ASSESSMENT OF THE QUALITY OF DIET OF *ALZHEIMER'S* DISEASE INDIVIDUALS LIVING AT HOMES AND IN NURSING HOMES

Dariusz Włodarek*, Dominika Głąbska

Chair of Dietetics, Department of Dietetics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences – SGGW, Warsaw, Poland

ABSTRACT

Background. In case of many individuals, decrease of body mass is observed during aging, that is often in elderly living in nursing homes. It is especially important for patients with *Alzheimer's* disease (AD), when decrease of body mass, resulting in malnutrition.

Objective. The aim of the study was the assessment of the quality of diet of AD individuals living at homes and in nursing homes, in comparison with a control group

Material and methods. In the study participated 160 individuals with and without AD, living at home or in nursing homes. Assessment of diet of individuals living at homes was based on self-reported data from one-day dietary recall. Assessment of diet of individuals living in nursing homes was based on one-day menu from nursing homes accompanied by information about snacking between meals. The diets were assessed on the basis of qualitative meal classification method of *Bielińska* and *Kulesza*.

Results. Individuals living in nursing homes consumed meals more often than living at homes, while AD did not have any impact on it. Individuals consuming fruits and vegetables not often enough were in all the groups, however, in case of individuals living at homes it was serious problem. Consuming animal products to almost all main meals was observed in case of many individuals in all analyzed groups. Composition of majority of main meals and small amount of lunches and afternoon snacks was rational.

Conclusions. Improperly balanced diet following observed not only in a group of AD individuals but also of ones without dementia (both living at homes and in nursing homes), may result in dietary deficiencies.

Key words: *Alzheimer's disease, elderly, diet, nursing homes*

STRESZCZENIE

Wprowadzenie. Wraz ze starzeniem się organizmu może dochodzić do zmniejszenia masy ciała, co jest często stwierdzane u osób starszych przebywających w domach opieki. Zjawisko to może występować u osób z chorobą *Alzheimera*, a tym samym może przyczyniać się do wystąpienia niedożywienia.

Cel. Celem badania była ocena jakości diet osób z chorobą *Alzheimera* mieszkających we własnych domach i domach opieki w porównaniu z grupą kontrolną

Materiał i metoda. W badaniu uczestniczyło 160 osób chorujących lub nie chorujących na chorobę *Alzheimera*, mieszkających we własnych domach lub w domach pomocy społecznej. Ocenę sposobu żywienia osób mieszkających we własnych domach przeprowadzono na podstawie jednodniowych jadłospisów uzyskanych od badanych lub ich opiekunów. Natomiast ocenę sposobu żywienia osób mieszkających w domach opieki przeprowadzono na podstawie jednodniowego jadłospisu w tych placówkach z uwzględnieniem informacji dotyczących dojadania między posiłkami. Jadłospisy poddane zostały ocenie jakościowej wykorzystując metodę klasyfikacji posiłków wg *Bielińskiej* i *Kuleszy*.

Wyniki. Osoby mieszkające w domach opieki częściej spożywały posiłki w ciągu dnia niż mieszkające we własnych domach, niezależnie od występowania choroby *Alzheimera*. We wszystkich badanych grupach spożycie warzyw i owoców przez znaczą część osób było zbyt małe, co dotyczyło zwłaszcza osób żyjących we własnych domach. Produkty pochodzenia zwierzęcego występowały prawie we wszystkich głównych posiłkach spożywanych przez badane osoby. Za racjonalnie zestawione można było uznać większość głównych posiłków i tylko część drugich śniadań oraz podwieczorków.

Wnioski. Nieprawidłowe zestawienie posiłków w diecie było stwierdzane zarówno u osób chorujących na chorobę *Alzheimera* jak i niechorujących na demencję, niezależnie od miejsca zamieszkania. Może to prowadzić do wystąpienia niedoborów żywieniowych u tych osób.

Słowa kluczowe: *choroba Alzheimera, osoby starsze, dieta, domy opieki*

* Corresponding author: Dariusz Włodarek, Chair of Dietetics, Department of Dietetics, Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences – SGGW, Nowoursynowska street 159c, 02-776 Warsaw, Poland, phone +48 22 5937024, fax +48 22 5937018, e-mail: dariusz_wlodarek@sggw.pl

INTRODUCTION

In case of many individuals, moderate decrease of body mass is observed during aging, that is associated with metabolic changes and loss of appetite [20, 21]. Decrease of body mass is often observed in elderly living in nursing homes [5, 14]. It is especially important for patients with *Alzheimer's* disease (AD) and other types of dementia, when decrease of body mass, resulting in malnutrition, may be one of symptoms of natural course of the mentioned diseases [27]. Decrease of body mass is observed in case of 40% patients with AD and it may occur in all stages of disease, also early stages, or even before diagnosis [3].

The reasons of decrease of body mass in AD are not clear. Some hypothesis assume that the main reason may be increase of energy expenditure, decrease of food intake or changes of dietary habits [9]. It may partly result from emerging difficulties in everyday activities associated with buying food products, as well as preparing and consuming meals [9, 22]. *Cicconetti* et al. [6] emphasize, that mentioned difficulties observed in case of AD individuals may contribute to improper intake of energy as well as of vitamins, minerals and other nutrients.

One of the factors influencing nutrients intake is composition of diet. In elderly individuals, in comparison with younger ones, composition of diet may be modified, because of products and dishes choice limitations associated with observed diseases, resulting in low intake of vegetables and dairy products [18]. To counteract consequences of improper diet following, the improper composition of diet should be identified as soon as possible, especially if there is possibility to modify diet.

Especially important is to identify improper dietary habits in case of AD individuals, because some deficits may have negative impact on course of the disease. Malnutrition of AD patients may cause faster loss of cognitive functions [11, 26]. Simultaneously, decrease of body mass may be associated with protein-energy malnutrition, that may lead to a lot of disturbances, e.g. immune system dysfunction, muscle loss, high risk of falls or injury, and as a consequence loss of independence in everyday life [1, 9]. On the other hand, improperly balanced diet following is one of the factors that may contribute to AD [30] and other diseases development [16, 24], so not only in case of individuals with AD, but also healthy individuals, quality of diet is an important issue.

The aim of this study was the assessment of the quality of diet of AD individuals living at homes and in nursing homes, in comparison with a control group.

MATERIAL AND METHODS

The study was carried out in group of 160 individuals aged 60-94 years with diagnosed AD and without dementia and other neurodegenerative diseases. In the Table 1 is presented characteristics of analyzed individuals – divided on the basis of AD presence and place of living. The subjects with AD were qualified to the study on the basis of diagnosis of AD conducted by neurologist – they all were under constant medical treatment. Simultaneously, subjects from the control group were also under constant medical treatment and they did not have dementia and other neurodegenerative diseases. Study protocol was approved by the Ethic Committee of the Regional Medical Chamber in Warsaw (No 4/08; 7.02.2008) – each participant and their caregivers prior to participation gave their informed written consent.

Assessment of diet of individuals living at homes – from Group 1 and Group 3 was based on self-reported data from participants' one-day dietary recall. To provide the reliable estimates of food intake, participants and caregivers were instructed about the principles of doing one-day dietary recall, as well as about the necessity of accurate and scrupulous recording of all the food consumed and the beverages drunk. The one-day dietary recall was conducted on the basis of widely accepted and applied rules [13], as it is stated that accuracy of the one-day dietary recall on the group level is satisfactory [17].

Assessment of diet of individuals living in nursing homes – from Group 2 and Group 4 was based on one-day menu from nursing homes. In case of Group 2 information about presumptive snacking of products brought by family was obtained from participants and their caregivers, while in case of Group 4 – from caregivers only.

The diets were assessed on the basis of qualitative meal classification method of *Bielińska* and *Kulesza* [10]. According to mentioned method, each meal may be adjudicated as one of nine types of meals (presented in Table 2), on the basis of present nutrients (carbohydrates, fat, protein) and products (meat, fish, egg, dairy products, fruits, vegetables). As it is determined for the method, rational meals are types „5", „6" and „7", especially unfavorable is type „1", while types „8" and „9" are not unfavorable only as an afternoon snack.

Participants and their caregivers were also asked some questions associated with their diets – e.g. about quantity of meals eaten daily, hot meals consumption, servings of vegetables and fruits daily, as well as which meals do they consume every day.

To compare distribution of analyzed features between groups, chi-2 test was used. In order to characterize the age in compared groups, one-way *ANOVA*

Table 1. Characteristics of analyzed individuals

Group	Characteristics of group	n (quantity of individuals)		Age [years] **
		Total for group	Gender (male / female patients) *	
Group 1 – control group	Non-AD individuals living at homes (cont-h)	40	33/ 7	71.0 ± 4.8 a
Group 2 – control group	Non-AD individuals living in nursing homes (cont-nh)	40	30/ 10	83.4 ± 7.9 b
Group 3 – *Alzheimer's* disease group	AD individuals living at homes (AD-h)	29	18/ 11	75.1 ± 7.5 c
Group 4 – *Alzheimer's* disease group	AD individuals living in nursing homes (AD-nh)	51	40/ 11	79.7 ± 5.9 b

* gender distribution in groups do not differ significantly (p=0.2464) on the basis of *chi-2 test*
** comparison between groups on the basis of analysis of variance – *ANOVA* and post-hoc *Tukey* test (p≤0.05)

and post-hoc *Tukey* test were conducted. Level of significance α=0.05 was used. Statistical analysis was conducted using Statistica software version 8.0 (Stat-Soft, Tulsa, Oklahoma, USA).

RESULTS

The distribution of male and female patients in analyzed groups did not differ (Table 1), so the further analysis did not require separate analysis for male and female individuals in groups. Simultaneously, the mean age in groups differed – the oldest individuals were in the Group 2 and Group 4 (individuals living in nursing homes), while the youngest – in the Group 1 (non-AD individuals living at homes).

Table 2. Qualitative meal classification method of *Bielińska* and *Kulesza* [10]

Type of meal	Nutrients present in meal
„1"	Carbohydrates/ carbohydrates and fat
„2"	„1" and meat/ fish/ egg protein
„3"	„1"and dairy protein
„4"	„1", meat/ fish/ egg and dairy protein
„5"	„2" and vegetables/ fruits
„6"	„3" and vegetables/ fruits
„7"	„4" and vegetables/ fruits
„8"	„1" and vegetables/ fruits
„9"	Vegetables/ fruits

In the Table 3 is presented number of analyzed individuals characterized by specified features of diet – specified quantity of meals daily (< 3, 3 and >3), everyday consumption of specified meals (hot meal, breakfast, lunch, dinner, afternoon snack, supper), specified quantity of servings of vegetables and fruits daily. It was observed that all the individuals living in nursing homes (Group 2 and Group 4) and majority of individuals living at homes (65-83%) consumed 4 and more meals daily. Simultaneously, differences between groups of individuals living at homes and living in nursing homes were significant.

Meals everyday consumed were mainly: breakfast and dinner, and in nursing homes also supper. Significant differences were denoted in case of breakfast and supper, consumed less often by individuals from the Group 1, while in case of dinner all patients consumed it everyday. Other meals were consumed not so often, but they were significantly oftener consumed by individuals in nursing homes and AD individuals (in case of lunch) or by individuals at homes and AD individuals (in case of afternoon snack). In all the groups hot meal was consumed everyday (only 1 individual in the Group 1 consumed it few times a week) and no differences between groups were observed.

Fruits and vegetables were consumed significantly more often by individuals living in nursing homes (Group 2 and Group 4) than living at homes (Group 1 and Group 3).

In the Table 4 is presented number of analyzed individuals characterized by specified types of meals according to qualitative meal classification method of *Bielińska* and *Kulesza*. It was observed that 85-100% of breakfasts, dinners and suppers in all groups of individuals contained products being the source of meat/ fish/ egg protein or dairy protein. The rest of meals consisted of carbohydrates/ carbohydrates and fat, sometimes with fruits and vegetables. The highest quantity of rational meals was observed in case of dinners (80-100% contained carbohydrates, animal protein and fruits or vegetables). In the Group 1 rational meals were observed for breakfast in case of 50% of meals, for dinner – in case of 80% and for supper – in case of 76%. Simultaneously, in the Group 2 it were in case of 95%, 100% and 95% respectively, in the Group 3 – in case of 38%, 90% and 44% respectively, while in the Group 4 – in case of 37%, 98% and 57% respectively.

Table 3. Number of analyzed individuals [%] characterized by specified features of diet

		Group 1 (cont-h)	Group 2 (cont-nh)	Group 3 (AD-h)	Group 4 (AD-nh)	Comparison between groups (p-Value) *
Quantity of meals daily	< 3	2.5	0.0	0.0	0.0	0.0000
	3	42.5	0.0	17.2	0.0	
	> 3	65.0	100.0	82.8	100.0	
Everyday consumption	hot meal	97.5	100.0	100.0	100.0	>0.05
	breakfast	90.0	100.0	100.0	100.0	0.0064
	lunch	65.0	100.0	79.3	100.0	0.0000
	dinner	100.0	100.0	100.0	100.0	>0.05
	afternoon snack	40.0	25.0	75.9	31.4	0.0000
	supper	85.0	100.0	93.1	100.0	0.0038
Servings of vegetables and fruits daily	≥5	20.0	12.5	0.0	3.9	0.0000
	3-4	25.0	82.5	44.8	96.1	
	1-2	45.0	5.0	48.3	0.0	
	few times a week	10.0	0	6.9	0.0	

* comparison on the basis of Chi^2 test

Table 4. Number of analyzed individuals [%] characterized by specified types of meals according to qualitative meal classification method of *Bielińska* and *Kulesza*

		Group 1 (cont-h)	Group 2 (cont-nh)	Group 3 (AD-h)	Group 4 (AD-nh)	Comparison between groups (p-Value) *
Breakfast	„5"/ „6"/ „7"	45.0	95.0	37.9	37.3	0.0000
	„2"/ „3"/ „4"	40.0	5.0	55.3	62.7	0.0000
	„8"/ „9"	0.0	0.0	3.4	0.0	>0.05
	„1"	5.0	0.0	3.4	0.0	>0.05
	Lack of meal	10.0	0.0	0.0	0.0	0.0064
Lunch	„5"/ „6"/ „7"	12.5	22.5	17.2	25.5	>0.05
	„2"/ „3"/ „4"	10.0	7.5	20.7	9.7	>0.05
	„8"/ „9"	25.0	32.5	20.7	58.9	0.0009
	„1"	17.5	37.5	20.7	5.9	0.0023
	Lack of meal	35.0	0.0	20.7	0.0	0.0000
Dinner	„5"/ „6"/ „7"	80.0	100	89.8	98.0	0.0020
	„2"/ „3"/ „4"	5.0	0.0	3.4	0.0	>0.05
	„8"/ „9"	10.0	0.0	3.4	2.0	>0.05
	„1"	5.0	0.0	3.4	0.0	>0.05
	Lack of meal	0.0	0.0	0.0	0.0	>0.05
Afternoon snack	„5"/ „6"/ „7"	0.0	0.0	0.0	0.0	>0.05
	„2"/ „3"/ „4"	2.5	12.5	6.9	15.7	>0.05
	„8"/ „9"	20.0	12.5	44.9	3.9	0.0001
	„1"	17.5	0.0	24.1	11.8	0.0166
	Lack of meal	60.0	75.0	24.1	68.6	0.0001
Supper	„5"/ „6"/ „7"	65.0	95.0	41.4	56.9	0.0000
	„2"/ „3"/ „4"	12.5	5.0	31.0	41.1	0.0001
	„8"/ „9"	0.0	0.0	17.3	0.0	0.0000
	„1"	7.5	0.0	3.4	2.0	>0.05
	Lack of meal	15.0	0.0	6.9	0.0	0.0038

* comparison on the basis of Chi^2 test

In all the groups, the lunch and afternoon snack consisted in most cases of carbohydrates/ carbohydrates and fat, sometimes with fruits/ vegetables, or fruits/ vegetables alone.

The analysis of the quantity of rational meals in groups revealed, that in the Group 1 53.3% of meals was rational, while in the Group 2 – 72.3%, in the Group 3 – 41.5% and in the Group 4 – 53.2%. It was stated, that highest share of proper meals was observed in case of individuals from the control group living in nursing homes (for breakfast, dinner, supper).

Simultaneously, AD individuals living at homes (Group 3) often consumed meals without any animal protein – for afternoon snack and supper for type "8"/ "9 it was significantly more often than in case of other groups. Lack of meal was most often observed in case

of individuals from the control group living at homes (Group 1), that was significant for breakfast, lunch and supper. Only in case of afternoon snack, it was not consumed most often by control group individuals living in the nursing homes, while consumed most often by AD individuals living at homes.

DISCUSSION

In case of elderly patients, food ratio during a day should be committed with pauses between meals no longer than 3 hours. It is recommended to consume 4-5 meals a day and under no circumstances less than 3 meals a day. Except 3 main meals (breakfast, dinner, supper) it is recommended to consume 2 smaller meals (lunch and afternoon snack) [15]. In the presented research, most of individuals consumed 4 and more meals a day. Simultaneously, it was concluded, that individuals living in nursing homes consumed meals more often than living at homes, while AD did not have any impact on it. It was associated with planning meals for nursing home dwellers by the staff. At the same time in case of individuals living at homes, patients from the control group consumed less meals than those with AD, that may have been associated with care of the family members or caregivers planning and preparing meals.

The results of the presented research associated with frequency of meals in the control groups are similar, as in other research of the elderly in Poland. *Tokarz* et al. [25] concluded, that individuals aged 60-90 years, in most cases consumed 3 (46% of analyzed group) or 4 meals daily (42% of analyzed group), while about 10% of analyzed group consumed more than 4 meals a day. In the mentioned research all participants consumed breakfast and dinner, while supper was consumed by 97% of analyzed group and each third of group consumed lunch and each third – afternoon snack. Similar situation was observed in the control group of the presented research.

In other research conducted in Poznań [7], it was observed that each third of analyzed groups of elderly consumed 3 meals a day, 34-42% consumed 4 meals, while 34-36% 3-4 meals a day. In the mentioned research also almost all individuals consumed 3 main meals (breakfast, dinner, supper). Similarly, in the research of *Kołłajtis-Dołowy* and *Tyska* [19], it was concluded, that 2/3 of elderly consumed 3 meals a day and they were in most cases breakfast, dinner and supper, while lunch was consumed less regularly. In the mentioned research 4 meals a day was eaten by each fourth of analyzed individuals, while it was more common in case of nursing home dwellers.

In the presented group eating hot meals was more common than in other research conducted in the groups of elderly. It may be concluded, that AD did not influen-

ce it, and every individual in analyzed group consumed at least 1 hot meal daily, while in research of *Duda* [7] worse situation was observed.

General recommendations for the population of elderly include everyday consumption of fruit and vegetables, if it possible – row ones [23]. World Health Organization recommends for adults, consuming at least 400g of fruits and vegetables daily [29], while it should be consumed with every meal – 5 servings of various fruits and vegetables a day (excluding potatoes and including no more than 1 serving of fruit juice) [2]. Moreover, individuals with chronic diseases, should adjust fruits and vegetables consumption to their ability and specific recommendations [28].

In the presented research, it may have been concluded, that individuals living in nursing homes consume fruits and vegetables more often than individuals living in nursing homes – most of the nursing home dwellers consumed them 3-4 or more times a day, in spite of the fact that they were significantly older than individuals living at homes. The significant influence of the place of living was associated with the meals planned in the menus of nursing homes, while at homes they were probably not so strictly composed. As a consequence, most of individuals living at homes, consumed fruits and vegetables 1-2 times a day or even less often, that is consistent with results of other research indicating that most of elderly consumes fruits and vegetables once a day or less often [19]. At the same time, it is stated, that each additional serving of fruits and vegetables in diet reduces the risk of cardiovascular incidents by 4% and the risk of stroke by 5%, that is a significant evidence of the role of intake of recommended amounts of them [4].

Diet of elderly should also provide protein of the high biological value. Consuming animal products to almost all main meals, observed in case of many individuals in all analyzed groups, may provide suitable quantity of protein in their diets. Diet should also provide all the nutrients in proper amount and proportions, that may be secured by variety of chosen products. Properly planned meals should provide recommended amounts of protein, fat, carbohydrate, vitamins and minerals. In the presented research a lot of meals was not properly balanced, as according to the qualitative meal classification method of *Bielińska* and *Kulesza*, they were not rational, that was observed mainly in case of individuals living at homes. It may result in dietary deficiencies and, as a consequence, in malnutrition in analyzed group. Not rational meals were observed mainly in case of AD individuals living at homes (almost 60% of the group), so it may be concluded that the risk of malnutrition in that group is serious. Moreover, it may be concluded, that not only AD individuals may be malnourished, but also healthy elderly individuals, as in spite of the fact

that they consume adequate amount of meals which are not properly balanced.

Suitable nutritional intervention may have general positive impact on the diet of elderly. *Guigoz* [12], on the basis of review of research, concludes, that such an early conducted intervention may cause delaying body mass loss and as a consequence, reduce the risk of malnutrition in case of elderly. The results of research indicate, that dementive elderly individuals are characterized by similar nutritional status and similar lifespan, as individuals in the similar age but without dementive states, if they are provided proper diet following [8].

CONCLUSIONS

1. Individuals living in nursing homes consumed meals more often than living at homes, while *Alzheimer's* disease patients did not have any impact on it.
2. Individuals consuming fruits and vegetables not often enough were in all the groups, however, in case of individuals living at homes it was especially serious problem.
3. Consuming animal products to almost all main meals was observed in case of many individuals in all analyzed groups.
4. Composition of majority of main meals and small amount of lunches and afternoon snacks was rational.
5. Improperly balanced diet following observed not only in a group of *Alzheimer's* disease individuals but also of ones without dementia (both living at homes and in nursing homes), may result in dietary deficiencies.

Conflict of interest
The authors declare no conflict of interest.

REFERENCES

1. *Abellan van Kan G., Vellas B.*: Prevention of Alzheimer's disease: implication of nutritional factors. In: Food for the ageing population. Ed. *M. Raats, L. de Groot, W. van Staveren*, Woodhead Publishing Limited, Cambridge 2009, 205-218

2. *Ashfield-Watt P.A.L., Welch A.A., Day N.E., Bingham S.A.*: Is five-a-day an effective way of increasing fruit and vegetable intake? Public Health Nutr. 2004, 7, 257-261

3. *Aziz N.A., van der Marck M.A., Pijl H., Olde Rikkert M.G., Bloem B.R., Roos R.A.*: Weight loss in neurogenerative disorders. J. Neurol. 2008, 255, 1872-1880

4. *Bazzano L.A., He J., Ogden L.G., Loria C.M., Vupputuri S., Myers L., Whelton P.K.*: Fruit and vegetable intake and risk of cardiovascular disease in US adults: The First National Health and Nutrition Examination Survey epidemiologic follow-up study. Am. J. Clin. Nutr. 2002, 76, 93-99

5. *Cairella G., Baglio G., Censi L., Ciaralli F., Marchetti A., Rebella V., Sonni L., Tarsitani G.*: Mini Nutritional Assessment (MNA) and nutritional risk in elderly. A proposal of nutritional surveillance system for the Department of Public Health. Ann. Ig. 2005, 17, 35-46

6. *Cicconetti P., Fionda A., Bauco C., Migliori M., Marigliano V.*: Nutritional deficiency and Alzheimer's disease: how to identify and prevent. Recenti. Prog. Med. 2000, 91, 135-140

7. *Duda G.*: Zwyczaje żywieniowe a stan zdrowia i odżywienia osób w wieku podeszłym. Bromat. Chem. Toksykol. 2003, Supl., 243-248

8. *Franzoni S., Frisoni G.B., Boffelli S., Rozzini R., Trabucchi M.*: Good nutritional oral intake is associated with equal survival in demented and nondemented very old patients. J. Am. Geriatr. Soc. 1996, 44, 1366-1370

9. *Gillette Guyonnet S., Abellan Van Kan G., Alix E., Andrieu S., Belmin J., Berrut G., Bonnefoy M., Brocker P., Constans T., Ferry M., Ghisolfi-Marque A., Girard L., Gonthier R., Guerin O., Hervy M.P., Jouanny P., Laurain M.C., Lechowski L., Nourhashemi F., Raynaud-Simon A., Ritz P., Roche J., Rolland Y., Salva T., Vellas B., International Academy on Nutrition and Aging Expert Group – IANA*: Weight loss and Alzheimer's disease. J. Nutr. Health Aging 2007, 11, 38-48

10. *Gronowska-Senger A.*: Zarys oceny żywienia. Wydawnictwo SGGW, Warszawa 2009

11. *Guerin O., Soto M.E., Brocker P., Robert P.H., Benoit M., Vellas B., REAL.FR Group*: Nutritional status assessment during Alzheimer's disease: results after one year (the REAL French Study Group). J. Nutr. Health Aging 2005, 9, 81-84

12. *Guigoz Y.*: The Mini Nutritional Assessment (MNA) review of the literature – What does it tell us? J. Nutr. Health Aging 2006, 10, 466-485

13. *Hebert I., Ockene I.S., Hurley T.G., Luippold R., Well A.D., Harmatz M.G.*: Development and testing of a seven-day dietary recall. J. Clin. Epidemiol. 1997, 50, 925-937

14. *Izawa S., Kuzuya M., Okada K., Enoki H., Koike T., Kanda S., Iguchi A.*: The nutritional status of frail elderly with care needs according to the mini-nutritional assessment. Clin. Nutr. 2006, 25, 962-967

15. *Jeszka J., Kołłajtis-Dołowy A.*: Planowanie żywienia. W: Żywienie człowieka. Postawy nauki o żywieniu. Red. *J. Gawęcki*. Wydawnictwo Naukowe PWN, Warszawa 2010, 501-513

16. *Kałuża J., Dołowa J., Roszkowski W.*: Survival and habitual nutrient intake among elderly men. Rocz. Panstw. Zakl. Hig. 2005, 56(4), 361-370 (in Polish)

17. *Karvetti R.L., Knuts L.R.*: Validity of the 24-hour dietary recall. J. Am. Diet. Assoc. 1985, 85, 1437-1442

18. *Keller H.H., Hedley M.R.*: Nutritional risk needs assessment of community-living seniors: prevalence of nu-

trition problems and priorities for action. J. Community Health 2002, 27, 121-132

19. *Kołłajtis-Dołowy A., Tyska M.*: Świadomość żywieniowa ludzi starszych w relacji do ich postaw i zachowań żywieniowych. Żyw. Człow. Metab. 2004, 31, 3-17

20. *Parker B.A., Chapman I.M.*: Food intake and ageing – the role of the gut. Mech. Ageing Dev. 2004, 125, 859-866

21. *Parker B.A., Ludher A.K., Loon T.K., Horowitz M., Chapman I.M.*: Relationships of ratings of appetite to food intake in healthy older men and women. Appetite 2004, 43, 227-233

22. *Poehlman E.T., Dvorak R.V.*: Energy expenditure, energy intake, and weight loss in Alzheimer disease. Am. J. Clin. Nutr. 2000, 71, Suppl. 650S-655S

23. *Roszkowski W.*: Żywienie osób starszych. W: Żywienie człowieka zdrowego i chorego. Red. *M. Grzymisławski, J. Gawęcki*. Wydawnictwo Naukowe PWN, Warszawa 2010, 80-89

24. *Tokarz A., Stawarska A., Kolczewska M.*: Nutritional habits and supplementation of elderly people with cardiovascular diseases from Warsaw. Rocz. Panstw. Zakl. Hig. 2008, 54(4), 467-472 (in Polish)

25. *Tokarz A., Stawarska A., Kolczewska M.*: Ocena jakościowa sposobu żywienia ludzi starszych zrzeszonych w wybranych warszawskich stowarzyszeniach społecznych. Bromat. Chem. Toksykol. 2007, 40, 359-364

26. *Vellas B., Lauque S., Gillette-Guyonnet S., Andrieu S., Cortes F., Nourhashémi F., Cantet C., Ousset P.J., Grandjean H., REAL.FR Group*: Impact of nutritional status on the evolution of Alzheimer's disease and on response to acetylcholinesterase inhibitor treatment. J. Nutr. Health Aging 2005, 9, 75-80

27. *White H.K.*: Nutrition in advanced Alzheimer's disease. N.C. Med. J. 2005, 66, 307-312.

28. *Wizner B.*: Promocja zdrowia i aktywności fizycznej. W: Geriatria z elementami gerontologii ogólnej. Red. *T. Grodzicki, J. Kocemba, A. Skalska A.*, Via Medica, Gdańsk 2006, 53-59

29. World Health Organization. Diet, nutrition and the prevention of chronic disease. Technical Report Series No 797WHO, Geneva 1990

30. *Wyka J.:* Nutritional factors in prevention of Alzheimer's disease. Rocz Panstw Zakl Hig 2012, 63(2) 135-140 (in Polish)