cut-off for both gender) measurement. It has recently been shown that mid-arm measurements may be a more practical and suitable index not only for nutritional assessment but also for an index of fat and lean component of the arm (50, 65, 123). Decrease in MUAC was observed where there was a significant reduction in weight, reported in the SENECA study (124). The median of mid-upper arm circumferences of both groups and genders assessed in our study were similar to American, Irish and French but slightly higher than British (Tab. 5.1). In comparison to the reference values supposed by Burr (43) male migrants data exceeded their 90th percentile. Females' MUAC, from both groups in our study, was similar to 95th percentile, this being 30.5 cm for individuals aged 75-79 years.

Turkish both cross-sectional and institutionalized elderly studies showed similar MUAC values for male and female migrants (Tab. 5.2).

Ferro-Luzzi et al. (125) have proposed MUAC cut-off points for use as an alternative for BMI, as part of a screening tool in the acute phase of an emergency. The values 23.0 cm in men and 22.0 cm in women are suggested as useful cut-off points (126). It has been shown that MUAC cut-off of 22 cm has a sensivity of nearly 86% in relation to the BMI cut-off of 16 kg/m² (127). Suzana et al. (122) observed elderly with extreme underweight, i.e. BMI<16, had below the cut-off MUAC. When using MUAC as a nutritional indicator, none of the migrants and only one of non migrants was undernourished. Kondrup et al. (128) suggested that a MUAC <25 cm corresponds to a BMI <20.5. One explanation could be that in our study none of the participants had an extreme low BMI value.

Nevertheless, probably this cut-off MUAC value is more indicative of long term chronic energy deficiencies and more suitable for geriatric patients (hospitalized elderly).

Arm muscle circumference (AMC)

A number of studies have demonstrated that AMC is an another indicator of muscle mass (129-131) and a predictor of mortality for older people (132).

When we compared our results (Tab. 5.1) with the French (121) and Irish 50th percentile (36) of elderly populations, male migrants had similar values but non migrant males and as well as females from both groups showed slightly higher AMC values.

Compared with NHANES III data, the 50th percentile of male migrants was similar to Irish and French values. Lower than American but higher than British males' median values. The median AMC of both migrant and non migrant females corresponded to American 75th percentile values this being 24.8 cm for 70-79 years.

The mean AMC value of male migrants showed similarity (25.8 ± 0.67) when compared with a study conducted in one Middle East country nursing home (133).

Arm muscle area (AMA)

AMA is an accepted index of body protein stores and is useful in identifying and monitoring malnutrition (134). The mean AMA values of both migrant and non migrant females were higher than the females (35.9 ± 9.6 cm^2) in a study conducted an old people's houses in Heidelberg (78) as well as for Irish (36) and British elderly populations (43). It is well known that with the advancing age, the compressibility of subcutaneous tissue changes and the fat content of muscles increases (123). And these effects tend to interfere with the assessment of AMA.

Corrected arm muscle area or bone-free arm muscle area (CAMA)

CAMA has been developed to account for the problem of arm muscle area over estimating actual arm muscle area (adjusted for bone) by 15% to 20%. Some authors suggest that very low CAMA associates with a significant increase in the relative death risk (113, 135). It is a measurement of important prognostic value for severe wasting malnutrition in elderly individuals. We found in our study CAMA value being 20.3 cm^2 only in one of non migrant female (Appendix, Tab. 9.9). Anyhow, as CAMA is deducted from AMA, the same limitations apply here.

Fat-free mass (FFM) and body fat percentage (BF%)

Fat free mass and body fat percentages thought to be important in the evaluation of nutritional status. We estimated BF% from BMI using a formula in our study. Because, this is less dependent on observer errors than skinfold measurements and validation of prediction formulas in population described in literature (49).

In the elderly fat mass increases and fat-free mass decreases with advancing age (81, 84, 136). This changes associate strongly with impaired mobility and lowers the quality of life (83, 137). Forbes (138) suggested that a weight gain of 2.3 kg/decade is necessary to avoid losing FFM during aging. Kyle et al. (137) showed FFM does appear to decrease after the age of 60. Probably, weight gains are no longer large enough to offset the inevitable loss of FFM with aging. There are some available FFM reference values in the literature. However, these values are derived in healthy elderly and different measurements (such as bioelectrical impedance) are used for body composition (139, 140). Compared with NHANES III data (140) (FFM for males; 59.1 kg, females; 44.2 kg; 70-79 years), the mean FFM values of males from our study groups and female migrants had lower, whereas non migrant females had similar values (Appendix, Tab. 9.4, 9.5).

Mean BF% of non migrant females was comparable with NHANES III data (females; 35.9%, males; 25.1%) whereas, female migrants had lower values. The BF% of males in our study group had higher values (140). The lower BF% of male migrants that we found was probably due to the low body weight of them. Among female migrants and non migrants as well, there was only one extremely high BF% (53% v.s. 50%) value. The relationship between BMI and BF% has been previously shown in an adult population (49). This was also observed in both groups in the present study (Tab. 4.20).

Calf circumference (CC)

The cut-off of 30.5 cm provides a good diagnostic capacity for both women and men (141). CC <31 cm has been also proposed to be as a valid nutritional screening instrument for malnutrition in elderly (38). Using this cut-off value as an indicator, more than half of the migrants and 22% of non migrants were undernourished. Male migrants were critically more close to this value. CC recommended as a better descriptor of overall muscle mass because the legs contain over half of the muscle mass of the body (50, 142, 143). One of the first things that happen during wasting or undernutrition is reduced walking which precipitates the cascade of reduced mobility and fat-free mass. Corish et al. (36), in their countrywide survey study showed that calf circumference declines with age in both genders.

Compared to the Irish study sample 50th percentile CC values of both female and male migrants had lower, whereas non migrants had similar or higher values. Moreover, another study conducted in Turkey (79) showed that the mean CC value of individuals was 31.5 cm. It is quite similar to our results concerning the whole group of migrants (Tab.5.2). Comparable data for

mean as well as median of CC for females from NHANES III (144) was higher than for females from both groups in our study being 35 cm for aged 60 and over. Non migrant males' CC showed similarity to American males being 36.2 cm but migrants' were slightly lower. Correlation coefficients indicated a clear association between other anthropometric measurements and calf circumference in both groups as well as between nutritional problems (Tab. 4.21, Fig. 4.11). In our study we also found a good correlation (migrants; r=0.876, non migrants; r=0.636) between BF% and CC.

Muscle strength

Although some authors suggested that muscle strength is a more powerful predictor of mortality than muscle mass (50), in our study a reliable data of hand grip strength was not available from all participants, due to cognitive or physical impairment (Tab. 4.4).

Summarising it can be stated that using different anthropometric measurements as an indicator of nutritional status showed different results. According to the CC cut-off value the rate of under nutrition was higher than for MUAC cut-off values. Similar differences have been also observed in geriatric patients (145) and nursing home residents (146). As we have already discussed, the MUAC cut-off value of 22 cm was probably quite low for this population, although adopted from mini nutritional assessment. However, Chumlea et al. (143) recently suggested that these cut-off values should be considered in any country-specific version of MNA. A comparable difference in result was also observed on elderly population in Taiwan and these values were adopted for the population-specific cut-off standards (147). Although arm circumference is an easy method to determine nutritional status, it only poorly reflects the muscle mass because the movement of the arms in daily activities occurs until the very late stages of wasting helping to maintain muscle mass locally (143).

Table 5.1: Comparison of body composition assessed in international studies (mainly free living elderly)

Author/ Study	Age (years)	Gender	n	TSF (mm) mean (SD)	AMC (cm) mean (SD)	MUAC (cm) mean (SD)	AMA (cm²) mean (SD)	CAMA (cm²) mean (SD)	CC (cm) mean (SD)
NHANES III (37)	70-79	men women		n 50th 825 12.4 902 21.8	n 50th 824 27.2 914 30.1	n 50th 832 31.3 914 30.1	----	----	----
Irish cross-sectional study (36)	72.5 ± 5.4 (65-92)	men women	276 598	50th 10.8 19.1	50th 25.5 22.4	50th 29.1 28.6	50th 51.8 40.1	----	50th 35.8 34.5
French Study sample (121)	65<	men women	289 337	10.8 ± 4.3 19.3 ± 6.2	26.2 ± 2.7 23.0 ± 2.1	29.4 ± 1.9 29.0 ± 3.3	----	49.0 ± 8.0 37.1 ± 4.7 (65-69 years)	----
British Study sample (43)	65<	men women	298 526	50th 7.0 14.6	50th 22.1 20.0	50th 24.5 24.9	50th 39.4 32.3	----	

Table 5.2: Comparison of body composition assessed in different studies in Turkey and current study

Author/ Study	n	Gender	Age (years)	Weight (kg)	BMI (kg/m²)	CC (cm)	MUAC (cm)
Kucukerdonmez et al.(148) (Cross sectional)	1564	men women	median 71 (65-110) 70 (65-102)	median 72 (40-113) 65 (30-97)	median 25.7 (16.3-33.9) 27.0 (14.7-33.8)	median 35 (24-47) 35 (16.5-46)	median 29 (19-44) 29.5 (14.5-44)
Aslan et al.(99) (urban)	350	men women	mean 71.8 ± 4.9 71.2 ± 5.8		mean 25.4 ± 2.9 26.9 ± 3.9	------	-------
Sanlier et al. (79)	429		F: 71.2± 6.1 NH: 73.8±7.2 A: 72.7± 6.2	F: 70.4 ± 13.9 NH: 65.2 ± 13.0 A: 69.2 ± 12.1	F: 25 ± 4.2 NH: 23.7 ± 4.7 A: 25.1 ± 4.6	F: 31.5 ± 3.3 NH: 31.5 ± 4.4 A: 32.1 ± 2.5	F: 24.1 ± 2.8 NH: 23.9 ± 3.4 A: 23.3 ± 2.1
Rakicioglu et al. (77)	391	men women	65<	F: 78.7 ± 10.4 NH: 70.8 ± 15.4 F: 72 ± 11.1 NH: 69.3 ± 11.8	F: 26.9 ± 3.2 NH: 25.5 ± 1.8 F: 29.3 ± 1.8 NH: 29.9 ± 4.9	----- -----	F: 33.1 ± 5.6 NH: 28.6 ± 4.2 F: 31 ± 5.5 NH: 31.2 ± 5.2
Current study (migrants)	23	men women	65<	NH: 64.5 ± 9.4 NH: 61.1 ± 16.6	22.6 ± 2.7 27.5 ± 8.2	30.9 ± 4.2 32.8 ± 7.6	28.6 ± 2.9 30.1 ± 4.7

CC= calf circumference, MUAC= mid-upper arm circumference, F= living with family, NH= in nursing home, A= living alone

Core indicators of nutritional status

As previously discussed, we observed different results for nutritional status of the residents by evaluating each single anthropometric marker (cut-off values). Therefore, collected nutritional parameters as well as loss of appetite were evaluated as core indicators. The differences in nutritional status, according to the nutritional core indicators, may be due to pre-morbid condition in those who were bedridden or tube fed among the migrants.

Weight changes

Weight change, or mostly weight loss, is an important predictor of poor nutritional status and a common problem in institutionalized elderly (92, 149).

Rapid unintentional weight loss in elderly is usually indication of underlying diseases (82), and it correlates negatively with functional capacity for independent living (102, 150-153). There is a tendency of weight loss in residents who are depressed (154) or have dementia (155) (156, 157).

Although no clear consensus exists, some researchers suggest that a 10% loss of body weight over a six-month period strongly predicts mortality among elderly in nursing homes (82, 102, 153, 154, 158). According to ESPEN guidelines, more than 5% involuntarily body weight loss over 3 months is usually regarded as significant (159).

In our study sample, the prevalence of weight loss during the last three months was not very high in both groups and the majority of individuals had stable weight (Fig. 4.3, Appendix Tab. 9.11). It could be helpful to inquire if weight loss was intentional which may also associates improvements in physical function (160, 161). On the other hand researchers have suggested that all weight loss, whether voluntary or involuntary, is similarly associated with increased mortality (102, 152, 158).

However, information on weight loss is often unreliable in elderly individuals (162) and elderly are seldom weighed even under professional care (88, 163) as well as in our study sample. It was difficult to obtain reliable weight data of the residents so that we estimated before three months' weight for some of the participants.

Nutritional habits and problems

Nutritional habits

The number of the residents consuming their meals pureed was higher among the migrants (Tab. 4.6). Johnson et al. (164) evaluated the nutrient content of menus planned for regular consistency

meals and pureed meals in a long-term care facility. They found that although energy and nutrient values for regular diet menus (i.e. food served) were higher than for pureed menus, both had values exceeding recommended allowances for most nutrients.

It is very clear that the vast majority of the migrants chose to drink black tea (94%) whereas coffee was preferred by non migrants (94%). Black tea is the main beverage in Turkish society and it is not only preferred for breakfast but also between the meals. This result shows that migrants have tendency to choose habitual foods and underlines the difference between the two cultural groups.

Nutritional problems

In our study we defined subjective variables affecting food intake as nutritional problems. In literature severe nutritional problems are often found in residents of assisted-living facilities or nursing homes (154, 165) and they may in fact be the reason for long term care placement and high prevalence of undernourishment among nursing home residents. The number of nutritional problems, especially lack of appetite and refusing to eat in our study, showed a clear association with MNA and CC in both groups and with BMI only in migrants (Tab. 4.20, 4.21, 4.22). In the meaning of that, the higher the number of problems was the poorer nutritional status. Some authors suggest that the presence of dementia and depression are the major contributors to poor appetite (166).

Older people lose their appetites for many reasons, including low physical functional capability, severe cognitive impairment (167), adverse drug effects (168) and acute disease (111, 169).

Apart from underlying disease, being dependent, the ability to do things without assistance and how the residents look upon their life situation is important as well as being satisfied with living in the nursing home for elderly.

Environmental factors of importance are eating alone and absence of emotional and physical support (loss of motivation to eat). The external factors are dependent on wholesomeness, unfamiliar food, eating environment and meal fellowship may also cause a loss of appetite (169). Appetite increases when the food is well prepared and fulfills the expectations, i.e. the right consistency, habitual way and served fresh. Eating together is another important factor that affects appetite (170). Our observation is that the migrants in our study sample had little contact with non migrants, even if they sometimes shared the same dining table with them. Language and other cultural barriers may also be the reason for this.

Additionally, it has been suggested that delayed gastric emptying in elderly subjects may cause distension of the stomach and contribute to lack of appetite (82).

Surprisingly chewing and swallowing difficulties, often mentioned as reasons for decreased food intake (111, 168, 171) were not relevant in our study. It has been shown that at least 80% of nursing home residents have some degree of tooth loss (111) and have other chewing problems, enjoy the food less than before. Food had less taste (172) and finally they show loss of appetite (169). Although dentition is often mentioned as a factor in nutrition of elderly people, some authors observed no relationship (173). In our study, use of artificial teeth and problems with teeth was not directly examined but asked whether participants having chewing difficulties.

The other main nutritional problems in migrants were eating noticeably little, a possible reason for this could be the loss of appetite, and drinking only when requested (Tab. 4.7). Compared to non migrants, the prevalence of this was higher and shows that migrants are unwilling to eat and drink.

Ensuring adequate food intake in institutions is contingent on a number of organizational factors such as menu design, delivery of food conform to nutritional standards, meal service in favorable environment and availability of feeding assistance (174).

Adequate assistance at mealtimes, adequate time, and a better environment can both physically and socially help to improve the situation. Feeding assistance intervention studies have shown an important influence on food intake and weight gain (149). However, with an increasing work load, there may not be sufficient time to ensure the nutritional care of all residents. Walton et al. (175) have shown that, compared to the care staff, volunteers socialized more with residents, encouraged them to eat more often and spent more time feeding them. Volunteers were available from time to time in one of the nursing homes in our study. Changes in the sensory quality of food through flavor enhancement have already been shown to lead to improvements in food intake in nursing home residents (176).

Occasionally, older persons develop early satiation and can only eat a small portion of their meals (111). An increased number of the meals and especially providing nutrient dense snacks for the residents may therefore help to solve part of the problem.

According to Beck et al. (88) nutritional problems often go unrecognized and untreated. Some authors suggest that the management of this problem should be interdisciplinary and individualized (111). Efforts should be directed toward the decrease of this kind of problems.

Food, energy and nutrient intake

Food groups

The differences in food items intake are summarized in table 4.10 (Appendix, Tab. 9.14). Compared with migrants, non migrants had a significantly greater average daily intake of meat and sausages, cheese and curd, bread, pastries and butter. In contrast, the migrants' diet was richer in grain and vegetable products compared with non migrants although it was still lower than the recommended (Fig. 4.4). Our dietary protocol did not include the day fish was served. This can be one of the explanations of lower consumption in both groups.

Generally, in Turkish diet wheat is a staple food which is mainly consumed as white bread and pasta. The major percentage of energy comes from bread with other cereals (58%). Lentils, chickpeas and dry beans are the most widely eaten pulses. Yoghurt is the most frequently used milk product, fresh vegetables and fruit are both in rural and urban areas of the country frequently consumed (177). A Turkish study including 1060 community living elderly showed that the consumption of milk and milk products especially cheese, fruit and vegetables reached the recommended level (98). In contrast, cheese consumption was quite low among migrants in our study although white cheese was available in both nursing homes.

A study conducted in Germany investigated the food habits of three different groups of migrants. The study results show that in Turkish families the main food items are vegetables, bread and rice. White cheese was habitually consumed especially at breakfast together with olives and tomatoes (16). This indicates that migrants still follow their traditional eating habits even if they are in another country. But we found in our study that food intake did not show similarity to their traditional eating habits e.g., less bread, vegetables and fruit intake. The reason might be the way the food was prepared and the type of bread served. Nevertheless both nursing homes offered the meals as "international kitchen and Muslim cuisine".

A study on the elderly performed in Turkey showed a lower consumption of meat and meat products (98). The reason for this could be the higher price of meat and meat products compared to other protein sources. In our study, the consumption of meat and sausages was higher than recommended among non migrants and the intake of fruit and vegetables was lower than recommended in both groups (59). Although ethnic sausages (without pork) were available for migrants in both nursing homes, the consumption was low. The reason could be that meat products (e.g. sausage) are generally not preferred food in Turkish society.

Some other studies have shown that the intake of vegetables and fruit decreases with age (178, 179). It should be noted that in the nursing homes taken into consideration for our study, fruit was not a regular part of the menu. In one of the homes, fruit was served twice a week.

In Turkey, people eat two hot meals a day (if they can afford it). Hot meals, however contributed to a considerable part of the daily energy and nutrients intake among the elderly in the SENECA study (180). It has also been suggested that compared to the community-living elderly group, the elderly living in institutions tended to have a more traditional diet (181). In general, in nursing homes a hot meal is only served for lunch, a contradiction to the migrants' traditional way of eating.

Energy and nutrient intake

It is difficult to compare our results with other studies designed to examine dietary intake in elderly for a number of reasons. The most important factor relates to dietary methodology. Some used food frequency questionnaires and some used 24-h recall or diet histories.

In the institutionalized elderly an observation and direct measurement method appears to be a useful but time consuming (182). We used 3- consecutive days weighed food intake records and did not collect weekend food records. Although, there is some indication that weekend food intakes are higher than during the week (183) which can most probably be valid for non-institutionalized elderly.

Several researchers have found three days to be an acceptable, practical and feasible compromise in a situation with limited resources (184). The use of either three random day or three consecutive day records seems to be acceptable for describing large groups (185).

In some of the studies, residents who were tube or parenterally fed were excluded (186). As a result, comparison with other studies was more of a challenge.

Energy

Energy requirements continue to fall with advancing age. This is due to a decrease in lean body tissue (muscle), leading to a fall in basic metabolic rate. Older people also tend to be less active. The average daily intake of energy was respectively 1527 kcal (6.4 MJ) and 1635 kcal (6.8 MJ) for migrants and non migrants. Concerning PAL value of 1.2 which means exclusively sedentary or bedridden, daily energy intake seems adequate. But on the other hand considering only a limited physical activity level (PAL 1.4), the average daily energy intake was below the

recommended values for older people, in both groups (men: 2000 kcal / MJ 8.3, women: 1600 kcal / 6.9 MJ (53).

In our study 30% of migrants and 8% of non migrants were bedridden. It is possible that for most of the other residents PAL 1.4 is more suitable. In which cases the energy deficit would have been greater. The elderly are a heterogeneous group with respect to age and physical activity levels and consequently have different energy requirements (53) methodological differences may explain the large variations in intake between studies.

Some authors suggest that energy requirement should be calculated at 30 kcal/kg/day to maintain body weight and adjusted if weight gain or loss is desired (60). In our study groups only female migrants reached this value.

Recently, nutritional support of elderly subjects has been discussed in Brussels Forum (187). According to the report, nutritional intake should take into consideration the physical activity of the senior residents and 20 kcal/kg/day should be enough in semi-or immobile persons. On the other hand, it has been also discussed that the objective of nutritional support in malnourished elderly is to achieve an energy intake ranging from 30-35 kcal/kg/ day.

Then again, it has been well documented that it is difficult to design a diet containing all essential nutrients at recommended level in a nursing home with residents who have a relatively low intake of energy, especially among those at higher age (60, 188).

In the SENECA study, 1282 European non-institutionalized elderly food intake data were collected using the dietary history method. The energy intake of elderly ranges was 6.3-10.2 MJ (females), 7.9-12.1 MJ/day (males) and even with an energy intake above 6.3 MJ/day, inadequate intake of at least one micronutrient has been observed (80).

In a recent Austrian study, the residents' daily energy intake was similar to ours as being 6.6 MJ and 6.5 MJ, for males and females respectively (189). The average energy intake was also similar to Swedish nursing home residents being 6.3 MJ/day (25 kcal/kg/day) (190). Comparing our female participants' results with an another study carried out in a German nursing home, daily energy intake was higher than our results being 6.8 MJ a day (87). When we compared our results with those of a study conducted in Turkey, female institutionalized elderly had a higher (6.6 MJ) but males a lower (5.7 MJ) daily energy intake than the migrants (77).

Interestingly in our study sample energy intake did not correlate with BMI (Tab. 4.20). Thought one would expect that females and males on extreme ends of the BMI scale would have different energy intakes.

Protein

The recommended daily dietary protein intake is 0.8 g/kg body weight for adults older than 65 years (53). This value represents amount of protein required to avoid progressive loss of lean body mass in most individuals. However, there is a scientific discussion that moderately increased daily protein intake beyond 0.8 g/kg may enhance muscle protein anabolism (191) (192) and help if nitrogen balance is to be maintained in the long term (173). In addition, in low energy intakes inflammatory conditions, catabolic diseases and fever this recommendation increases.

In this study the average protein intake of migrants and non migrants seemed adequate as being 0.9 g/kg bw/day for both groups. It also corresponded to 14.5% and 15.8% of daily energy for migrants and non migrants respectively. According to the recommendation, the percentage of intake considered as adequate.

Comparing our results with some studies of the migrants' country of origin, the daily protein intake (54.5 g, 62.7 g for men and women respectively) and the energy derived from protein was higher being 16.4% (men) and 15.8% (women) in nursing home residents (77). Energy derived from protein (14.3%) was higher in female Dutch nursing home residents than in our female migrants but lower than in non migrants (Appendix, Tab. 9.17) (193). The average daily protein intake was similar to some other studies (189, 194).

Recent studies suggest that higher protein intake would be beneficial for the elderly. In a prospective study, women with protein intakes ranging from 1.20 to 1.76 g/kg body weight, tended to have fewer health problems over a 10-year period than those with protein intakes higher than 0.8 g/kg per body weight (195). In another study the reasonable target was defined 1.5 g/kg/day, or about 15-20% total caloric intake for elderly to maintain health and function (196). According to some authors a moderate protein intake of 1.0-1.3 g/kg/day may be required to maintain nitrogen balance and offset a potentially lower energy intake (197). Evidence from an intervention study suggests that an increase in dietary protein (1.6 g/kg bw) intake may enhance the hypertrophic response to resistance exercise (198). Morais et al. (199) recommend that when energy intake is as low as 5.4 MJ /day, the energy derived from protein should be in the range of 16-20%. Requirement can also increase along with vitamin C and zinc in special situations, such as pressure ulcer (60).

Recently it has been suggested that to maximize muscle protein synthesis, one should take every meal 25-30 g of high quality protein (~10 g EAA) per meal (200).

Of course, not only the amount of protein but also the source is important. Protein rich foods with a high biological value, such as meat, milk and eggs, can be important to ensure that the

essential amino acid requirements are met. Recent data suggest that a moderate 113 g serving of intact protein (i.e., lean beef) contains sufficient amino acids (30 g total; 10 g essential amino acids) to increase mixed protein synthesis by ~50% in elderly women and men (191). It would be useful to analyse sources of protein intake in our study. However, the consumption of meat and sausages together with cheese were higher than recommended among non migrants.

Carbohydrates

In our study neither migrants nor non migrants reached the minimum recommended level of 50% energy intake from carbohydrates. The average carbohydrate intake was below 200 g/day and energy derived from simple carbohydrates was higher than (Tab. 4.11, Appendix Tab. 9.15) recommended (10%) in both groups. The only benefit of high simple carbohydrate intake is that it serves as an additional energy source.

There are similar low carbohydrate intake results (41.5-49.8 E%) in other European studies on elderly (87, 189, 201). The study results from Turkey show higher carbohydrate intake in elderly both living at home (55.3 E%) or institutionalized (52.2-55.8 E%) (77, 202). This is not surprising, because the major percentage of energy comes from bread and cereals eaten at every meal in Turkey. In our study bread and pastries consumption among migrants was not only below the recommendation (Fig. 4.4, Appendix Tab. 9.14) but also lower than for non migrants.

Fat and cholesterol

The DA-CH Reference Guiding Values (53) for total fat intake of adults (not more than 30% of energy intake) are related to light work. Saturated fatty acids (SFAs) should not exceed 10% of energy. One’s diet should also provide a minimum intake of polyunsaturated fat of 8.1 g per day.

The proportion of fat from the total energy was higher than the recommended level as well as SFAs in both groups and especially among non migrants (Tab. 4.11). With regard to fat composition, SFAs are present in the diet in high quantities. The main source of SFAs was the butter used on bread. Using margarine or other spread instead of butter would decreased saturates intake, as would substituting semi skimmed milk for whole milk. Also the consumption of a higher amount of meat, sausages and cheese can explain higher intake of fat and SFAs among non migrants. This also relates to dietary high cholesterol intake. Two different study results from Turkey showed lower intake of cholesterol (181 mg/day) in institutionalized elderly than migrants in our study (77, 202).

Our result concerning energy derived from fat is quite higher than that for the institutionalised elderly living in Turkey (males; 28.5 E%, females; 32.2 E%) (77) and again higher (36.2 E%) (189) and similar to (193) some other European study results.

According to a comprehensive cross-sectional study carried out on 3.533 elderly to determine the nutritional status, dietary intakes of elderly living at home in Turkey, the mean percentages of energy from carbohydrate, protein and fat were 64%, 13%, 24% for males and 66%, 14%, 24% females respectively (203).

The study conducted in the Netherlands showed that in general the diet of migrants is higher in macronutrients but lower in micronutrients compared to the Dutch diet (15).

Fibre

A sufficient dietary fibre intake generates a variety of positive effects on bowel function, glucose metabolism (204), improved blood cholesterol level and possible reduce risk of colon cancer.

The average fibre intake among participants was lower (Tab. 4.11) than recommended, 30 g/day (53) which can be explained with a low intake of fibre rich foods such as legumes, wholegrain cereals, vegetables and fruit. Migrants consumed a significantly higher amount of grain products than non migrants and were still lower than the recommended.

Some other study results also support our findings with a lower fibre intake for elderly (11-15 g/day) (87, 189, 190, 204). Moreover, the study conducted in Turkey showed that elderly living at home consume more fibre (22 g) than those ones in nursing homes (17 g) (77).

However, reaching the recommendation is difficult because of lower energy requirements with aging but with a well planned menu the intake of fiber could have been higher such as changing white bread to whole bread and add more grain products to the menu.

In general, the composition of energy yielding nutrients in elderly people' diet show a large range in different populations (205). In studies performed in the US and Europe we find protein range between 13 and 19 energy percent (E%), fat between 33 and 45 E% and carbohydrates between 41 and 57 E%. There was a general tendency in these studies to state that the fat E% was too high while the contribution of carbohydrates was too low compared to recommendations for the elderly population.

Micronutrients

As in other studies performed on elderly people living in nursing homes (189, 190, 193, 204, 206-208) in general, our study sample does not reach the recommendations. The main

differences between migrants and non migrants were intake of vitamin A, B12 and niacin. This might be the result of some non migrants' consuming liver over the 3-day record keeping period. Individual heterogeneity regarding intake of some nutrients have been also observed in other studies (131). Since the menu was repeated every six weeks in nursing homes, this might give an accurate account of the eating behaviours of the residents.

Previous studies have suggested that there are specific nutritional deficits in as many as 20% to 70% of the community dwelling, functionally dependent elderly. Deficits in protein, calcium, iron and B vitamins are most frequently cited (173, 209). However, the risk might increases substantially if dietary intakes are less than 50% of the recommendation for a particular nutrient. The nutrients found to meet this criterion among the participants in our study were vitamins D, C, and folate. Additionally, vitamin B12 in migrants and vitamin E in non migrants were also in this category. Perhaps this relates to medical condition and/or nutrition care systems in institutions. Some studies showed that independent nursing home residents receive a diet less nutritionally adequate than those who were supervised at meal times (204).

Berner et al. (208) conducted an analysis of institutionalized elderly dietary intake from 38 studies. According to this review elderly people from most of the Western European countries, the United States, Chile, Israel, Australia, Hong Kong and Japan did not meet for at least two nutrients at recommended level. Particularly low intakes were vitamins D, E and B6, thiamine, biotin and folic acid as well as those of calcium, magnesium, zinc, and copper.

It shows that even if the food choices are different from one country to another, still some of the nutrients are missing in all elderly diet.

Fat soluble vitamins

Vitamin A

Intake of ß-carotene is linked to enhanced immune response, inhibition of mutagenesis, and protection from oxidative damage (53). In our study sample, non migrants' daily vitamin A intake was higher than migrants. The difference between the groups was probably due to lower consumption of animal origin foods (e.g. liver, butter) among migrants. 74% of migrants did not reach (Tab. 4.12) the recommended intake (female; 0.8, male; 1.0 mg RE). Our results show that this inadequate intake (0.7 mg) was comparable with investigations performed in Turkey (202).

Vitamin E

Due to its antioxidant properties, vitamin E plays a role in the prevention of certain diseases, including cancer, diabetes, cataracts, and cardio- and cerebrovascular disease (210) and has been related to the prevention or slowing of cognitive decline (211). The dietary intake of vitamin E was significantly higher in migrants than in non migrants, probably due to higher consumption of grain products and vegetable oil which was used to prepare migrants' meal. Another reason might be the higher number of tube fed residents among migrants. The fat sources in these products were sunflower or rape seed oil that gave them sufficient intake of vitamin E. Nevertheless, only 30% of the migrants and 14% of non migrants were met with the recommended intake of 12 mg (men) and 11 mg (women) tocopherol equivalents. Although vitamin E intake was judged to be inadequate, it was not considered as a critical nutrient in elderly.

The intake of vitamin E by the elderly people in this study (Tab. 4.13) was similar to (6 mg) (212), or lower than, that reported in other studies (213). Comparing a study conducted in Turkey, our results were lower than for elderly living at home (12 mg) but similar to those living in nursing homes (6.7 mg) (77).

Vitamin D

The lowest intake levels compared to recommendation were observed for vitamin D. The median intake was 2.1 µg (migrants) and 1.6 µg (non migrants) which were much lower than the 10 µg recommended by DACH for those over the age 65 years. In three participants of the migrant group the values exceed recommended levels due to tube feeding. It could have been generally higher if we would have been able to evaluate fish consumption. Fish was served only on Fridays and was thus not included to our dietary protocol days. This low intake is similar to other studies (164, 204, 206, 212) and less than (3.7 µg) in non-institutionalized elderly in Sweden (190). It is an unrealistic expectation to meet adequate intake for vitamin D through dietary sources alone. The intake might not be as inadequate as suggested if residents have access to sun light. It is well known that vitamin D plays an important role in bone growth and maintenance by enhancing intestinal absorption of calcium (214). The relation between vitamin D deficiency (serum 25 OHD) and muscular function, osteoporosis, falls, fractures and disability has been also indicated (215, 216). It is on the other hand possible that elderly with poorer functions go out less and mostly spend their time in the nursing home and rarely are exposed to sunlight. The majority of the migrants (43%) in our study left the nursing home either never or once a month. Therefore, vitamin D supply has to be considered a problem, especially in migrant women.

Vitamin D insufficiency has been observed among Turkish migrants living in Germany, especially in veiled women who get little sunshine exposure and due to the number of children they have (217). The vitamin D status was found much better in women with western style clothing than in women dressed with the whole body covered in Turkey (218). Some other study results from Middle East countries support this relationship too (219).
Offering residents regularly, dietary sources such as oily fish like salmon or mackerel several times in a week and margarine (which is fortified with vitamin D) may reduce risk of deficiency.

Vitamin K

There is strong evidence supporting the importance of vitamin K in bone health, the association with abnormal calcification and the role of deficiency in osteoporosis which affect many elderly (220, 221). It has been suggested that insufficient vitamin K intakes may contribute to an acceleration of the progression of Alzheimer's disease (222).
In contrast to some studies (223) more than 95% of the participants consumed adequate amount of vitamin K in our study. This was probably due to food items such as muscle meat or eggs in participant's diet, since their meals only contain few green leafy vegetables.

Water soluble vitamins

Intakes of thiamine, riboflavin and niacin are related to caloric intake, as are requirements for these nutrients. However DACH stipulates a minimum intake for the elderly of 1.0 mg thiamine, 1.2 mg riboflavin, 13 mg niacin even when the individuals are consuming fewer calories than average.

Vitamin B1 (Thiamine)

This vitamin acts as a coenzyme in energy metabolism and also plays a key role in the normal effectiveness of the nervous system and quite important for the brain. Recently, it has been suggested that it modulates cognitive performance, especially in elderly (224). Although it is widely available in a variety of foods 60% of the residents' dietary thiamine intake did not cover the needs in both groups. Whole grain products are good dietary sources of thiamine as well as lean pork and liver. The consumption of bread, pastries and meat were lower in migrants than non migrants which might be the reason for low intake of thiamine. It is difficult to explain the low intake of this vitamin among non migrants since their diet was rich in pork and organ meat. It was probably due to low consumption of grain products.

It has been shown that the institutionalized elderly had a lower intake of thiamine (0.73 mg/day) compared with the healthy elderly (1.09 mg/day) and that might adversely affect their clinical state (225). Inadequate intake also observed in some other studies conducted on institutionalized elderly (77, 87, 193, 204, 212). Migrants' thiamine intake was comparable (0.66-0.8 mg/d) with the studies conducted in Turkey (77, 202).

Vitamin B2 (Riboflavin)

More than half of the residents from both groups met the recommended level of riboflavin. The respective recommendation was exceeded to 70-90% in males although only 1/3 of female migrants met with it (Fig. 4.6). This is possibly due to lack of cheese and muscle meat in their diet. Similar results (1.1 mg) have been found among Turkish institutionalized elderly (202).

Vitamin B6 (Pyridoxine)

Low vitamin B6 intake and nutritional status have been associated with impaired immune function, especially in the elderly. A few studies have associated cognitive decline with inadequate nutritional status of folic acid, vitamin B12, and vitamin B6 and thus, elevated levels of homocysteine (226, 227). It has been also suggested that vitamin B6 deficiency may lead to depression in elderly. Several surveys have found that over half of individuals over age 60 consume less than recommended.

More than 50% of the participants from both groups had pyridoxine intake below the recommended and it became even worse in female migrants (Tab. 4.12, Fig. 4.6,).

On the other hand, the daily protein intake was high in both groups which may results in an increased requirement for vitamin B6 (228).

Vitamin B12 (Cobalamins)

Regarding vitamin B12, it has been established that bioavailability decreases with increasing age due to a reduced intrinsic factor and atrophic gastritis as well as food- cobalamin malabsorption (59, 226, 229). It has been shown that vitamin B12 deficiency frequently occurs (>20%) among elderly people (229). Studies report that deficiency (as well as lack of folic acid and vitamin B6) associates with elevated homocysteine concentrations which results in cognitive decline (230-232) increased risk of arteriosclerosis and chronic heart disease (233).

Recommendation for vitamin B12 is based on the amount needed for the maintenance of hematological status and normal serum vitamin B12 values. The average daily vitamin B12

intake of migrants was comparable (male: 2.4 µ, female: 2.1 µ) with the study conducted in Turkey (77). In our study group, over 60% of the migrants' dietary intake was less than recommended (Tab. 4.12). This may be due to low consumption of muscle meat, meat products and cheese among migrants.

Folate

Folate associates with homocysteine concentration and was defined as an independent risk factor for cardiovascular disease (234).

Intake of folate among all participants was substantially below the recommendation. The DACHs recommendation for folate (400 µg FE) was met by only one (5.6%) of non migrants. Low intakes have similarly been found among institutionalized Spanish (207 µg) (235) and institutionalized women on a regular (281 µg) and pureed (214 µg) textured diet (164). The average daily folate intake of institutionalized elderly was slightly higher (male: 245 µg, female: 270 µg) than the migrants in our study sample (77).

Actually, there is a limited opportunity to implement sufficient amount of folate intake unless the diet is rich in green leafy vegetables or fruit. Inadequate consumption of vegetables and fruit were reflected in residents' low intake of folate.

Pantathonic acid

An intake of 6 mg/day pantathonic acid considered sufficient for elderly (53). Although pantathonic acid is quite widely distributed in foodstuffs, the average intake of the participants from both groups was lower than the recommended. Almost 95% of non migrants did not reach this level. Some of the good sources of it such as liver and fish are also good sources of vitamin A.

Vitamin C

Vitamin C, α-tocopherol, and ß-carotene have been reported to increase cardiovascular protection among men and reduce cognitive loss due to ageing (236). Inadequate intake of vitamin C is also observed at older age and associated with disability (237). Heseker et al. (238) concluded that the elderly need more vitamins C. The recommendation for vitamin C is lower (70 mg/day) in some countries than DACH's (100 mg/day).

More than 2/3 of the residents' vitamin C intake was less than recommended in both groups. Low intake of vitamin C has been frequently observed among nursing home elderly (87, 188, 193) but some of the study results of the Mediterranean countries (212, 235, 237, 239) including

Turkey (77) and Israel (208) showed sufficient vitamin C (70-90 mg/day) intake. Lack of vitamin C is seen when the consumption of fruit and especially raw vegetables is low, which may lead to bleeding gums and impairment of wound healing (53).

In our study, we only examined the daily consumption of beverages including apple and orange juice if they are served with the meals. Thus, vitamin C intake could have been higher. As we already discussed, fruit was not frequently served especially in one of those nursing homes. The consumption of salad was also very low among the participants which may lead to low intake of vitamin C.

Iron

Iron is one of the nutrients that, is often deficient in the diets of many older adults. Although the risk for iron deficiency is common throughout the world, the risk changes with advancing age and with increased iron stores (240). There are, however, anaemia's that are seen in elderly populations, often associated with chronic disease, inflammatory processes or malnutrition. The iron requirement of older people is low but the factors associated with old age may increase the risk of iron deficiency anaemia.

The average daily iron intake was low and more than 65% of the participants did not meet with the recommended value of 10 mg iron per day in both groups. Low intake of iron is suggesting a trend of lower consumption of meat and meat products. As it mentioned before, some of non migrant individuals' diet was rich in liver thus, for those daily intake of iron increased to 21 mg.

Moreover, the study conducted in Turkey showed that more than half of the elderly living at home had intakes of iron less than 67% of recommended (203). Daily average iron intake of migrants was comparable (male: 8.3 mg/day, female: 9.1 mg/day) with institutionalized elderly in Turkey (77).

Calcium

Reduction in bone density occurs with age is very well known, especially in post menoposal women. This contributes to the high rates of hip and vertebral fracture seen in older people. Inadequate intake of calcium is frequently observed among the elderly population although its importance is high. Nevertheless, 60.9% of migrants' daily dietary calcium intake was lower than the recommendation. Similar results have been found (527 mg; 66.9%) in institutionalised elderly in Turkey (77).

The high proportion of the residents with low Ca intakes may relate to lack of milk and milk products in their diet. Generally, inadequate intake of calcium seems one of the main problems among elderly in every country.

Magnesium

Magnesium and selenium deficiencies among the elderly are well documented, especially among the institutionalized (241). Magnesium deficiency would arise from simple lack of foods containing it and leads to apathy and muscle weakness. In adults with prolonged diarrhoea from any cause, may also arise the deficiency (242).

More than 90% of the residents in our study did not meet with the recommendation of 300 mg/day (women) and 350 mg/day (men). As contrast, magnesium intake of free- living elderly found sufficient for men and women (385 mg vs. 348 mg) in a study conducted in Germany (243). The average daily magnesium intake is about 280-350 mg in Germany (53).

Most foods contain useful amounts of magnesium, particularly those of vegetable origin whole grain cereals, milk and dairy products. In our study group the consumption of those foods were insufficient. Magnesium intake is generally directly correlated with caloric intake (224) as we have also found in our study (Tab. 4.24).

Moreover, the nursing home residents showed similar low (men; 165 mg, women; 190 mg) intake in a study conducted in Turkey (77).

Zinc

Zinc plays a role particularly in behavioural and mental function (224), cell-mediated immunity and bone metabolism (244) in elderly. On the other hand, there is evidence from the 1995 National Nutrition Survey that zinc intakes are low in older people, particularly women, where 43% women had an intake of zinc less than 70% of the 1991 Recommended Dietary intake (245). Dietary zinc deficiency, considered to be a public health problem. It has been associated with reduced insulin secretion (244), prolonged wound healing (246), and other pathologies related to oxidative stress damage and poor appetite (247).

Daily zinc requirements for elderly over age 65 were established at 10 mg for men and 7 mg for women (53). The average intake of the participants from both groups were in recommended range (Appendix, Tab. 9.18, Tab. 9.20) but still 56% of non migrants' intake was lower (Tab. 4.12). The low zinc level is often observed in elderly people mainly due to a decrease in the consumption of meat, fish and seafood. It has been suggested that this low level can lead to reduced of taste (loss of taste acuity) (244) so that less is eaten due to the loss of pleasure (224).

We found an association between daily caloric and zinc intake in both groups (Tab. 4.24). Older patients with inadequate dietary habits tend to be at risk for mild to moderate zinc deficiency.

Taken together in present study, the composition of participants' diets with respect to macronutrients was not well balanced (e.g., overabundance of dietary fat). The DACHs recommendations were not met by the majority of participants of either group for the following nutrients vit D, folate, E, A, B1, C, pantothenic acid, calcium, magnesium, iron and potassium (Tab. 4.12) and additionally vit B12 for migrants. A low specific nutrient intake with the possible exception of a few nutrients reflected both a relative lack of foods containing these nutrients. Intake of most nutrients positively associated with energy intake (Tab. 4.24). On the other hand, we didn't examine whether the energy content and the nutritional values of the food served to them were adequate or not. A study conducted in the German state of Hesse has shown that the daily diets of 20 nursing homes were not sufficient in carbohydrates (248). Magnesium, calcium, zinc, iron were lower than recommended (249). Some epidemiological investigations have linked malnutrition with an increased risk of Alzheimer's disease, and some dietary deficiencies of vitamins (C, B12, thiamine, folate and riboflavin), especially in association with infection and other stresses (250). Increasing the types and amounts of fruit and vegetables may help improve intakes of some micronutrients such as vitamin C and potassium as well as increase dietary fibre intake.

Health status

Chronic diseases

Relatively few data concerning the health status of migrants are available and most of them represent results from community living population. According to the studies enrolled in Turkey the most frequently diagnosed diseases among the elderly population are hypertension, cardio vascular diseases and diabetes (177, 251, 252).

The seventeen most common diagnosed chronic diseases are presented in table 4.15. Almost half of the migrants suffered from dementia, followed by hypertension and depression. In the literature associations between cognitive decline and higher prevalence of under nutrition are often found especially in nursing homes (103, 253, 254).

People with dementia have a decreased ability to express their needs verbally and are easily distracted from eating and they often forget or refuse to eat and feeding can become a time-

consuming process (167). Depending on the severity of the disease, requirement of feeding assistance increases and even taking food with assistance can become difficult (255-257). Feeding difficulty is often recognized as a common problem for older adults and is associated with weight loss, poor nutrition and risk for aspiration pneumonia. The cognitive impairment found in persons with dementia impairs the ability of these individuals to complete motor and perceptual tasks required for eating. It often prevents the older adult from accepting help with feeding from caregivers.

Eating dependency associated with dementia in non migrants but not in migrants in our study (Tab. 4.23). This may be related to interactions of cognitive status with other variables such as other chronic diseases or was due to low number of participants in migrants.

A study conducted in Denmark showed that the prevalence of dementia in elderly Turkish migrants living in community is higher (13.3%) than in the Danish population (7%) (258).

The most common diagnosed diseases were hypertension (men; 31.8%, women; 50.9%), cardio vascular disease (men; 36.4%, women; 24.5%) and diabetes (men; 18.2%, women; 35.8%) among residents, according to the nursing home study results from Turkey (251). As contrast, dementia was the most common disease (48%) among migrants in our study and the prevalence of hypertension showed similarity. Hypertension and stress in males and obesity in females also found as a risk factor of coronary heart disease (CHD) among Turks living in Germany (259).

The retired migrants showed risk profile for CHD due to physical inactivity and current smoking (260) and migrant women had a higher prevalence of risk factors for CHD due to abdominal obesity and lipid profile in Sweden (13). Chronic arthritis was the most (41%) self-reported health status among Turkish elderly in a study enrolled in Denmark (261).

The prevalence of depression in the nursing home population was found three to four times higher than in the community-dwelling elderly. Age, pain, visual impairment, stroke, functional limitations, negative life events, loneliness, lack of social support and perceived inadequacy of care were found to be risk indicators for depression (262). This is often associated with low food intake (60). Some authors have shown that a depressed mood linked to longstanding disease and malnutrition (162). In Turkey, the prevalence of depression in the elderly population has been found as being 41.5% (263) and 41% for those living in an institutionalized and 29% for those living at home (264).

The result of cross-sectional studies conducted in Netherlands showed that the prevalence of clinically significant depressive symptoms was very high in elderly migrants living in community and highest in the Turkish sample (61.5%) compared to the native Dutch elderly

(14.5%) (11) as well as diabetes mellitus (12.3% vs. 3%) and cardiovascular diseases (10.6% vs. 5%) (265). Self reported higher depressive symptoms were also found among adult migrants in a study conducted in Belgium (266).

It has been suggested that, age-related physiological changes, as well as poor appetite, could cause risk of osteoporosis (267). The prevalence of osteoporosis among migrants was lower (18%) than the elderly (38.8%) (268) living in community and similar to for those living in nursing homes in Turkey (251). Since osteoporosis is very common among elderly, this was not well defined through physician in both nursing homes.

Nutrition related health conditions

Presence of nausea, diarrhea and constipation were considered as medical problems in present study. These syptoms may indicate medication side effects or gastrointestinal disorder. The prevalence of diarrhea and exsiccosis was significantly higher among migrants than non migrants (Tab. 4.16). It is well known that both of them are also symptoms of malnutrition. Diarrhea is also thought to be a frequent side effect of enteral nutrition (EN). Other factors than EN itself may cause diarrhea, i.e hypertonic EN, high infusion rates, electrolytes, or sorbitol in liquid medicine mixture (269). The higher prevalence of diarrhea among migrants can be explained with the higher prevalence of tube fed residents.

Functional ability and mobility

Mobility

Functional ability is the ability to perform basic activities of daily life without support. Specifically functional ability impairment means a decreased ability to meet one’s own daily needs such as getting out of bed, dressing, and personal hygiene, eating, walking. Loss of mobility is the principal cause of a limited quality of life and increased dependence in elderly people. It has been suggested that mobility impairment can affect nutritional status by impeding participation to eating patterns (250). On the other hand, nutritional status may also influence the muscular dimension of functional ability in elderly. Underweight elderly certainly have decreased reserve capacity and can easily develop chronic fatigue that can lead to problems related to independent functional ability. This can be also one of the explanations residents’ low prevalence of participating in activities.

The rate of participants joining physical activities was generally low, but higher in non migrants than migrants (Tab. 4.18). Comparing our results with the same age group of elderly living in nursing homes in Turkey, participating exercises was higher (42.5%) than migrants (25%, bed ridden excluded) in our study (202). Physical activity is an important component of nursing home care. Physical conditioning in older persons has numerous positive effects, such as slowing of the age-related changes in muscle strength, balance, aerobic conditioning and bone loss (111). Fiatarone et al. (270) observed that frail nursing home residents who took part in a high-intensity exercise program over a 10-week period not only improved their strength but also increased their total energy intake. Sauvage et al. (271) found improvements in strength (5 to 10%) as a result of strengthening and aerobic exercise program in male nursing home residents. Many of the benefits of physical exercise are nutrition-related, such as enhanced appetite, enhanced protein intake, improved bowel function (decreased constipation), improved blood pressure and a decreased likelihood of glucose intolerance (271).

Therefore, a well planned regular exercise program might bring benefits to participants, not only to improve their appetite but also to decrease dependency, especially for migrants. It is important to keep them active (e.g. walking, gardening, climbing stairs) in order to maintain mobility and prevent obesity.

Activities of Daily Living (ADL)-Barthel Index

The Barthel Index is a simple to administer tool for assessing self care and mobility activities of daily living. It is widely used in geriatric assessment settings. The main aim is to establish degree of independence from any help, physical or verbal however, minor and for whatever reason (54). Except bathing, the majority of migrants were more dependent than non migrants in every item of ADL which reflected to the total score (Fig. 4.7, Appendix Tab. 9.13). 77% of the migrants and 41% non migrants needed either help or total assistance for feeding and it has been elsewhere showed that eating dependency is a major risk factor for malnutrition (107). It has been also suggested that nursing home residents, particularly those with a low ADL level, can easily develop malnutrition (272). One of the well known predictors of ADL disability is a history of stroke, did not explain differences between the groups. Cognitive decline is another strong risk factor for functional dependence among elderly population, especially in nursing homes (273, 274).

In our study the total score of ADL associated with dementia only in non migrants (Tab. 4.23). It is possible that demented migrants were still able to feed themselves without assistance or it was due to the low number of migrants in our study. Strong associations between BMI, ADL and

cognitive decline was found in other studies (90), Wilms et al. (275) examined the relationship between dementia and individual ADL tasks. They found that some ADL tasks were more frequently associated with dementia than others; for instance bathing, dressing, toileting and transferring were significantly associated with dementia while eating and grooming were not. We found a weak negative correlation between cognitive impairment and eating dependency in non migrants but not in migrants. This was probably due to low number of participants in migrants. ADL was strongly correlative to a number of nutritional problems and nutritional status according to MNA (Tab. 4.22) in both groups.

Mini Nutritional Assessment (MNA)

We also used MNA to evaluate nutritional status of participants because it is a well accepted and recommended screening tool in elderly populations (276, 277). Actually, most of the questions that take a place in MNA were evaluated in our study separately. The question about the frequency of daily meal intake showed no difference between the groups and the majority of the participants consumed 3 full meals a day (data not shown).

As we mentioned before, we did not evaluate MNA for residents receiving enteral tube feedings because of the questions related to dietary intake and eating problems. These residents are known to already be at nutrition risk, with the nutrition intervention being the enteral feeding (277). Even with exclusion of tube fed residents, the prevalence of undernourished residents was quite higher among migrants than non migrants (22% vs. 3%) (Fig. 4.8).

The result of a cross-sectional study in Turkey including 1564 elderly showed a malnourished prevalence as 7.8% (MNA<17) (148). Compared with the study conducted on institutionalized elderly in Turkey, the rate of malnourishment was lower, being 2.4% than in migrants. They found risk of malnutrition (MNA 17-23.5) to be the highest (45.7%) in nursing home residents compared to aged people living in families (24.8%) or alone (33.9%) (79). Migrants' MNA score is comparable to Italian long-term care residents (85.3 ± 8.4 years), being 20.3% (276) and to institutionalized elderly in Taiwan being 22.1% (147) but lower (29%) than nursing home residents in Finland (MNA<17) (278).

The correlation between functional ability and MNA (Tab. 4.22) in our study was also observed by other investigators (276, 278). In previous studies low MNA values have been consistently shown to be associated with dementia, which explains the poor nutritional status (279, 280) of aged persons, was not observed in our study. This was probably due to the low number of demented participants. MUAC which is one of subgroup question of MNA was not related to the

MNA score. Hence, inconsistency might lie in its categorization (lower cut-off point, 21 cm) as other authors have pointed out (281). We found a higher negative correlation ($r= -0.864$, $r= -0.662$, $p<0.01$, migrants and non migrants, respectively) for MNA and number of nutritional problems (Fig. 4.12, Tab. 4.22) by indicating the higher the number of nutritional problems, the lower the MNA score.

Nutritional status of the residents according to care staff's estimation

Care staffs are responsible for noticing nutritional problems and ensure adequate nutrition for the residents. In our study we simply asked their opinions about nutrition and health status of the residents. When comparing their opinions to our findings some of their evaluations showed similarities but we found that they overestimated the number of well-nourished and overweighed residents in both groups (Tab. 4.19, Fig. 4.9).

In other studies it has been observed that the care givers' idea of proper BMI for older adults is often as the same as it is for young and middle- aged persons (88). Undernutrition, obesity and frailty are often intertwined among elderly individuals (282). Recognizing undernutrition and sarcopenia in elderly individuals is often difficult (283). One can speculate that this discrepancy between objective and subjective assessment could be explained by the preconception that elderly individuals "do not need so much food". This is partly true since the energy requirement falls with age although the necessity for most nutritional substances is unchanged. On the other hand, to ensuring proper amount of food may depend on the carers' opinions of the nutritional status of the residents.

Improving the knowledge of nutrition among care staff and residents would improve the nutritional status of residents. Kim et al. (284) have observed a significant improvement in dietary intake during the period of a program related to nutrition and healthy food habits but this improvement was not sustained after the program ended, indicating that individuals in nursing homes need great attention and a continuous nutritional education program.

6 Conclusion

This study confirmed that undernourishment is a frequent health problem in elderly migrants living in German nursing homes. The high prevalence of undernourishment is associated with nutritional problems and functional ability. The number of bedridden and tube fed residents among migrants was also higher compared to matched non migrants as well as their dependency in daily life activities. Although the prevalence of diagnosed chronic diseases and the daily use of medication were similar in both groups, the majority of migrants showed loss of appetite and food refusal. These two problems were identified as an important factor associated with the nutritional status among migrants. However, for these associations, a larger confirmatory study is also needed.

Our findings showed that participants' daily intake of macronutrients was not well balanced and micronutrients were often inadequate in both groups. Most of the daily nutrient intake remained below the recommendations for both groups. It can be questioned whether adequate intake levels could be achieved by a change in food selection alone, since the energy intake is low. The supply of energy and micronutrients-dense meals may be the first approach to increase nutritional intake.

Some questions though have still not been answered and we can only speculate. First of all, little is known about whether undernourishment was present upon admission or if it increased after settling in a nursing home. Our estimation, using the available body weight data upon admission, showed that 45% of migrants were already undernourished, this being a higher percentage than the current status. This information could have been useful to us to better understand our results. However, this study was not designed to answer this question.

Another question is the reason for the frequent unwillingness to eat among migrants. Apart from underlying disease, social isolation, or unfamiliar food or difficulties accepting their residence in a nursing home can also contribute to this problem. Adjusting to life in a nursing home may not be easy for these residents to accept. Language and other cultural barriers may also be problematic for elderly migrants and especially for women that results in social isolation. These issues should be further addressed in future studies.

The group investigated in this study was relatively small. In spite of this, the results indicate that the nutritional status of migrants should be prioritized to a greater degree, with regard to identifying both the risk of undernourishment and possible treatment methods. By increasing the attention to nutritional status and dietary habits of elderly migrants, it might be possible to

reduce the frequency of their undernourishment and increase their life quality. Individualizing residents' care by serving food they want and enjoy or familiar ethnic food could also help to improve nutritional status.

Additionally, educating care staff about nutrition and assessment skills may ensure better quality care for residents. The periodic assessment of the nutritional status among the residents using simple methods could facilitate the implementation of an appropriate nutritional intervention in specific cases. Early identification and intervation may help to improve the health and the quality of residents' life in nursing homes.

Given the increasing number of elderly migrants in Germany, it is of great importance to carry out more studies concerning nutrition and health status in these groups in the near future.

Limitations of the study

The main limitations of this study arose from its size.

1. First of all, this relatively small group limited us in the interpretation of some of our results. Especially, in the assessment of the factors associated with nutritional status.
2. There were also limitations associated with the statistical analysis. The number of participants was insufficient for a statistical power and to detect a relationship which would allow definitive conclusions.
3. The sample was so small that the performance of a just few individuals had a big effect on the data.

Additionally, the study was restricted to two nursing homes in Germany. For these reasons our findings can not be generalized to the broader community and the data of the small group renders it less representative for the whole population.

This thesis has provided a perspective on the nutrition and health status and related factors of migrants in German nursing homes. To our knowledge, this is the first study describing and comparing in detail these factors in elderly migrants in German nursing homes. However, further studies are needed to replicate the findings in different surroundings.

7 Summary

Elderly migrants from other European countries represent an increasing portion of German nursing homes residents. The nutritional status of elderly migrants and related problems are however still largely unknown. The main aim of this study was to investigate health and nutritional status, dietary intake, functional ability and mobility of the migrants in German nursing homes (NH). A further aim was to compare this provided detailed information with data about non migrants living in the same NH.

Two nursing homes were chosen for this study, in the states of Hesse and Nordrhein-Westfalen, on the basis of the significant number of ethnic minority residents who were available to participate in the research. Exclusion criteria were: <65 years, severe psychological disorders, ongoing terminal disease and residing in the nursing home for less than 3 months.

Analyses were based on a comprehensive questionnaire which covered lifestyle, health and functional status, dietary habits as well as nutritional problems. Care staff's estimations about nutritional and health status of the residents were asked for in this questionnaire. Nutritional status was evaluated using anthropometric measurements and 3-consecutive day weighed food records. Additionally the mini nutritional assessment (MNA) was evaluated for the participants who were not receiving enteral tube feedings.

Twenty-three migrants took part in the study and the majority of them (87%) had a Turkish background, the rest were from other non-Western countries. A group of non migrants (n=37) matched in age and gender, was selected for comparison.

Significant fundamental differences between migrants and non migrants were observed. The length of stay in nursing home was shorter in migrants than non migrants ($p<0.05$). Almost half of the migrants were seriously in need of care (48% vs.11%), one third of them were bedridden (30% vs. 8%) and five of them were tube fed (22% vs. 3%).

Only 26% of migrants had desirable weight (BMI 24-<29 kg/m²) according to the National Research Council's definition. Corresponding value was 62% for non migrants. The prevalence of undernutrition was significantly higher among migrants than non migrants by almost every method we used for the evaluation. The prevalence was the highest in both groups according to a CC<31 cm (migrants; 57%, non migrants; 22%), followed by a BMI <22 kg/m² (39% vs.11%) and a TSF cut-off value (26% vs. 5%). According to MNA (<17 points), 22% of migrants and

3% of non migrants were classified as malnourished. The evaluation of anthropometric results showed that there were differences emerging for male groups. Migrant males had considerably lower values compared to non migrant males. Evaluation of unintended weight loss of more than 5 kg body weight during last 3 months according to available data was irrelevant. The majority of the participants had a stable weight.

Consumption of pureed diet was higher in migrants (17%) compared to non migrants. The number of nutritional problems was also higher in migrants than in non migrants (83% vs. 27%). The main nutritional problems in migrants and non migrants were eating noticeably little (61% vs. 25%) refusal to eat (56% vs. 25%) and loss of appetite (56% vs. 19%). Additionally more than one third of the migrants (39%) needed drinking assistance and 44% of them drank only when requested. Corresponding values were 5% and 19% for non migrants. Chewing difficulties in migrants and non migrants (39% vs. 22%) and as well as swallowing problems (6% vs. 3%) did not show difference between the groups. Nutritional problems were highly correlative with a low BMI as well as with the activities of daily living (ADL) score.

Daily food consumption showed differences as follows: Migrants had higher intake of grain and vegetable products and lower intake of meat products, bread, pastries and butter compared to non migrants. Non migrants' meat and meat products consumption was higher than recommendation and the consumption of fresh fruit and vegetables were low in both groups.

The average daily energy intake was 6.2 MJ for female (f) and 6.6 MJ for male (m) migrants. The corresponding values were 6.2 MJ (f) and 7.7 MJ (m) for non migrants. Participants from both groups did not reach the recommendation of 6.9 MJ (f) and 8.3 MJ (m) for individuals of 65 years and older (PAL 1.4). Male migrants had considerably lower energy intake than non migrant males ($p<0.05$). Average carbohydrate intake was around 44% of energy intake (E), protein 14.5 E% and fat 39.6 E% for migrants. The corresponding values were 42 E%, 15.8 E% and 43 E % for non migrants. Dietary fibre intake was also insufficient in both groups (migrants 12.5 g, non migrants 14.5 g). Daily energy intake associated with most of the nutrients, especially magnesium, calcium, zinc, niacin and folate.

In conclusion, the composition of participants' diets with respect to macronutrients was not well balanced (e.g., overabundance of dietary fat) for both groups. More than 50% of the participants fall below D-A-CH's reference values for the following nutrients: Vitamin B1, B6, C, D, E, folate, calcium, iron, magnesium and potassium. Additionally 61% of the migrants had a low vitamin B12 and 56% of non migrants had a low zinc intake. This specific low nutrient intake with possible exception of a few nutrients reflected both a relative lack of food containing these nutrients e.g. whole grains, fruit.

Dementia was the most common diagnosed disease (48%) in migrants whereas in non migrants it was hypertension (49%). Frequency of arthritis (43%) was significantly higher in non migrants. The frequency of diarrhea (17%) and exsiccosis (17%) were higher in migrants than in non migrants. The number of daily medicine intake in both groups was similar.
Functional status according to the Barthel index of dependency in ADL was fairly poor in migrants. Except for bathing and stairs, the majority of migrants were more dependent than the non migrants in every item of ADL which reflected to the total score. 61% of the migrants were totally dependent, whereas 24% of the non migrants were dependent in their daily activities ($p<0.01$).

Care staff's assessment for migrants as being well nourished was approximately 3 times (65%) higher than our findings (BMI 24-<29 kg/m²; 26%). The similar higher assessment was also observed for overweight participants (migrants; 22%, non migrants; 32%) for both groups compared to our findings (BMI>=29; 13% vs. 22%).

The results of this study indicate that elderly migrants living in German nursing homes are more frequently undernourished and have more nutritional problems than the matched non migrants. Clearly migrants are not willing to eat and/or show loss of appetite. Awareness of these specific problems and treatment may be important to counteract undernutrition. Specific care should be given, taking traditional habits into consideration.

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9 Appendix

Questionnaires

In the following, the German wording of the original questions presented. Some of the questions have not been used in this thesis.

Einrichtung: _____ **Datum:**_____ **Probanden-Nr.:**_____
PFK: _____ **Interviewerin (Nachbefragung):** _____

A) Charakterisierung der Bewohner (Informationen aus der Pflegedokumentation)

A1.	Geschlecht	☐ männlich ☐ weiblich
A2.	Geburtsjahr	
A3.	Aufnahmedatum (Monat/Jahr)	
A4.	Gewicht (in kg) [falls bei den angegebenen Zeitpunkten das Gewicht nicht vorliegt, den nächst liegenden Zeitpunkt wählen → Datum bitte eintragen]	a.) bei Aufnahme: _____ (Datum: _____) b.) vor 3 Monaten: _____ (Datum: _____) c.) aktuelles Gewicht: _____ (Datum: _____)
A5.	Größe (in cm)	a.) bei Aufnahme: _____ b.) wie gemessen/erhoben: ☐ im Stehen ☐ im Liegen ☐ gefragt ☐ Personalausweis ☐ _____
A6.	Pflegestufe	☐ 0 ☐ I ☐ II ☐ III
A7.	Hat der Bewohner regelmäßig soziale Kontakte?	☐ ja ☐ nein
A8.	Besitzt der Bewohner ein Haustier?	☐ ja, welches?_____ ☐ nein
A9.	Raucht der Bewohner?	☐ ja, täglich ☐ ja, mind. 1 mal pro Woche, aber nicht täglich (fahren Sie bitte mit Frage A11. fort) ☐ ja, aber weniger als 1 mal pro Woche (fahren Sie bitte mit Frage A11. fort) ☐ nein, der Bewohner raucht nicht (fahren Sie bitte mit Frage A11. fort)
A10.	Wenn der Bewohner <u>täglich</u> raucht, wie viele Zigaretten raucht er?	☐ weniger als 5 Zigaretten ☐ 5 bis 10 Zigaretten ☐ 1 Schachtel ☐ mehr als 1 Schachtel
A11.	Trinkt der Bewohner Alkohol?	☐ mehrere Gläser alkoholischer Getränke täglich ☐ ein Glas alkoholischer Getränke pro Tag ☐ mehrere Gläser pro Woche ☐ mehrere Gläser pro Monat ☐ selten ☐ nie (fahren Sie bitte mit Frage A13. fort)
A12.	Um welche alkoholischen Getränke handelt es sich dabei? (Mehrfachnennung möglich)	☐ Bier ☐ Spirituosen ☐ Wein ☐ _____ ☐ Sekt ☐ _____

Einschätzungen durch die Pflegefachkraft (PFK): Jetziger Zustand, Ausnahmen sind gekennzeichnet mit[1]				
A13.	Ernährungszustand	☐ unterernährt	☐ normal ernährt	☐ überernährt
A14.	Gesundheitszustand	☐ gut	☐ mittel	☐ schlecht
A15.	Gesundheitszustand	☐ stabil	☐ instabil	
A16.	Liegt eine Depression vor?	☐ leicht	☐ schwer	☐ nein
A17.	Liegt eine Demenz vor?	☐ leicht	☐ schwer	☐ nein
A18.	Liegt ein Dekubitus vor?	☐ ja	☐ nein	
A19.	Liegen Wundheilungsstörungen vor?	☐ ja	☐ nein	
Leidet der Bewohner unter … (A20-A25)				
A20.	… Exsikkose (Austrocknungs-erscheinungen)?	☐ ja	☐ nein	
A21.	… Ödemen?	☐ ja: ☐ Arm, ☐ Bein	☐ nein	
A22.	… Übelkeit?	☐ ja	☐ nein	
A23.	… Erbrechen?	☐ ja	☐ nein	
A24.	… Obstipation?	☐ ja	☐ nein	
A25.	… Diarrhöen?	☐ ja	☐ nein	

Chronische Krankheiten **(auf Grund ärztlicher Diagnose!)** → für **jede** Krankheit **eine** Antwort				
A26.	Zuckerkrankheit (Diabetes mellitus)	☐ ja	☐ nein	
A27.	Bluthochdruck	☐ ja	☐ nein	
A28.	Herzschwäche (Herzinsuffizienz)	☐ ja	☐ nein	
A29.	Andere Herzkrankheiten: _____	☐ ja	☐ nein	
A30.	Schlaganfall	☐ ja	☐ nein	
A31.	Bösartiger Tumor / Krebs	☐ ja	☐ nein	
A32.	Schilddrüsenüberfunktion (Hyperthyreose)	☐ ja	☐ nein	
A33.	Schilddrüsenunterfunktion (Hypothyreose)	☐ ja	☐ nein	
A34.	Erkrankungen der Atemwege	☐ ja	☐ nein	
A35.	Gastritis, Magenerkrankungen	☐ ja	☐ nein	
A36.	Entzündliche Darmkrankheiten	☐ ja	☐ nein	
A37.	Chronische Leberkrankheit	☐ ja	☐ nein	
A38.	Chronische Nierenerkrankung	☐ ja	☐ nein	
A39.	Gelenkserkrankungen (Arthritis, Arthrose)	☐ ja	☐ nein	
A40.	Osteoporose	☐ ja	☐ nein	
A41.	Demenz	☐ ja	☐ nein	
A42.	Depression	☐ ja	☐ nein	
A43.	Andere (bitte eintragen): _____	☐ ja	☐ nein	
A44.	Häufigkeit akuter Infektion(en)[1]	☐ >3 mal	☐ 1-3 mal	☐ nie

	(in den letzten **3 Monaten**)	(wenn „nie“ fahren Sie bitte mit Frage A46. fort)
A45.	Art der Infektion(en)[1] (in den letzten **3 Monaten**)	☐ pulmonale Infektion ☐ Sonstiges:_____ ☐ Harnwegsinfektion ☐ grippaler Infekt
A46.	Bettlägrig verbrachte Krankheitstage[1] (in den letzten **3 Monaten**)	a.) ☐ ja ☐ nein ☐ entfällt, weil bettlägrig b.) Anzahl (Tage): _____
A47.	Krankenhausaufenthalte[1] (in den letzten **3 Monaten**)	a.) ☐ ja ☐ nein (bitte mit A48. fortfahren) b.) Anzahl (Aufenthalte): _____ c.) Anzahl (Tage insgesamt über alle Aufenthalt):_____ d.) Gründe für Krankenhausaufenthalt: _____ _____ _____ _____ _____
Einnahme von Medikamenten		
A48.	Anzahl verschiedener täglich eingenommener Medikamente	☐ keine ☐ 1 bis 3 ☐ 4 oder 5 ☐ 6 und mehr
A49.	Einnahme von Laxantien (Abführmitteln) [dazu zählen Medikamente, Nahrungsergänzungsmittel, Hausmittel]	☐ täglich/alle 2 Tage(*) ☐ gelegentlich(*) ☐ nie (*) Wenn „täglich“, „gelegentlich“, welche? ☐ Medikamente ☐ Nahrungsergänzungsmittel ☐ Hausmittel ☐ _____
A50.	Einnahme von Diuretika	☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie
A51.	Einnahme von Antibiotika[1] (in den letzten **3 Monaten**)	☐ >3 mal ☐ 1-3 mal ☐ nie

Aktivität des Bewohners		
A52.	Aktivität im Heim: Wie umfangreich bewegt sich der Bewohner (mit Einsatz von Hilfsmitteln)?	a.) Täglich im Heim: ☐ ja ☐ nein b.) Täglich im Gang: ☐ ja ☐ nein c.) Täglich zum Speisesaal: ☐ ja ☐ nein ☐ nie, weil bettlägrig (weiter mit Frage A56.)
A53.	Wie oft verlässt der Bewohner das Heim (Einkaufen, Spazierengehen, Besuche, Garten)?	☐ täglich ☐ monatlich ☐ mehrmals wöchentlich ☐ nie ☐ wöchentlich ☐ weiß ich nicht
A54.	Nimmt der Bewohner an Aktivitäten teil?	a.) Aktivitäten zur körperlichen Ertüchtigung: ☐ ja ☐ nein b.) Aktivitäten zur Beschäftigung: ☐ ja ☐ nein c.) Aktivitäten im Hauswirtschaftlichem Bereich: ☐ ja ☐ nein
A55.	Wenn ja, wie oft nimmt der Bewohner pro Woche (Wo) an den Aktivitäten teil?	a.) Aktivitäten zur körperlichen Ertüchtigung: _____mal/Wo b.) Aktivitäten zur Beschäftigung: _____mal/Wo c.) Aktivitäten im Hauswirtschaftlichem Bereich:_____mal/Wo
A56.	Erhält der Bewohner individuelle Krankengymnastik?	☐ ja, ____ Einheiten die Woche ☐ nein 1 Einheit dauert _____ min
A57.	Einsatz von Hilfsmittel (Mehrfachnennung möglich)	☐ Rollstuhl ☐ Betreuungsperson ☐ Rollator ☐ _____ ☐ Gehstock ☐ keine Hilfsmittel ☐ nie, weil bettlägrig

Aktivitäten des täglichen Lebens (ADL) → *für* **jede** *Tätigkeit bitte* ***eine*** *Einstufung* ***ankreuzen***			
A58.	Essen	Unabhängig, isst selbständig, benutzt Geschirr und Besteck	☐ 10
		Braucht Hilfe, z. B. Fleisch oder Brot schneiden	☐ 5
		Völlig hilfsbedürftig	☐ 0
A59.	Bett/ (Roll-) Stuhltransfer	Unabhängig in allen Phasen der Tätigkeit	☐ 15
		Geringe Hilfen oder Beaufsichtigung erforderlich	☐ 10
		Kann sitzen, braucht für den Transfer jedoch Hilfe	☐ 5
		Bettlägerig	☐ 0
A60.	Waschen	Unabhängig beim Waschen von Gesicht und Händen; beim Kämmen	☐ 5
		Nicht selbständig bei o. g. Tätigkeiten	☐ 0
A61.	Toilettenbenutzung	Unabhängig in allen Phasen der Tätigkeit	☐ 10
		Benötigt Hilfe, z. B. bei Gleichgewicht, Kleidung aus- und anziehen,	☐ 5
		Kann nicht auf Toilette / Nachtstuhl	☐ 0
A62.	Baden	Badet oder duscht ohne Hilfe	☐ 5
		Badet oder duscht mit Hilfe	☐ 0
A63.	Bewegung	Unabhängiges Gehen (auch mit Gehhilfe) für mind. 50 m	☐ 15
		Mind. 50 m Gehen, jedoch mit Unterstützung für mind. 50 m	☐ 10
		Für Rollstuhlfahrer: unabhängig für mind. 50 m	☐ 5
		Kann sich nicht (mind. 50 m) fortbewegen	☐ 0
A64.	Treppensteigen	Unabhängig (auch mit Gehilfe)	☐ 10
		Benötigt Hilfe oder Überwachung	☐ 5
		Kann auch mit Hilfe nicht Treppen steigen	☐ 0
A65.	An- und Auskleiden	Unabhängig, inkl. Schuhe anziehen	☐ 10
		Hilfsbedürftig, kleidet sich teilweise selbst an	☐ 5
		Völlig hilfsbedürftig	☐ 0
A66.	Stuhlkontrolle	Ständig kontinent	☐ 10
		Gelegentlich inkontinent, maximal einmal/Woche	☐ 5
		Häufiger / ständig inkontinent	☐ 0
A67.	Urinkontrolle	Ständig kontinent, ggf. unabhängig bei DK/Cystofix.	☐ 10
		Gelegentlich inkontinent / Hilfe bei ext. Harnableitung	☐ 5
		Häufiger / ständig inkontinent	☐ 0
A68.	Aktivität insgesamt	☐ (sehr) aktiv ☐ moderat aktiv ☐ wenig aktiv ☐ nicht aktiv	

B.) Ernährung und Ernährungsprobleme des Bewohners		
B1.	Welche Kost erhält der Bewohner? (Mehrfachnennung möglich)	☐ Vollkost ☐ Vegetarisch ☐ Leichte Vollkost ☐ salzarm ☐ Diabeteskost ☐ purinarm ☐ Energie-reduziert ☐ Fett-reduziert ☐ Energie-reich ☐ Fett-reich ☐ _____
B2.	Erhält der Bewohner passiertes Essen? [LM = Lebensmittel]	☐ ja, immer ☐ ja, nur bei manchen LM* ☐ nein
B3.	Erhält der Bewohner zusätzlich Trinknahrung/Energy-Drinks ? (Mehrfachnennung möglich)	☐ täglich/alle 2 Tage. ☐ gelegentlich ☐ nie ☐ wird abgelehnt (vom Bewohner/Angehörigen)
B4.	Erhält der Bewohner zusätzlich Nahrungsergänzungsmittel (z. B. Vitamin- und/oder Mineralstofftabletten)?	a.) Vitamintabletten: _____ ☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie b.) Mineralstofftabletten: _____ ☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie c.) Sonstiges: _____ ☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie
B5.	Wird der Bewohner über eine	☐ ja, ausschließlich ☐ nein (weiter

	Sonde ernährt?	☐ ja, ergänzend zur oralen Nahrung mit Frage B7.)
B6.	Falls der Bewohner über Sonde ernährt wird (**Anmerkungen:** Falls der Bewohner „***ausschließlich***“ über die Sonde ernährt, endet die Befragung über den Bewohner an dieser Stelle)	a.) Grund für Sonde: _____ _____ _____ b.) Genaue Produktbezeichnung: _____ _____ c.) Menge/Tag: _____ d.) Seit wann (Datum):_____ e.) Art d. Verabreichung: ☐ Bolus ☐ kontinuierlich: Ernährungspumpe ☐ kontinuierlich: per Schwerkraft
Leidet der Bewohner unter …? (B7-B9)		
B7.	… Appetitlosigkeit?	☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie
B8.	… Kaubeschwerden? [*LM = Lebensmittel]	☐ täglich/alle 2 Tage ☐ bei harten LM* ☐ nie
B9.	… Schluckbeschwerden?	☐ ja ☐ nein
B10.	Fordert der Bewohner Hilfe zur Unterstützung bei der Nahrungsaufnahme?	☐ ja ☐ nein
B11.	Benötigt der Bewohner Hilfe beim Kleinschneiden?	☐ ja ☐ nein
B12.	Beteiligen sich die Angehörigen im Rahmen ihrer Möglichkeiten bei der Unterstützung der Aufnahme von Speisen und Getränken?	☐ ja ☐ nein
B13.	Lehnt der Bewohner die Nahrungsaufnahme ab?	☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie
B14.	Ist die Lebensmittel-Auswahl bei dem Bewohner einseitig?	☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie
B15.	Nimmt der Bewohner nur auffällig geringe Nahrungsmengen zu sich?	☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie (*) (*) wenn „nie“, fahren Sie bitte mit Frage B17 fort)
B16.	Warum isst der Bewohner auffällig wenig? (Mehrfachnennung möglich) [*ZM = Zwischenmahlzeiten]	☐ es schmeckt ihm nicht ☐ hat Schwierigkeiten beim Essen ☐ hat Schmerzen ☐ zeigt kein Interesse am Essen ☐ scheint durch ZM schon satt zu sein ☐ möchte Sterben ☐ terminaler Zustand ☐ ist depressiv ☐ ist dement ☐ _____ ☐ _____
B17.	Welche Getränke nimmt der Bewohner zu sich? (Mehrfachnennung möglich)	☐ schwarzer Tee ☐ Früchte-/Kräutertee ☐ Kaffee ☐ Kaffee (entkoffeiniert) ☐ Mineralwasser ☐ Saft ☐ Kakao ☐ Milch ☐ Limonade ☐ _____
B18.	Welche Vorlieben hat der Bewohner bzgl. Getränke? (Mehrfachnennung möglich)	☐ schwarzer Tee ☐ Früchte-/Kräutertee ☐ Kaffee ☐ Kaffee (entkoffeiniert) ☐ Mineralwasser ☐ weiß nicht ☐ Saft ☐ Kakao ☐ Milch ☐ Limonade ☐ _____
B19.	Benötigt der Bewohner Hilfe beim Trinken?	☐ ja ☐ nein (trinkt mit Glas u/o Schnabeltasse selbstständig)
B20.	Trinkt der Bewohner nur nach Aufforderung?	☐ ja ☐ nein
B21.	Nimmt der Bewohner nur auffällig geringe Trinkmengen zu sich?	☐ täglich/alle 2 Tage ☐ gelegentlich ☐ nie (*) (*) wenn „nie“, fahren Sie bitte mit Frage B23. fort)

B22.	Warum trinkt der Bewohner auffällig wenig? (Mehrfachnennung möglich)	☐ hat keinen Durst ☐ Wunsch nach geringer Urinausscheidung (z. B. Angst vor In kontinenz, häufige Toilettengänge) ☐ Schluckstörungen ☐ ist depressiv ☐ hat Schmerzen ☐ ist dement ☐ zeigt kein Interesse am Trinken ☐ _____ ☐ möchte Sterben ☐ terminaler Zustand
B23.	Wird der Bewohner von außerhalb des Heimes zusätzlich mit Nahrungsmitteln versorgt (kauft sich selber welche oder lässt sich Lebensmittel mitbringen)?	☐ ja ☐ nein
B24.	Teilt der Bewohner mit, welche Umgebungsfaktoren für ihn während der Mahlzeiteneinnahme förderlich bzw. störend sind?	☐ ja ☐ nein
B25.	Wirkt der Bewohner an der Umgebungsgestaltung seines Essplatzes mit?	☐ ja ☐ nein
B26.	Äußert der Bewohner Vorlieben und/oder Abneigungen bzgl. Speisen und Getränke?	☐ ja ☐ nein
B27.	Bestimmt der Bewohner, ob er lieber in einer Gemeinschaft oder alleine isst?	☐ ja ☐ nein
B28.	Teilt der Bewohner mit, welche Probleme er hat (ernährungsrelevante Einschränkungen, Unverträglichkeiten, Beeinträchtigungen und Unterstützungsbedarf)?	☐ ja ☐ nein
B29.	Lässt der Bewohner sich zu möglichen Vorbeugemaßnahmen beraten (z. B. Diäten, Zahnprophylaxe)?	☐ ja ☐ nein
B30.	Entscheidet der Bewohner über die Annahme therapeutischer Angebote zur Behandlung ernährungsrelevanter Erkrankungen und Beeinträchtigungen?	☐ ja ☐ nein

Table 9.1: Description of food items in main food groups

Food groups	Food samples
Meat	Beef, pork, poultry, liver
Meat products	Sausages, ham, bacon
Fish	Mackerel, herring, tuna, canned fish in oil
Milk and yoghurt	Milk, yoghurt, cream, buttermilk, pudding, vanilla sauce
Eggs	Eggs and egg products
Cheese and curd	Processed cheese, goat cheese
Bread and pastries	White bread, crispbread, biscuits, wholemeal bread and rolls
Grain products	Flour, rice, products from usual grain, pasta, rice pudding
Vegetables	Cauliflower, leafy vegetables etc.
Fresh vegetables	tomatoes, cucumber, carrot etc.
Vegetable products	Canned vegetables, pulses, peas, lentils, beans
Fresh fruit	Apple, cherry, strawberries, grape, banana etc.
Fruit products	Dried fruit, canned fruit, compote, frozen fruit
Confectionary	Chocolate, ice-cream, honey, candies

Table 9.2: Distribution of the residents according to care level*

	migrants		**non migrants**	
Care level	**n**	**%**	**n**	**%**
Level 0†	-	-	4	10.8
Level I	2	8.7	11	29.7
Level II	10	43.5	18	48.6
Level III	11	47.8	4	10.8

†care level 0= no care level, *Cochran Armitage's test for trend; $p < 0.05$

Table 9.3: Male participants: Comparison of anthropometric measurements

Measurements	mean ± SD	n	p value
Body weight (kg)			<0.01[a]
non migrants	80.1 ± 14.5	15	
migrants	64.5 ± 9.4	11	
Body height (cm)			ns[b]
non migrants	172.3 ± 6.2	15	
migrants	168.6 ± 4.1	11	
BMI kg/m² (admission)			ns[a]
non migrants	26.2 ± 3.0	14	
migrants	22.5 ± 5.3	9	
BMI kg/m² (current)			<0.05[a]
non migrants	26.8 ± 3.9	15	
migrants	22.6 ± 2.7	11.0	
CC (cm)			<0.05[a]
non migrants	35.8 ± 4.2	15	
migrants	30.9 ± 4.2	11	
MUAC (cm)			<0.01[a]
non migrants	31.7 ± 3.2	15	
migrants	28.6 ± 2.9	11	
TSF (mm)			<0.05[b]
non migrants	13.9 ± 3.1	14	
migrants	11.0 ± 2.7	10	
AMA (cm²)			ns[a]
non migrants	59.7 ± 11.8	14	
migrants	51.5 ± 9.7	10	
AMC (cm)			ns[a]
non migrants	27.2 ± 2.9	14	
migrants	25.3 ± 2.5	10	
BF%			<0.05[a]
non migrants	33.6 ± 4.9	15	
migrants	28.2 ± 2.9	11	

[a]Mann Whitney-U-test, [b]t-test

Table 9.4: Female participants: Comparison of anthropometric measurements

Measurements	mean ± SD	n	p value*
Body weight (kg)			ns
non migrants	66.8 ± 13.1	22	
migrants	61.1 ± 16.6	12	
Body height (cm)			ns
non migrants	156.4 ± 5.0	22	
migrants	152.8 ± 4.7	12	
BMI kg/m² (admission)			ns
non migrants	27.2 ± 4.9	19	
migrants	26.1 ± 6.8	11	
BMI kg/m² (current)			ns
non migrants	27.2 ± 4.9		
migrants	27.5 ± 8.2	12	
CC (cm)			ns
non migrants	33.8 ± 4.5	22	
migrants	32.8 ± 7.6	12	
MUAC (cm)			ns
non migrants	30.2 ± 4.2	22	
migrants	30.1 ± 4.7	12	
TSF (mm)			ns
non migrants	18.0 ± 7.0	22	
migrants	17.9 ± 11.3	12	
AMA (cm²)			ns
non migrants	48.5 ± 10.8	22	
migrants	47.9 ± 5.8	12	
AMC (cm)			ns
non migrants	24.5 ± 2.8	22	
migrants	24.5 ± 1.4	12	
BF%			ns
non migrants	34.8 ± 6.1	22	
migrants	32.9 ± 8.0	12	

*t-test

Table 9.5: Nutritional status of participants according to BMI in four categories*

	migrants (n=23)		non migrants (n=37)	
BMI (kg/m²)	**n**	**%**	**n**	**%**
<20	3	13	2	5.4
20 -< 24	11	47.8	4	10.8
24 -<29	6	26.1	23	62.2
≥29	3	13	8	21.6

***Cochran Armitage's test for trend; p<0.05

Table 9.6: Nutritional status of participants according to the WHOs classification*

	migrants (n=23)		non migrants (n=37)	
BMI (kg/m²)	**n**	**%**	**n**	**%**
18.5-<25	14	60.9	11	29.7
25-<30	6	26.1	19	51.4
30-<35	2	8.7	4	10.8
>=35	1	4.3	3	8.1

***Cochran Armitage's test for trend; p<0.05

Table 9.7: Male migrants: The percentiles of anthropometric measurements and BF%

Parameters	min	P10	P25	median	P75	P90	max	n
Height (cm)	162.4	162.4	164.5	169.9	172.3	173.0	173.2	11
Weight (kg)	51.5	52.4	57.5	63.1	70.8	82.7	84.9	11
BMI (kg/m²)	19.5	19.6	20.4	22.2	25.0	27.7	28.3	11
CC (cm)	24.5	24.7	27.2	31.0	34.9	37.9	38.6	11
MUAC (cm)	23.5	23.8	26.2	29.0	30.0	33.0	33.2	11
TSF (mm)	6.3	6.5	8.6	11.9	12.9	15.1	15.3	10
AMC (cm)	20.7	20.8	24.1	25.8	26.5	29.0	29.1	10
AMA (cm²)	34.2	34.6	46.4	53.0	55.9	66.9	67.5	10
CAMA (cm²)	24.2	24.6	36.4	43.0	45.9	56.9	57.5	10
FFM (kg)†	38.7	39.3	42.7	45.3	50.1	55.6	56.5	11
BF% ‡	23.7	23.9	25.3	28.1	29.6	33.1	33.4	11

Table 9.8: Male non migrants: The percentiles of anthropometric measurements and BF%

Parameters	min	P10	P25	median	P75	P90	max	n
Height (cm)	160.0	163.0	166.3	173.0	178.3	179.8	180.1	15
Weight (kg)	50.8	55.1	74.7	81.8	88.5	98.7	101.0	15
BMI (kg/m²)	19.8	20.5	24.1	27.3	30.2	32.3	33.4	15
CC (cm)	27.5	28.2	33.0	37.0	38.2	41.6	42.5	15
MUAC (cm)	24.5	25.5	30.1	31.8	34.5	35.1	35.4	15
TSF (mm)	9.1	9.4	12.1	13.5	16.2	19.3	19.8	14
AMC (cm)	20.6	21.5	26.1	27.8	29.0	30.7	30.9	14
AMA (cm²)	33.9	36.8	54.3	61.5	66.9	75.0	76.2	14
CAMA (cm²)	23.9	26.8	44.3	51.5	56.9	65.0	66.2	14
FFM (kg)†	37.8	40.9	49.3	53.8	58.5	60.7	63.3	15
BF% ‡	25.5	25.8	31.5	33.6	37.3	40.8	42.8	15

†estimated fat-free mass, ‡estimated body fat percentage

Table 9.9: Female migrants: The percentiles of anthropometric measurements and BF%

Parameters	min	P10	P25	median	P75	P90	max	n
Height (cm)	142.0	143.3	150.2	154.6	156.2	157.5	157.9	12
Weight (kg)	46.2	46.6	49.2	56.3	68.8	95.1	105.2	12
BMI (kg/m²)	18.5	18.9	20.8	24.3	29.6	39.6	42.8	12
CC (cm)	27.0	27.3	28.1	29.7	36.7	49.1	53.7	12
MUAC (cm)	25.2	25.6	26.9	29.0	30.8	40.2	42.0	12
Triceps (mm)	7.6	7.7	10.5	13.8	23.1	41.5	44.0	12
AMC (cm)	22.8	22.9	23.4	24.4	24.9	27.5	28.2	12
AMA (cm²)	41.3	41.8	43.5	47.6	49.3	60.1	63.2	12
CAMA (cm²)	34.8	35.3	37.0	41.1	42.8	53.6	56.7	12
FFM (kg)	34.4	34.6	35.8	38.6	43.6	48.6	49.6	12
BF%	23.3	23.7	26.8	32.3	37.2	48.5	52.9	12

Table 9.10: Female non migrants: The percentiles of anthropometric measurements and BF%

Parameters	min	P10	P25	median	P75	P90	max	n
Height (cm)	147.0	148.7	152.9	156.5	160.4	162.0	167.0	22
Weight (kg)	42.1	48.0	58.1	67.1	73.7	89.1	94.6	22
BMI (kg/m²)	18.6	21.2	24.6	26.5	28.6	37.1	39.0	22
CC (cm)	26.0	27.5	30.6	33.2	37.1	41.1	43.0	22
MUAC (cm)	21.0	24.6	28.2	29.6	32.7	37.0	39.0	22
Triceps (mm)	8.4	11.3	13.6	15.7	19.9	30.4	34.5	22
AMC (cm)	18.4	20.8	22.3	24.8	27.0	28.2	29.6	22
AMA (cm²)	26.8	34.5	39.7	48.9	57.9	63.5	69.6	22
CAMA (cm²)	20.3	28.0	33.2	42.4	51.4	57.0	63.1	22
FFM (kg)†	31.4	34.1	39.5	44.2	47.2	48.8	49.0	22
BF% ‡	25.4	27.6	31.5	33.9	35.7	45.9	49.7	22

†estimated fat-free mass, ‡estimated body fat

Table 9.11: Weight changes of the participants in last 3 months†

Weight changes	migrants		non migrants	
	n	%	n	%
Loss >5 % bw	1	4.3	5	13.5
Remain stable +/-5 % bw	19	82.6	24	64.9
Gain < 5 % bw	2	8.7	3	8.1

†missing values; migrants: 1, non migrants: 5, bw=body weight

Table 9.12: Classification of participants according to Barthel Index*

ADL-score	migrants†		non migrants	
	n	%	n	%
Independent (100-65 points)	3	13	15	40.5
In need of assistance (64-35 points)	5	21.7	13	35.1
Dependent (34-0 points)	14	60.9	9	24.3

ADL=activities of daily living, †one missing data, *Cochran Armitage's test for trend; p <0.01

Table: 9.13 Comparison of the participants according to ADL-items (Barthel index)

Activity	migrants†		non migrants		p value*
	n	%	n	%	
Feeding					<0.001
unable	9	39.1	3	8.1	
needs help cutting	8	34.8	12	32.4	
independent	5	21.7	22	59.5	
Bathing					ns
dependent	21	91.3	36	97.3	
independent	1	4.3	1	2.7	
Grooming					<0.05
needs help	17	73.9	17	45.9	
independent	5	21.7	20	54.1	
Dressing					<0.05
dependent	17	73.9	13	35.1	
needs some help	2	8.7	12	32.4	
independent	3	13	12	32.4	
Bowels control					<0.05
incontinent	12	52.2	10	27	
occasionally incontinent	6	26.1	4	10.8	
continent	4	17.4	23	62.2	
Bladder control					<0.05
incontinent	15	65.2	12	32.4	
occasionally incontinent	4	17.4	10	27	
continent	3	13	15	40.5	
Toilet use					<0.05
dependent	10	43.5	9	24.3	
needs some help	9	39.1	11	29.7	
independent	3	13	17	45.9	
Transfers (bed to chair and back)					<0.001
unable	6	26.1	2	5.4	
major help	10	43.5	10	27	
minor help	3	13	6	16.2	
independent	3	13	19	51.4	
Mobility					<0.05
immobile or <50 m	15	65.2	8	21.6	
wheelchair independent	2	8.7	11	29.7	
walks with help of person >50m	1	4.3	0	0	
independent (may use any aid-stick >50m)	4	17.4	18	48.6	
Stairs mobility					ns
unable	18	78.3	21	56.8	
needs help	1	4.3	12	32.4	
independent	3	13	4	10.8	

†one missing data,*Chi² Fisher's exact- test

Table 9.14 Comparison of daily food intakes (gram/day) of the participants (mean ± SD)

Food groups	migrants (n=18)	non migrants (n=36)	p-value*
Meat	31.9 ± 29.8	43.9 ± 27.3	ns
Meat products and sausages	13.7 ± 20.5	56.2 ± 44.8	<0.001
Fish	6.8 ± 12.6	7.3 ± 12.2	ns
Eggs	29.9 ± 53.1	17.5 ± 23.8	ns
Milk and yoghurt	369 ± 381	194.8 ± 151.9	ns
Cheese and curd	37.5 ± 30	86.4 ± 71	<0.05
Butter	9.2 ± 6.4	21.2 ± 16.5	<0.05
Fats (oil and margarine)	19.6 ± 14	20.3 ± 15.9	ns
Bread and pastries	115.5 ± 63.1	164.7 ± 50.8	<0.01
Grain products	49.7 ± 33.4	23.7 ± 16.4	<0.05
Potatoes	72.0 ± 60.7	95.5 ± 45.3	ns
Vegetables	65.4 ± 46.9	61.1 ± 40.1	ns
Fresh vegetables	31.3 ± 36.7	21.3 ± 18.5	ns
Vegetable products	28.1 ± 25.2	15.4 ± 17.4	<0.05
Fresh fruit	24.3 ± 46	31.6 ± 60	ns
Fruit products	22.6 ± 16	17 ± 21.1	ns
Sugar	7.7 ± 7.9	5.6 ± 5.6	ns
Confectionary	2.8 ± 5.2	4 ± 8.9	ns
Spices and ingredients	2.8 ± 2.2	5.6 ± 8.1	ns
Sauce	3.0 ± 5.4	13.2 ± 14.2	<0.001

*Mann Whitney-U Test

Table 9.15: Comparison of daily energy and macronutrients intake of participants (mean ± SD)

	migrants (n=23)	non migrants (n=37)	p value
Energy (kcal)	1526.5 ± 329.0	1635.3 ± 380.3	ns[a]
Energy (MJ)	6.4 ± 1.4	6.8 ± 1.6	ns[a]
Protein (g)	54.8 ± 17.7	63.0 ± 16.9	ns[a]
Fat (g)	64.2 ± 15.5	76.0 ± 21.6	<0.05[b]
Carbohydrate (g)	159.5 ± 63.3	166.1 ± 52.8	ns[a]
Protein (g/kg bw)	0.9 ± 0.3	0.9 ± 0.2	ns[a]
Monosaccharide(g)	17.9 ± 10.2	17.6 ± 10.6	ns[a]
Disaccharide (g)	63.8 ± 53.0	52.2 ± 27.5	ns[a]
Mono and disaccharide (g)	81.7 ± 57.4	69.8 ± 32.0	ns[a]
Polysaccharide (g)	96.5 ± 34.1	96.9 ± 29.0	ns[a]
SFA (g)	26.1 ± 9.7	34.2 ± 11.7	<0.05[b]
MUFA (g)	23.6 ± 6.2	27.3 ± 7.9	<0.05[a]
PUFA (g)	10.8 ± 7.6	9.7 ± 5.0	ns[a]

bw= body weight, SFA=saturated fatty acid, MUFA=monounsaturated fatty acid
PUFA=polyunsaturated fatty acid, [a]t-test, [b]Mann Whitney U-test

Table 9.16: Comparison of daily micronutrients intake of the participants (mean ± SD)

	migrants (n=23)	non migrants (n=37)	p value
Fat soluble vitamins			
Vitamin A (mg RE)	0.8 ± 0.3	1.5 ± 1.1	<0.001[a]
Retinol (mg)	0.4 ± 0.1	1.1 ± 1.0	<0.001[a]
Beta-Carotene (mg)	1.3 ± 0.7	2.1 ± 1.4	<0.01[b]
Vitamin E (mg TE)	11.5 ± 7.8	8.0 ± 5.7	<0.05[b]
Vitamin K (µg)	158.9 ± 83.1	194.6 ± 78.4	ns[b]
Vitamin D (µg)	4.4 ± 5.3	2.5 ± 2.5	ns[b]
Water soluble vitamins			
Vitamin B_1 (mg)	0.9 ± 0.7	0.9 ± 0.4	ns[a]
Vitamin B2 (mg)	1.5 ± 0.8	1.3 ± 0.5	ns[b]
Niacin (mg NE)	16.4 ± 6.0	20.8 ± 5.5	<0.05[a]
Vitamin B6 (mg)	1.4 ± 0.8	1.3 ± 0.4	ns[b]
Biotin (µg)	41.2 ± 25.8	31.8 ± 13.6	ns[b]
Vitamin B12 (µg)	2.6 ± 1.4	4.9 ± 5.2	<0.01[b]
Vitamin C (mg)	64.8 ± 34.1	61.1 ± 33.0	ns[b]
Folate (µg FE)	222.1 ± 62.4	246.1 ± 91.4	ns[b]
Minerals			
Sodium (mg)	1977.6 ± 2249.9	2298.1 ± 1157.5	<0.01[a]
Potassium (mg)	1885.2 ± 672.9	1880.3 ± 558.1	ns[b]
Calcium (mg)	845.6 ± 422.8	696.8 ± 306.1	ns[b]
Magnesium (mg)	212.7 ± 85.6	198.3 ± 59.8	ns[b]
Phosphorus (mg)	967.8 ± 348.9	1019.1 ± 306.9	ns[b]
Chloride (mg)	3138.4 ± 3386.1	3634.1 ± 1761.8	<0.01[a]
Iron (mg)	9.0 ± 5.6	8.9 ± 3.2	ns[b]
Zinc (mg)	9.3 ± 4.7	8.5 ± 2.7	ns[b]
Fluoride (µg)	587.3 ± 749.9	396.8 ± 244.3	ns[b]
Iodine (µg)	88.0 ± 60.6	65.2 ± 35.4	ns[b]

RE=retinol-equivalants, TE=tocopherol-equivalants, NE=niacin-equivalents

FE=folate-equivalants, [a]Mann Whitney-U test, [b]t-test

Table 9.17: Female participants: Comparison of daily energy, macronutrients, fibre and cholesterol intake (mean ± SD)

	migrants (n=12)	non migrants (n=22)	p value
Energy (kcal)	1471.8 ± 354.2	1488.8 ± 380.2	ns[a]
Energy (MJ)	6.2 ± 1.5	6.2 ± 1.6	ns[a]
Energy (kcal/kg bw)	31.9 ± 5.9	27.3 ± 5.2	<0.05[a]
CHO E%	46.4 ± 14.9	41.3 ± 10.8	ns[a]
Prot E%	13.3 ± 2.4	15.5 ± 3	<0.05[a]
Fat E%	38.3 ± 8.3	43.1 ± 7.9	ns[a]
Protein (g)	48.2 ± 17.5	56.3 ± 17.1	ns[a]
Protein (g/kg bw)	0.8 ± 0.4	0.8 ± 0.2	ns[a]
Carbohydrate (g)	161.4 ± 63.8	150.6 ± 55.9	ns[a]
Monosaccharide (g)	18.7 ± 11.4	16.1 ± 10.3	ns[a]
Disaccharide (g)	66.4 ± 58.2	49.3 ± 25	ns[a]
Mono and disaccharide (g)	85.1 ± 64.0	65.4 ± 30.5	ns[a]
Polysaccharide (g)	93.6 ± 26.0	89.1 ± 27.1	ns[a]
Fat (g)	59.5 ± 14.3	69.9 ± 23.2	ns[a]
SFA (g)	25.4 ± 8.4	32.7 ± 13.5	ns[a]
MUFA (g)	21.6 ± 6.2	24.3 ± 7.8	ns[a]
PUFA (g)	8.8 ± 5.7	8.5 ± 4.7	ns[a]
Fibre (g)	12.4 ± 3.4	13.6 ± 4.2	ns[a]
Cholesterol (mg)	229.2 ± 216.2	253.6 ± 115	ns[b]

bw=body weight , E%=% total energy, SFA=saturated fatty acid,
MUFA=monounsaturated fatty acid, PUFA=polyunsaturated fatty acid, [a]t-test, [b]Mann Whitney- U test

Table 9.18: Female participants: Comparison of daily micronutrients intake (mean ± SD)

	migrants (n=12)	non-migrants (n=22)	DACH	p value
Fat soluble vitamins				
Vitamin A (mg RE)	0.7 ± 0.3	1.3 ± 0.8	0.8	<0.01[a]
Retinol (mg)	0.4 ± 0.1	0.8 ± 0.8	0.8	<0.05[b]
Beta-Carotene (mg)	1.1 ± 0.5	2.3 ± 1.4		<0.05[a]
Vitamin E (mg TE)	9.2 ± 6.4	6.7 ± 4.7	11	ns[b]
Vitamin K (µg)	153.2 ± 94.3	178.4 ± 80.1	65	ns[b]
Vitamin D (µg)	3.8 ± 6.2	2.4 ± 2.6	10	ns[b]
Water soluble vitamins				
Vitamin B_1 (mg)	0.8 ± 0.7	0.8 ± 0.3	1.0	ns[b]
Vitamin B2 (mg)	1.3 ± 0.9	1.1 ± 0.4	1.2	ns[b]
Niacin (mg NE)	14.2 ± 4.9	18.9 ± 5.2	13	ns[a]
Vitamin B6 (mg)	1.2 ± 0.9	1.1 ± 0.3	1.2	ns[b]
Biotin (µg)	4.4 ± 31.5	3.4 ± 11.4	30-60	ns[b]
Pantothenic acid (mg)	39.6 ± 2.7	26.9 ± 1.0	6.0	ns[b]
Vitamin B12 (µg)	2.0 ± 1.6	3.3 ± 2.2	3	ns[a]
Vitamin C (mg)	62.6 ± 30.9	59.7 ± 35.0	100	ns[b]
Folate (µg FE)	220.0 ± 59.1	219.9 ± 81.3	400	ns[b]
Minerals				
Sodium (mg)	1412.6 ± 511.7	1857.0 ± 683.3	550	<0.05[a]
Potassium (mg)	1734.5 ± 756.7	1686.0 ± 489.6	2000	ns[b]
Calcium (mg)	743.4 ± 421.4	609.0 ± 289.5	1000	ns[b]
Magnesium (mg)	195.0 ± 101.1	174.7 ± 51.2	300	ns[b]
Phosphorus (mg)	863.6 ± 325.2	880.1 ± 274.6	700	ns[b]
Chloride (mg)	2321.1 ± 788.4	2967.6 ± 1028	830	<0.05[a]
Iron (mg)	8.0 ± 5.7	7.6 ± 2.3	10.0	ns[b]
Zinc (mg)	8.1 ± 5.4	7.5 ± 2.3	7.0	ns[b]
Fluoride (µg)	648.6 ± 940.1	389. 7 ± 312.8	310	ns[b]
Iodine (µg)	75.5 ± 69.1	57.5 ± 28.9	180	ns[b]

RE=retinol equivalants, TE=tocopherol equivalants,

NE=niacin equivalents, FE=folate equivalants, [a]Mann Whitney-U test, [b]t-test

Table 9.19: Male participants: Comparison of daily energy, macronutrients, fibre and cholesterol intake (mean ± SD)

	migrants (n=11)	non migrants (n=15)	p value
Energy (kcal)	1586.2 ± 304.4	1850.1 ± 268.2	<0.05[a]
Energy (MJ)	6.7 ± 1.3	7.7 ± 1.1	ns[a]
Energy (kcal/kg bw)	26.1 ± 2.7	25.7 ± 3.9	ns[a]
CHO E%	40.7 ± 13.9	41.7 ± 5.4	ns[a]
Prot E%	15.9 ± 1.6	16.3 ± 2.2	ns[a]
Fat E%	41.2 ± 9.0	42.7 ± 5.2	ns[a]
Protein (g)	62.2 ± 15.6	72.8 ± 11.2	<0.05[a]
Protein (g/kg bw)	1.1 ± 0.3	0.9 ± 0.3	ns[a]
Carbohydrate (g)	157.5 ± 65.7	188.9 ±39.1	ns[a]
Monosaccharide (g)	16.9 ± 9.3	19.8 ± 10.9	ns[a]
Disaccharide (g)	60.7 ± 49.5	56.3 ± 31.0	ns[a]
Mono and disaccharide (g)	77.6 ± 51.9	76.1 ± 34.0	ns[a]
Polysaccharide (g)	100.3 ± 43.5	107.8 ± 28.8	<0.05[a]
Fat (g)	69.4 ± 15.8	85.0 ± 15.8	ns[a]
SFA (g)	26.9 ± 11.3	36.4 ± 8.5	<0.05[a]
MUFA (g)	25.8 ± 5.7	31.6 ± 6.0	ns[a]
PUFA (g)	13.1 ± 9.0	11.5 ± 4.9	ns[a]
Fibre (g)	12.7 ± 4.0	15.6 ± 5.1	<0.05[b]
Cholesterol (mg)	207.3 ± 122.6	326.9 ± 86.8	<0.01[a]

E%=% total energy, bw=body weight, SFA=saturated fatty acid, MUFA=monounsaturated fatty acid, PUFA=polyunsaturated fatty acid, [a]t-test, [b]Mann Whitney-U test

Table 9.20: Male participants: Comparison of daily micronutrients intake (mean ± SD)

	migrants (n=11)	non-migrants (n=15)	DACH	p value
Fat soluble vitamins				
Vitamin A (mg RE)	0.8 ± 0.2	1.8 ± 1.3	1.0	<0.01[a]
Retinol (mg)	0.4 ± 0.1	1.5 ± 1.2		ns[b]
Beta-Carotene (mg)	1.6 ± 0.8	1.9 ± 1.3		ns[b]
Vitamin E (mg TE)	14.1 ± 8.7	10.0 ± 6.5	12	ns[b]
Vitamin K (µg)	165.1 ± 72.8	218.5 ± 71.8	80	ns[b]
Vitamin D (µg)	5.1 ± 4.4	2.6 ± 2.6	10	ns[b]
Water soluble vitamins				
Vitamin B_1 (mg)	1.0 ± 0.6	1.1 ± 0.4	1.0	ns[b]
Vitamin B2 (mg)	1.6 ± 0.7	1.6 ± 0.5	1.2	ns[b]
Niacin (mg NE)	19.2 ± 6.4	23.4 ± 5.1	13	ns[b]
Vitamin B6 (mg)	1.5 ± 0.8	1.5 ± 0.5	1.4	<0.05[a]
Biotin (µg)	43.0 ± 19.0	38.9 ± 13.7	30-60	ns[b]
Pantothenic acid (mg)	5.5 ± 3.1	4.9 ± 1.9	6.0	<0.01[b]
Vitamin B12 (µg)	3.1 ± 1.0	5.6 ± 2.6	3	ns[b]
Vitamin C (mg)	67.2 ± 38.7	63.3 ± 30.8	100	ns[b]
Folate (µg FE)	224.8 ± 70.3	282.9 ± 94.7	400	ns[b]
Minerals				
Sodium (mg)	2594 ± 3169.7	2945.1 ± 1410.9	550	ns[b]
Potassium (mg)	2049.5 ± 556.0	2165.1 ± 543.3	2000	ns[b]
Calcium (mg)	957.2 ± 414.3	825.6 ± 292.1	1000	ns[b]
Magnesium (mg)	231.9 ± 64.0	233.0 ± 55.6	350	ns[b]
Phosphorus (mg)	1081.5 ± 352.4	1222.9 ± 232.7	700	ns[b]
Chloride (mg)	4030.0 ± 4781.8	4611.7 ± 2162.0	830	ns[b]
Iron (mg)	10.1 ± 5.5	10.7 ± 3.5	10	ns[b]
Zinc (mg)	10.6 ± 3.6	10.0 ± 2.6	10	ns[b]
Fluoride (µg)	513.8 ± 470.3	407.2 ± 80.5	380	ns[b]
Iodine (µg)	101.7 ± 49.4	76.5 ± 41.7	180	<0.01[b]

RE=retinol-equivalants, TE=tocopherol-equivalants, NE=niacin-equivalents, FE=folate-equivalants

[a]Mann Whitney-U test, [b]t-test

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