

NUTRITIONAL STATUS IN COGNITIVELY INTACT OLDER PEOPLE RECEIVING HOME CARE SERVICES – A PILOT STUDY

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Abstract: Older adults are a potentially vulnerable group for malnutrition. This cross-sectional pilot study aims to assess the nutritional status of elderly patients living at home and receiving home health care services. The data were collected from patient care plans, the Mini Nutritional Assessment (MNA), and a questionnaire on eating problems. In addition, serum nutritional status indicators were measured, and an oral examination including quantitative saliva measurement was carried out. Out of 71 eligible patients 51 (72%) patients aged 76-93 years participated. MNA results showed that 47% were at risk of malnutrition. Care plans for 26 patients made reference to questions of nutrition but provided no detailed forward planning. The mean serum albumin value was 39.1 ± 3.8 g/l, seven patients had a value lower than 35 g/l. MNA scores were significantly lower for female patients with haemoglobin values lower than 120 g/l ($p = 0.027$). The dentist's estimation of dry mouth and subjective problems in energy intake were significantly associated with lower MNA scores ($p = 0.049$ and $p = 0.015$). Subjects with functioning natural dentition had higher body mass index (BMI) scores than others ($p = 0.0485$). The results point at the importance of using screening tools such as the MNA for purposes of nutritional assessment, the estimation of oral problems such as dry mouth, chewing and swallowing problems, and advance planning in nutritional issues within the field of home care.

Key words: Elderly patients, nutrition, nutrition assessment, Mini Nutritional Assessment, oral health, home care services.

Introduction

Older people with disabilities are increasingly treated in their homes instead of institutions. Since these people are a particularly vulnerable group for malnutrition (1), it would be important for geriatric assessments to include nutritional assessments as well (2). However, research has shown that nutrition is often neglected and that patient records rarely incorporate comprehensive care plans (3, 4), even though good records could support patient care, improve patient outcomes (5) and influence practice (6). Nutritional assessments are difficult to conduct in older adults and there is no single universally accepted method (7). The use of serum biochemical values as an indicator of poor nutritional status is complicated by the difficulty of interpreting the results, which undermines their applicability (8-10). It is also important to note that nutritional status is influenced by numerous different factors, including oral health and dentition (11, 12), functional ability (13) and diseases (14, 15) and may be related to other health concerns as well (16).

One tool specifically designed for use with older people is the Mini Nutritional Assessment (MNA), which determines the risk of malnutrition and identifies individuals those who may benefit from early intervention (17). The growing number of home care patients with chronic diseases and disabilities are at particularly high risk for malnutrition (18).

The purpose of this pilot study was to assess the nutritional status of home care patients on the basis of the MNA as main

outcome measure, their care plans as indicative of nutritional care, a structured questionnaire on eating problems and an oral examination including saliva measurement as determinants of oral health and biochemical values as confirmative information. The results were expected to provide a clearer picture of the role of nutrition in the planning of care as well as of the various factors influencing nutritional health.

Methods

Study Design

This cross-sectional pilot survey was the first step in a nutritional survey in three rural municipalities in southern Finland. Its aim was to gain a deeper understanding of home care patients' health in one of these municipalities. The research protocol was approved by the director of health services in primary health care. The protocol was pilot tested with 10 subjects receiving home care services in a neighbouring community; these subjects were not included in the present study. Minor changes were made to the protocol on the basis of the feedback received. Prior to the launch of our investigations, all home nurses were informed in writing about the aims of the survey. In response to the home nurses' queries, 51 patients gave their written informed consent to take part in the study.

Study sample

The original study population comprised all elderly patients receiving public home health care services in their homes in one

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municipality (N=123). Only one geographical area was included in the pilot study. The criteria for inclusion were age 75 or over and visited by a home nurse at least twice a month (n=91). Subjects with severe cognitive impairment or a severe psychiatric diagnosis such as personality disorders, severe depression or psychosis were excluded. Home care nurses (n=7) who normally delivered the services excluded 20 subjects on the basis of these criteria. A total of 71 persons met the criteria and 51 (72%) participated in the study. The main reasons for non-participation were fatigue or being too unwell to meet new people.

Examination protocol

The study comprised five parts: a content analysis of patient care plans; the MNA; a structured questionnaire on eating problems; biochemical values; and an oral health examination including saliva measurement. The content analysis of computerised patient records included an examination of structured patient care plans, which had the following components: background information, permanent data, aim of home care, home care interventions, home care evaluation, and follow-up plan. In the municipality concerned patient care plans were jointly used by all health care professionals, with the patient's named home nurse responsible for preparing these plans and for the provision of patient care.

Nutritional assessments were carried out using the Mini Nutritional Assessment (MNA) (17) translated into Finnish and modified for use in Finland. The following modifications not affecting the MNA score were made: neuropsychological problems in the case of mild dementia were recorded on the basis of the assessor's subjective impression, and the prescribed use of medication for depression was recorded and given 0 points. Dementia and depression were not tested because the participants were receiving regular home health care services and any demented or depressed patients would have received attention in that context. Psychological stress was defined as an acute disease or an aggravation of a chronic disease in the past three months.

The subjects were weighed with a floor scale to the nearest 0.1 kilogram (kg), and their standing height, mid upper-arm and calf circumferences measured to the nearest 0.1 centimetre (cm) (19). In the case of subjects who had degenerative changes in stature, knee height was measured (20). The structured questionnaire (yes/no) covered problems related to eating: chewing and swallowing problems, problems with food intake because of dry mouth, constipation, diarrhoea, indigestion and other problems (21). The use of services and living conditions were also queried.

Biochemical measurements included serum albumin, haemoglobin, haematocrit and for diabetic patients the latest glycosylated haemoglobin (HBA1C). Blood samples were collected by venipuncture in the morning in the patients' homes.

Oral health was estimated by means of a new protocol

specially developed for this study. Dry mouth was assessed by a dentist using clinical criteria, and the subjects were asked questions like, "Does your mouth feel dry? Do you have eating difficulties for this reason?" The subjects were presented with the response options yes or no. The functionality of teeth or prosthesis was evaluated by dentist on the basis of opposing natural or prosthetic tooth pairs and on the basis of clinical experience. The subject's opinion of functionality was inquired by questions like, "Are you able to chew food? Do you feel comfortable with dentures?" The amount of saliva was measured and recorded as resting saliva and stimulated saliva, using a generally accepted method (22). The protocol and the results of the oral health examination, including saliva measurements, are described in detail elsewhere (23).

Data collection

Information concerning nutrition during the past six months was collected from the patient's care plans by the researcher in charge (HS). The MNA, structured questionnaire, sampling for laboratory tests and the saliva sampling were carried out at the patients' homes by a registered nurse experienced in the care of older people. Oral health examinations by two primary health care dentists were offered free of charge at the patients' home. All the data were collected in May-October 2000.

Data analysis

The computerised and structured patient care plans were analysed using the method of content analysis (24). Numerical data were analysed using SAS 6.12 statistical software. Statistical analysis of the data involved examination of the patient classification with the MNA to establish whether there were any significant differences in patient characteristics, eating problems, biochemical data and oral health. The chi-square test and Fisher Exact Probability test were used for categorical data, the Wilcoxon two-sample test was used for two groups and the Kruskal-Wallis test for more than two groups in statistical comparisons. Multivariate techniques could not be used due to the small sample size. Agreement between patients' and dentist's assessments of oral dryness and functionality of the mouth were measured using Cohen's coefficient kappa. The level of significance was set at $P < 0.05$.

Results

Characteristics of study sample

The mean age of the patients was 83.7 years: the range was from 76 to 93 years and standard deviation (SD) 4.4. The two largest age groups were 80-84 and 85-89 years (n=18, accounting for 35% each). Most of the patients were female (n=40, 78%) and almost half of them lived alone (n=21, 41%). The same number (n=21, 41%) received home health care services at least once a week, but none on a daily basis. Home help services were received by close to two-thirds or 62% of the patients, the most disabled persons (n=16, 31%) on a daily

basis. A total of 30 patients (59%) received home-delivered meals, most of them daily or almost daily.

The subjects had received home health care services from one month to several years, the average being one to two years. The subjects needed regular assistance with movement, personal hygiene, nutrition, medication and social relations. They were unable to take care of activities outside the home without assistance. An old rural population, they relied mainly on a pension income. The majority had completed no more than elementary school, with some vocational training.

The study population had several chronic illnesses, mainly cardiovascular diseases or complications (n=45, 88%), diabetes mellitus type 2 (n=21, 41%), or both (n=19, 37%), joint disorders (n=6, 12%), asthma (n=5, 10%), malignant tumour (n=4, 8%) or mainly a combination of several disorders. Almost half (n=21, 42%) had three or more disorders.

Care plans

Care plans had been prepared for 43 patients (84%). Care plan sections made references to: background information (n=26), permanent anamnesis (n=7), aim of home care (n=3), home care interventions (n=4), home care evaluation (n=8), and follow-up plans (n=1). The largest number of references (n=20) applied to meals on wheels services. Patients' daily records written by nurses were also examined (data not shown) to make sure that the care plans had not been entered into those records. This examination revealed in these records few single statements. In most cases the nurses had not entered their patients' weight and height information with BMI.

Nutritional status

None of the patients was regarded as malnourished, i.e. no one scored less than 17 MNA points; 24 (47%) were at risk of malnutrition (17-23.5 points) and 27 (52%) were well nourished. The average MNA score was 23.5. The mean BMI was 27.0 (SD 5.1), with three patients recording a BMI <19 and 16 a BMI >30. The mean BMI for diabetic patients was 28.1 (SD 5.0).

Most patients had several problems associated with eating and digestion. The most common problems were dry mouth (n=33, 66%), constipation (n=23, 45%), indigestion (n=20, 39%) and chewing and swallowing problems (n=15, 29%). Of all the patients (n=51) one had no problems; one problem was reported by 41% (n=21) and two by 37% (n=19).

Oral health and saliva

Two-thirds (67 %) or 34 patients were edentulous; the rest (n=17, 33%) had 2 to 23 natural teeth (Mean 10.6, SD, 6.9). Among the dentate patients 12 (71% of the dentate) were considered by the dentist to have functional natural dentition. Half of the population (n=26, 51%) wore complete dentures. Oral health was rather poor in the whole group. Flow rates below 0.1 ml/min for resting saliva and 0.8 ml/min for stimulated saliva were considered hyposalivation. Almost half

(n=24, 47%) of the subjects had resting saliva rates of less than 0.1 ml/min, and more than half (n=24, 53%) had stimulated saliva rates of less than 0.8 ml/min. Those who had no functional natural dentition and no prosthesis had less stimulated saliva secretion than others (p = 0.012).

Biochemical values

Local reference values were used where <35 g/l for albumin, <120 g/l for female and <130 g/l for male haemoglobin and <35% for female and <38% for male haematocrit represented subnormal values. The value of >9% for HBA1C represented poor glycemic regulation. The figures for subnormal values are shown in Table 1.

Table 1

Total number of patients with subnormal biochemical values, and their distribution in two different MNA groups and their mean MNA

	MNA 17-23.5	MNA 23.5 <	MNA Mean ± SD
S-Alb <35	4	3	21.6 ± 3.8
B Haemoglobin female <120 g/l	7	1	20.9 ± 2.6
B Haemoglobin male <130 g/l	1		23.0
B Haematocrit female <35%	4	1	21.4 ± 2.9
B Haematocrit male <38%	1		23.0
B-GHBA1C <7.5	3	5	23.9 ± 3.1
B-GHBA1C 7.5-8.9	1	3	24.8 ± 1.7
B-GHBA1C >9	1	1	24.5 ± 4.2

Nutritional status and other factors

Table 2 shows the mean biochemical values and anthropometrics for the at-risk and well-nourished groups. The MNA score was significantly lower for female patients with a haemoglobin lower than 120 g/l (Kruskal-Wallis test, χ^2 (2, N = 51) = 7.22, p = 0.027). Haemoglobin and haematocrit values were significantly lower for women with anaemia, (Wilcoxon 2-sample test, z(40) = -2.2985, p = .027), dementia (Wilcoxon 2-sample test, z(40) = 2.0820, p = .044), or joint disorders (Wilcoxon 2-sample test, z(40) = -2.1085, p = 0.042). MNA points were significantly lower for Hypothyreosis patients (Wilcoxon 2-sample test, z (51) = -2.1085, p = .04). Chewing and swallowing problems were significantly associated with lower MNA scores (χ^2 (1, N = 51) = 5.89, p = 0.015). Ten subjects (20%) who complained of both dry mouth and chewing and swallowing problems, were significantly more often in the at-risk group (χ^2 (1, N = 51) = 9.21, p = 0.002). In the dentist's estimation, the subjects at risk of malnutrition suffered from a dry mouth significantly more often than did well-nourished subjects (χ^2 (1, N = 50) = 3.89, p = 0.049). Oral status was not associated with MNA scores. However, those who had natural functioning dentition had a higher BMI score than others (Kruskal-Wallis test, χ^2 (2, N = 51) = 6.05, p = 0.049).

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Table 2

Mean biochemical and anthropometrical values in two MNA groups

	Total number of patients (n=51) Mean±s.d.	MNA 17-23.5 (n=24) Mean±s.d.	MNA 23.5 < (n=27) Mean±s.d.
S-Alb (g/l)	39.1±3.8	39.3±4.2	38.9±3.6
B-HB female (g/l)	128.8±13.4	125.0±11.9	132.9±14.1
B-HB male (g/l)	140.4±15.3	134.7±27.7	142.5±9.8
B-HKR female (%)	0.39±0.04	0.38±0.03	0.40±0.04
B-HKR male (%)	0.43±0.04	0.41±0.08	0.43±0.03
BMI female (kg/m ²)	26.8±5.1	25.8±6.2* ¹	27.8±3.5*
BMI male (kg/m ²)	27.7±5.1	29.2±3.2	27.2±5.6
MAC ² female (cm)	29.5±5.0	28.2±5.5	31.0±3.9
MAC ² male (cm)	32.3±5.3	31.5±0.5	32.6±6.3
CC ³ female (cm)	35.2±4.5	34.2±4.6	36.3±4.1
CC ³ male (cm)	36.9±3.6	38.5±3.8	36.3±3.5

Kruskal-Wallis test, *P<0.05, ¹one measurement missing 2Mid arm circumference, ³Calf circumference

Discussion

None of the participants was considered malnourished, but half of them were thought to be at risk of malnutrition. The patient records provided little or no information on nutrition. Serum albumin levels were mostly within the reference range. Most patients had poor oral health, but no direct association was seen with nutritional status. Dry mouth and eating problems were related to nutritional status. Even though we can draw no generalisations from the study because of the small number of participants, the findings do increase our understanding of nutrition in home care patients.

The comprehensive patients' care plans were for the most part completed, but information on nutritional status was incomplete. The plans contained very few, if any comments upon nutrition. Earlier studies (3, 4) have shown that questions of nutrition are often neglected in patient care. On the other hand it is not uncommon for nurses to fail to enter all relevant information into patient records. Sometimes nurses also keep personal records, and not all of that information goes into patient records (25). Computerised patient records are not necessarily very user friendly and they can be difficult to handle and process if the use of information technology is not properly planned (26). Our findings seem to suggest that nurses do not have any comprehensive written plans in matters related to nutrition. One possible explanation is that doing paperwork is accorded less status and priority than patient care (25). However, many patients received meals-on-wheels services and many diabetic patients were in good or satisfactory regulation. This suggests that nurses do talk with patients about nutrition issues, but do not necessarily record their discussions. Nevertheless structured patient records might help to improve

nutritional care and care outcomes (5, 6).

According to the MNA, about half of the study group were at risk of malnutrition. No one was classified as malnourished. The results for the group at risk of malnutrition are similar to those published earlier for patients in home nursing care in Sweden (18) and in Finland. In home care the proportion of malnourished patients has been quite low at 3-5 per cent (18, 27). One in seven had a serum albumin below the reference values, but it was not significantly associated with MNA scores. There were no findings of very low albumin values; similar results have earlier been reported for homebound elderly in the United States (28). The relationship between serum albumin values and nutritional status has received much attention in the research literature (29), and there are indications that serum albumin may relate more to poor health in general than to poor nutritional status (8). Most of the elderly people in our study population were not bedridden, even though they did have chronic diseases and problems with movement. One in seven also had haemoglobin values below the reference level; in women this was associated with at-risk status. Haematocrit was not significantly associated with the MNA score. In women, low haemoglobin and haematocrit values were significantly associated with anaemia, and also with joint disorders and dementia. Hypothyreosis was significantly associated with lower MNA. These results may reflect functional difficulties and other chronic conditions related to these diseases (13).

Neither oral health nor the functionality of teeth were associated with MNA scores, or with the saliva findings. Most of the patients in our study population had poor oral status. Dry mouth and chewing and swallowing problems were related to nutritional status, as has been demonstrated earlier (31). Likewise, an association has been shown between complaints of oral dryness and low saliva secretion and between complaints of oral dryness and recent loss of appetite (32). In our study no association was seen between saliva secretion and subjective or clinical evaluation of dry mouth. Our old and chronically ill patients had at least some medication, which might have contributed to the results (33). It is important that where subjects suffer from a dry mouth, immediate action is taken to relieve the problem by using enough drinks, soups and other moistened food. The discrepancies between the subjects' and dentists' opinions about dry mouth and dentures point to the difficulty of estimating oral health and dental treatment because many modifying factors influence oral health (34, 35, 36).

In contrast to earlier findings (18), the diabetic patients in this study did not significantly differ from other patients with regard to their MNA or BMI scores (18). Poor glycemic regulation was reported for 14% of these patients, but 30% did not conform to the regulation regime. In a similar patient group the number showing poor regulation was found to be 22%, while the not-conforming group was roughly the same size as in our study (37). Recent guidelines for the care of elderly

diabetic patients underscore the importance of regular monitoring and counselling on diet and exercise (38). Earlier studies have reported that mostly old diabetic patients are in poor glycemic regulation and that better mechanisms are needed for more effective monitoring (39).

In conclusion, while half of our study population were at risk of malnutrition, none were malnourished. The patient records contained very little information on nutrition and no comprehensive care plans concerning nutrition. A comprehensive nutritional care plan requires background information on reduced mobility, medication, skin problems, depression and cognitive impairment as well as on the need for support services. In addition, the planning of interventions requires information on height and weight, weight changes, energy intake and related problems such as oral health and eating problems. On the basis of information on nutrition, the patients most at risk could be identified and the interventions then carried out in time, focussing on the most vulnerable patients. The results of this study point at the importance of using comprehensive tools such as the MNA for purposes of nutritional assessment and advance planning in nutritional issues within the field of home care.

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References

1. WHO (2002): Active ageing: a policy framework. Geneva. www.who.int/hpr/ageing/ActiveAgeingPolicyFrame.pdf
2. Rubenstein L.Z., Harker J.O., Guigoz Y., Vellas B., Comprehensive Geriatric Assessment (CGA) and the MNA: an Overview of CGA, Nutritional Assessment, and Development of a Shortened Version of the MNA. In: Vellas, Garry, Guigoz (eds.) Mini Nutritional Assessment (MNA): research and Practice in the Elderly. Nestlé Nutrition Workshop Series Clinical & Performance Programme, 1999, 1.
3. Wilson M-M., Vaswani S., Liu D., Morley J.E., Miller D., Prevalence and Causes of Undernutrition in Medical Outpatients. *Am. J. Med.*, 1998, 104:56-63.
4. McCormack P., Undernutrition in the elderly population living at home in the community: a review of the literature, *J. Adv. Nurs.*, 1997, 26:856-63.
5. Mann R., Williams J., Standards in medical record keeping, *Clin. Med.*, 2003, 3:329-332.
6. Currell R., Urquhart C., Nursing record systems, *Cochrane Database of Systematic Reviews*, 2004, 1.
7. Schneider S.M., Hebuterne X., Use of nutritional scores to predict clinical outcomes in chronic diseases, *Nutr. Rev.*, 2000, 58: 31-8.
8. Jeejeebhoy K.N., Nutritional Assessment, *Nutrition*, 2000, 16: 585-90.
9. Cederholm T., Jägrén C., Hellström K., Outcome of Protein-Energy Malnutrition in Elderly Medical Patients, *Am. J. Med.*, 1995, 98:67-74.
10. Mukhopadhyay D., Mohanaruban K., Iron deficiency anaemia in older people: investigation, management and treatment, *Age Ageing*, 2002, 31: 87-91.
11. Mojon P, Budtz-Jørgensen E & Rapin CH., Relationship between oral health and nutrition in very old people, *Age Ageing*, 1999, 28: 463-8.
12. Hildebrandt G.H., Dominguez L.B., Schork M.A., Loesche W.J., Functional units, chewing, swallowing, and food avoidance among the elderly, *J. Prosthet. Dent.*, 1997, 77: 588-95.
13. Sharkey J.R., The Interrelationship of Nutritional Risk Factors, Indicators of Nutritional Risk, and Severity of Disability Among Home-Delivered Meal Participants, *Gerontologist*, 2002, 42: 373-80.
14. Andersson I., Sidenvall B., Case studies of food shopping, cooking and eating habits in older women with Parkinson's disease, *J. Adv. Nurs.*, 2001, 35: 69-78.
15. Westergren A., Karlsson S., Andersson P., Ohlsson O., Hallberg I., Eating difficulties, need for assisted eating, nutritional status and pressure ulcers in patients admitted for stroke rehabilitation. *J. Clin. Nurs.*, 2001, 10: 257-69.
16. McGee M., Jensen G., Nutrition in the Elderly, *J. Clin. Gastroenterol.*, 2000, 30: 372-80.
17. Guigoz Y., Vellas B., Garry P., Assessing the Nutritional Status of the Elderly: The Mini Nutritional Assessment as Part of the Geriatric Evaluation, *Nutr. Rev.*, 1996, 54: (II)S59-S65.
18. Saletti A., Johansson L., Cederholm T., Mini-Nutritional Assessment in elderly subjects receiving home nursing care, *J. Hum. Nutr. Dietet.*, 1999, 12: 381-7.
19. WHO. Physical status: the use and interpretation of anthropometry: report of a WHO Expert Committee on Technical Report Series no. 854. Geneva: WHO, pp 395-9, 1995.
20. Chumlea WC, Roche AF, Steinbaugh ML. Estimating stature from knee height for persons 60 to 90 years of age. *J. Am. Geriatr. Soc.*, 1985, 33:116-20.
21. Jeejeebhoy K.N., Nutritional Assessment, *Gastroenterology Clinics of North America* 1998, 27: 347-69.
22. Närhi TO. Prevalence of subjective feelings of dry mouth in the elderly. *J. Den. Res.*, 1994, 73:20-5.
23. Soini H., Routasalo P., Lauri S. & Ainamo A., Oral and Nutritional Status in Frail Elderly, *Spec. Care Dentist.*, 2003, 23(6).
24. Polit D., Hungler B., *Nursing Research. Principles and Methods.* J.B. Lippincott Company, Philadelphia, pp 195-6, 1995.
25. Payne S.; Hardey M., Coleman P., Interactions between nurses during handovers in elderly care, *J. Adv. Nurs.*, 2000, 32: 277-85.
26. Grace-Farfaglia P., Rosow P., Automating clinical dietetics documentation, *J. Am. Diet. Assoc.*, 1995, 95: 687-90.
27. Siljamäki-Ojansuu U., Isosomppi R., Korpio A., Kukkonen J., Oksa H., Parikka A., Peltola T., Pietilä M., The Nutritional Project in Valkeakoski district. The Publication Series of Pirkanmaa Hospital District (in Finnish), 2003.
28. Millen B.E., Silliman R.A., Cantey-Kiser J., Copenhafer D.L., Ewart C.V., Ritchie C.S., Quatromoni P.A., Kirkland J.L., Chipkin S.R., Fearon N.A., Lund M.E., Garcia R.I., Barry P.P., Nutritional risk in an urban homebound older population. *J. Nutr. Health Aging*, 2001, 5: 269-77.
29. Reuben D.B., Greendale G.A., Harrison G.G., Nutrition Screening in Older Persons, *J. Am. Geriatr. Soc.*, 1995, 43: 415-25.
30. Willet W., *Nutritional Epidemiology*, 2nd Eds. New York, Oxford University Press, 1998.
31. Sheiham A., Steele J.G., Marcenes W., Tsakos G., Finch S., Walls A.W.G., Prevalence of impacts of dental and oral disorders and their effects on eating among older people; a national survey in Great Britain, *Community Dent. Oral. Epidemiol.*, 2001, 29:195-203.
32. Dormenval V., Mojon E., Budtz-Jørgensen E., Associations between self-assessed masticatory ability, nutritional status, prosthetic status and salivary flow rate in hospitalised elders, *Oral. Dis.*, 1999, 5: 32-8.
33. Närhi T., Meurman J., Ainamo A., Nevalainen J., Schmidt-Kaunisaho K., Siukosaari P., Valvanne J., Erkinjuntti T., Tilvis R., Mäkilä E., Association Between Salivary Flow Rate and the Use of Systemic Medication Among 76-, 81-, and 86-year-old Inhabitants in Helsinki, Finland, *J. Dent. Res.*, 1992, 71:1875-1880.
34. Nevalainen MJ, Rantanen T, Närhi T, Ainamo A. Complete dentures in the prosthetic rehabilitation of elderly persons: five different criteria to evaluate the need for replacement. *J. Oral Rehabilitation*, 1997, 24:251-8.
35. Suominen-Taipale AL, Nordblad A, Alanen P, Alha P, Koskinen S. Self-reported dental health, treatment need and dental attendance among older adults in two areas of Finland. *Community Dent. Health*, 2000, 17:20-6.
36. Schembri A, Fiske J. The implications of visual impairment in an elderly population in recognizing oral disease and maintaining oral health. *Spec. Care Dentist.*, 2001, 21:222-6.
37. Kangas T., The consumption and direct costs of health care services among persons with diabetes in Helsinki. A case controlled cross-sectional study of the fiscal year 1997. (English summary). Helsinki, The Social Insurance Institution, Finland, Studies in social security and health 67, 2002.
38. Suomen Diabetesliitto, DEHKO – The Development Program on Prevention and Treatment in Diabetic Care, (in Finnish), Tampere, Finnish Diabetes Association, 2000.
39. Kristensen J., Bro F., Sandbæk A., Dahler-Eriksen K., Lassen J. F., Lauritzen T., HbA1c in an unselected population of 4438 people with Type 2 diabetes in a Danish county, *Scand. J. Prim. Health Care*, 2001, 19: 241-6.