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Dietary habits and physical activity patterns among Slovenian elderly: cross-sectional survey with cluster analysis

Prehranske in gibalne navade slovenskih starostnikov: presečna anketna raziskava z metodo razvrščanja v skupine

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ABSTRACT

Introduction: Physical activity and a healthy diet are significant predictors of healthy ageing-they help the elderly maintain their physical and mental health, and prevent chronic diseases.

Methods: The data for the empirical quantitative survey were collected on the sample of 218 elderly community-dwelling participants (aged 65 years or more), using a structured questionnaire for self-reporting. Data analyses were proceed by the bivariate statistics, and multivariate hierarchical cluster analysis.

Results: Most respondents reported good dietary habits (83.1 %) and a satisfactory physical activity level (60.5 %). On average, the elderly eat 3-4 meals per day (59.8 %) and engage in physical activity at least three times a week (58.6 %), with interventions lasting 15 minutes or more (84.4 %) and non-organized activities were prevailing (96.2 %). Ward's method yielded three clusters with homogenous dietary and physical activity patterns: 'Health Consciousness' (30.8 %), 'Being At Risk' (42.7 %) and 'Special Requirements' (26.5 %).

Discussion and conclusion: In the future, special attention should be placed on the elderly group with special dietary and physical activity requirements. Additional studies on representative samples are required for a comprehensive investigation into the lifestyle behaviours of elderly individuals.

IZVLEČEK

Uvod: Gibalna aktivnost in prehranske navade sta ključna dejavnika zdravega staranja, ki starostnikom omogočata vzdrževati telesno in duševno zdravje ter jih varujeta pred pojavom kroničnih bolezni.

Metode: Podatki za empirično kvantitativno anketno raziskavo so bili zbrani na vzorcu 218 starostnikov, stanujočih na svojem domu (starih 65 let ali več), z uporabo strukturiranega vprašalnika za samoporočanje anketirancev. Analiza podatkov je bila narejena z bivariatno statistiko in multivariatno metodo razvrščanja v skupine s hierarhičnim združevanjem.

Rezultati: Glavnina anketirancev je navedla, da ima dobre prehranske navade (83,1 %) in ustrezno raven gibalne aktivnosti (60,5 %). Starostniki povprečno na dan zaužijejo tri do štiri obroke (59,8 %) in so vsaj trikrat na teden gibalno aktivni (58,6 %), in sicer 15 minut (84,4 %) in v neorganizirani obliki (96,2 %). Wardova metoda je pokazala tri skupine starostnikov s homogenimi vzorci prehranskih in gibalnih navad: »v skrbi za zdravje« (30,8 %), »ogroženi« (42,7 %) in »s posebnimi potrebami« (26,5 %).

Diskusija in zaključek: V prihodnje je potrebno posebno pozornost posvetiti skupini starostnikov s specifičnim prehranskim in gibalnim režimom. Za kompleksno proučevanje življenjskega sloga starostnikov so potrebna prihodnja raziskovanja na reprezentativnih vzorcih.

Introduction

Life expectancy has been associated with an absence of disease and having one's needs met (Tourlouki, et al., 2009). Previous research examining successful ageing to identify and evaluate factors associated with elderly health status revealed physical activity and a healthy diet as significant predictors of healthy ageing - they help the elderly maintain their physical and mental health, prevent unwanted lifestyle behaviour such as tobacco use and alcohol consumption, and prevent chronic non-communicable diseases such as cancer, cardiovascular diseases, chronic respiratory diseases, orthopaedic conditions and diabetes (Hirvensalo, et al., 2000; World Health Organization, 2003; Maynard, et al., 2005; Denny, 2008; Gandy, 2009; Schneider, et al., 2009; Tourlouki, et al., 2009; Barnett, et al., 2012; Kavčič, et al., 2012). In Slovenia, previous research on a sample of 558 elderly persons aged 58-90 years revealed that physical activity regimens and healthy nutrition are, in the elderly, typically used as strategies for restoring previous health levels (Kavčič, et al., 2012).

Available research evidence confirms unhealthy diet as a major public health threat (World Health Organization, 2003). As people age, their dietary patterns undergo certain changes. In her study, Hlastan-Ribič (2008) discussed four groups of factors that influence food consumption patterns in the elderly: physiological, psychological, economic and social factors. Some of the most frequent signs of nutritional intake changes associated with ageing include a declining sense of taste, a decrease in the ability to detect thirst, difficulty with chewing due to loss of teeth and dental decay, use of medication, and adherence to dietary regimens necessary for treatment and prevention of diseases which may easily result in a one-sided, poorly balanced diet (Denny, 2008). For these reasons, elderly individuals are at risk of malnutrition which results in a weakened immune system and the onset of disease (Denny, 2008; Kavčič, et al., 2012). In Finland, Nykänen and colleagues (2013) found that 15 % of community-dwelling persons aged 75 years or older suffered from possible malnutrition. Previous study results revealed that 50 % of older individuals have inadequate diets (Maynard, et al., 2005).

In addition to a healthy diet, it has been established that physical activity is the other key element and 'secret' for achieving longevity (Tourlouki, et al., 2009). In the elderly, physical activity positively affects the ability to maintain and improve mental and physical health, well-being and independence. In contrast, mobility difficulties and immobility represent the two main predictors of decline in health and death. In their research, Hirvensalo and colleagues (2000) studied the interaction of physical inactivity as a predictor of mobility impairment, dependence and

mortality among 1109 independently living elderly persons from Jyväskylä, Finland, aged 65-84 years at baseline. They found that mobility impairment was the greatest single predictor of dependence and mortality. Inversely, regular physical activity may reduce the risk for mortality even in mobility-impaired people. Barnett and colleagues (2012) demonstrated that a decline in physical activity was particularly pronounced among retirees from lower occupational groups, especially manual workers, who preferred to continue with physically active pursuits rather than engaging in recreational physical activity following retirement.

Several methodological approaches have been used for assessing dietary habits and physical activity patterns among the elderly. Schneider and colleagues (2009) highlights the value of multivariate cluster analysis as an innovative method in lifestyle. According to Schneider and colleagues (2009) cluster analysis is employed to segregate the subjects according to distinct behaviours and to identify health-related behaviour patterns. Thus, complex health patterns and risk groups can be identified.

Aim and objective

The aim of our study was to determine the possible existence of clusters of elderly individuals aged 65 years or over with similar dietary and physical activity patterns which differentiated from other clusters. The study objectives were:
- to examine the dietary habits and physical activity patterns among the participating elderly;
- to investigate the relation of dietary habits and physical activity patterns among the participating elderly according to socio-demographic differences in gender, age, educational level and area of residence;
- to identify clusters with homogeneous patterns of dietary and physical activity habits.

Methods

An empirical quantitative research design using a structured questionnaire was employed. Our research was part of the broader research and development project, 'Intergenerational cooperation in health promotion', which received funding from the Ministry of Health of the Republic of Slovenia for the period 2009-2010 (Zurc & Skela-Savič, 2011).

Description of the research instrument

A structured questionnaire titled 'Intergenerational cooperation in health promotion: Questionnaire for respondents aged 65 years or more — dietary and physical activity patterns' was developed based on literature (Hirvensalo, et al., 2000; Denny, 2008; Gandy,

2009). The questionnaire included the following three sections: socio-demographic factors (five questions), physical activity patterns (ten questions), and dietary habits (nine questions). All questions were closed-ended.

Prior to administration, the questionnaire was pilot tested on a convenience sample of members from a local centre for retired people. Following pilot testing, minor adjustments were made to simplify the wording of some questions and to improve the format by making the questions more transparent. Cronbach's alpha value for internal consistency of the questionnaire was 0.802, indicating that the collected data were reliable.

Description of a sample

A non-randomized convenience sample of elderly community-dwelling individuals from the Gorenjska and Central Slovenia regions was recruited for the research. In their home towns, Faculty of Health Care Jesenice students visited accessible participants in a home setting, where the surveys were conducted.

The sample population consisted of 218 elderly individuals (56.9 % females and 43.1 % males). In age group distribution, almost half of the participating elders (44.5 %) belonged to the 65-70 year group, followed by the 71-76 year group (29.8 %), 77-82 year group (17.0 %), 83-88 year group (6.9 %), and, finally, the group with those over the age of 89 (1.8 %). Regarding educational levels, most participants had a primary school education (37.5 %) or a three-year vocational school degree (36.1 %), followed by a four-year secondary school degree (20.8 %) and, in 5.6 % of cases a higher-education degree. In terms of the area of residence, over half of the participants (52.8 %) came from a rural area, followed by urban areas and suburban areas in 26.1 % and 21.1 % of cases, respectively.

Description of the research procedure

The surveys were conducted in the home settings of the participating elderly from October through December 2009. All data collections were conducted by the Faculty of Health Care Jesenice students enrolled in the first-cycle nursing programme.

The study was conducted according to the guidelines laid down in the Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects and in the Slovenian Nurses' Code of Ethics. The collection and protection of personal data was performed in accordance with the provisions of the Personal Data Protection Act of the Republic of Slovenia (Zakon o varstvu osebnih podatkov, 2007). Data collection was implemented in accordance with the principles of research ethics on an anonymous and voluntary basis.

Description of data analysis

The obtained data were analysed using SPSS version 20.0 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics calculations were carried out for all variables. For computing significant differences in dietary habits and physical activity patterns among the elderly according to selected socio-demographic factors a bivariate statistical comparison was employed such as chi-square test, an independent samples *t*-test, and one-way ANOVA. To establish clusters of the elderly with homogenous dietary and physical activity patterns, multivariate cluster analysis - specifically, hierarchical cluster analysis - was used (Ward's method, Euclidean distance, dendrogram) (Ferligoj, 2011). The differences between obtained clusters were tested with one-way ANOVA. $p \leq 0.05$ was set as the level of statistical significance.

Results

Among the elderly aged 65 years or more, the majority (83.1 %) self-reported having good dietary habits, and only 16.9 % claimed their dietary habits were poor (Table 1). Four meals (30.5 %) or three meals (29.3 %) per day prevailed, with a meal lasting, on average, 10-20 minutes (52.1 %) or 20-30 minutes (30.5 %). Results further indicate that the participating elders prefer meat (18.8 %), vegetables (17.8 %), potatoes (16.8 %) and fruit (16.1 %), but not sweets (5.5 %) or fish and seafood (5.4 %). In terms of average fluid intake per day, one in two respondents (49.1 %) reported drinking 1-2 litres of fluid per day, and more than one in three (37.3 %) reported their daily fluid intake as half a litre to one litre per day. Of the 23 participants (13.9 %) who reported following a special diet, one in two (52.3 %) adhered to a diabetic diet, followed by a low cholesterol diet (26.1 %), a high-protein diet (8.7 %), a low-fat, low-salt and low-sugar diet, a gout diet and a gastric diet (8.7 %).

Regarding dietary habits among the elderly, the bivariate statistical analysis revealed significant differences for all four socio-demographic factors (Table 1). With respect to educational level, the elders with a primary school education or a four-year secondary school degree expressed a significantly higher conviction that diet was connected with health compared to their counterparts with a vocational school degree ($p = 0.043$). Male participants indicated a preference for meat, potatoes and sweets, unlike female participants, who preferred vegetables. The results were significant, at a level of below 1 %. A preference for vegetables ($p = 0.001$) and fruit ($p = 0.021$) emerged among the elderly living in rural areas. Participants with higher education reported a significantly higher preference for pasta ($p = 0.004$) and fish/seafood ($p = 0.012$).

Table 1: *Dietary habits among the elderly according to socio-demographic differences in gender, age, educational level and area of residence*
Tabela 1: *Prehranske navade starostnikov glede na socialnodemografske razlike spol, starost, izobrazba in okolje bivanja*

Dietary habits/ Prehranske navade	Number (%) of respondents/ Število (%) udeležencev	Gender/Spol	Age/ Starost	Educational level/ Nivo izobrazbe	Area of residence/ Bivalno okolje
Opinion of dietary habits		$\chi^2(p)$	$\chi^2(p)$	$\chi^2(p)$	$\chi^2(p)$
I don't have good eating habits	22 (16.9)	1.103 (0.294)	3.412 (0.332)	2.851 (0.415)	5.480 (0.065)
I have good eating habits	108 (83.1)				
Diet is connected with health					
I disagree	2 (1.3)	1.525 (0.217)	6.534 (0.088)	8.125 (0.043)	1.245 (0.537)
I agree	154 (98.7)				
What foods do you prefer to eat?					
Meat	105 (18.8)	16.401 (0.001)	1.680 (0.641)	4.419 (0.220)	0.614 (0.736)
Vegetables	100 (17.8)	7.065 (0.008)	3.729 (0.292)	2.711 (0.438)	20.299 (0.001)
Potatoes	94 (16.8)	8.123 (0.004)	2.230 (0.526)	0.632 (0.889)	5.936 (0.051)
Fruit	90 (16.1)	3.260 (0.071)	4.181 (0.243)	2.596 (0.458)	7.690 (0.021)
Dairy products	69 (12.3)	3.037 (0.219)*	12.800 (0.046)*	3.196 (0.784)*	6.495 (0.165)*
Pasta	41 (7.3)	0.139 (0.709)	7.162 (0.067)	13.123 (0.004)	2.844 (0.241)
Sweets	31 (5.5)	8.877 (0.003)	1.794 (0.616)	4.463 (0.216)	0.553 (0.759)
Fish and seafood	30 (5.4)	1.326 (0.250)	1.919 (0.589)	10.966 (0.012)	0.209 (0.901)
Special diet requirements					
No	143 (86.1)	2.528 (0.112)	0.749 (0.862)	6.534 (0.088)	2.911 (0.233)
Yes	23 (13.9)				
Food purchase location					
Shopping centre	112 (69.2)				
Farmers' market	8 (4.9)	2.002 (0.368)	15.869 (0.014)*	7.205 (0.302)*	9.508 (0.050)
Homegrown	42 (25.9)				
Average food cost per month					
Less than 100 EUR	79 (48.2)				
100-150 EUR	74 (45.1)	1.043 (0.594)	5.654 (0.463)*	9.041 (0.171)*	6.562 (0.161)
Over 150 EUR	11 (6.7)				
Number of meals per day		*t (p)*	*F (p)*	*F (p)*	*F (p)*
Two	25 (15.0)				
Three	49 (29.3)	1.632 (0.105)	0.793 (0.499)	0.728 (0.537)	2.862 (0.060)
Four	51 (30.5)				
Five	42 (25.1)				
Average meal time					
Less than 10 min	20 (12.0)				
10-20 min	87 (52.1)	0.744 (0.458)	1.420 (0.239)	2.391 (0.071)	1.002 (0.369)
20-30 min	51 (30.5)				
More than 30 min	9 (5.4)				
Fluid intake per day					
Less than half a litre	6 (3.7)				
Half a litre to 1 litre	60 (37.3)	-1.043 (0.299)	4.692 (0.004)	2.856 (0.039)	0.942 (0.392)
1-2 litres	79 (49.1)				
Over 2 litres	16 (9.9)				

*Legend/Legenda: $\chi^2(p)$ – chi-square test/test hi-kvadrat; t(p) – independent samples t-test/t-test za neodvisne vzorce; F(p) – one-way ANOVA/enofaktorska analiza variance; * – Chi-square test is accepted with reservation: more than 20 percent of cells had an expected count of less than 5 and the minimum expected count was less than 1./Rezultat testa hi-kvadrat se sprejema z zadržkom: več kot 20,0 % celic je imelo pričakovano frekvenco manjšo od 5 in najmanjša pričakovana frekvenca je bila manjša od 1*

Table 2: *Physical activity patterns among elderly according to socio-demographic differences in gender, age, educational level and area of residence*
Tabela 2: *Gibalna aktivnost starostnikov glede na socialnodemografske razlike spol, starost, izobrazba in okolje bivanja*

Physical activity patterns/ Gibalne aktivnosti	Number (%) of respondents/ Število (%) udeležencev	Gender/ Spol	Age/ Starost	Educational level/ Nivo izobrazbe	Area of residence/ Bivalno okolje
Frequency of PA (at least 30 min)		*t (p)*	*F (p)*	*F (p)*	*F (p)*
1-2 times a week	51 (31.5)				
3-4 times a week	45 (27.8)	1.324 (0.187)	0.413 (0.744)	1.210 (0.308)	2.053 (0.132)
Every day	50 (30.8)				
Physically inactive	16 (9.9)				
Duration of single PA intervention					
Less than 15 min	24 (15.6)				
15-30 min	69 (44.8)	-0.073 (0.942)	0.292 (0.831)	2.025 (0.113)	0.052 (0.949)
30-60 min	34 (22.1)				
More than 60 min	27 (17.5)				
Self-evaluation of sufficient PA to remain healthy		$\chi^2 (p)$	$\chi^2 (p)$	$\chi^2 (p)$	$\chi^2 (p)$
I am not physically active enough	64 (39.5)	0.742 (0.389)	1.106 (0.776)	5.399 (0.145)	1.284 (0.526)
I am physical active enough	98 (60.5)				
PA form					
Non-organized PA: individual, with friends or family members	150 (96.2)	0.300 (0.584)	13.309 (0.004)	1.490 (0.685)	0.772 (0.680)
Organised PA with professional supervision	6 (3.8)				
PA mode					
Walking	104 (51.7)	1.026 (0.311)	0.842 (0.839)	2.306 (0.511)	1.029 (0.598)
Garden work	62 (30.9)	4.909 (0.027)	5.054 (0.168)	2.644 (0.450)	7.714 (0.021)
Hiking	16 (7.9)	1.035 (0.309)	11.060 (0.011)	9.546 (0.023)*	5.144 (0.076)
Dancing	9 (4.5)	/	/	/	/
Bicycling	7 (3.5)	/	/	/	/
Swimming	3 (1.5)	/	/	/	/
PA during the times of day					
Before 8 a.m.	20 (12.6)				
8-12 a.m.	75 (47.5)				
12-4 p.m.	41 (25.9)	6.546 (0.162)	19.561 (0.076)*	13.943 (0.304)*	8.910 (0.350)*
4-8 p.m.	20 (12.6)				
After 8 p.m.	2 (1.3)				
PA environment					
Outdoors	152 (93.8)	0.844 (0.358)	6.966 (0.073)*	0.803 (0.849)*	3.938 (0.140)
Indoors	10 (6.2)				
Sports equipment used					
Bicycle	29 (38.2)				
Nordic walking poles	36 (47.4)				
Ball	3 (3.9)	2.930 (0.403)*	9.467 (0.395)*	9.515 (0.391)*	2.398 (0.880)*
Elastic band, gymnastics bars	4 (5.3)				
Working tools	2 (2.6)				
Stationary bicycle	2 (2.6)				
Reasons for physical inactivity					
Lack of time	3 (13.0)				
Illness	12 (52.2)	5.433 (0.143)	6.082 (0.732)*	7.341 (0.290)*	5.947 (0.429)*
Lack of motivation	3 (13.0)				
Lack of company	5 (21.8)				

Encouragement for PA

Friends	22 (15.6)				
Family members	65 (46.1)				
Health care professionals	18 (12.8)	11.312 (0.023)	8.776 (0.722)	8.869 (0.714)*	8.268 (0.408)
Centre for retired people	11 (7.8)				
Self-motivation	25 (17.7)				

*Legend/Legenda: χ²(p) – chi-square test/test hi-kvadrat; t(p) – independent samples t-test/t-test za neodvisne vzorce; F(p) – one-way ANOVA/enofaktorska analiza variance; * – Chi-square test is accepted with reservation: more than 20 percent of cells had an expected count of less than 5 and the minimum expected count was less than 1./Rezultat testa hi-kvadrat se sprejema z zadržkom: več kot 20,0 % celic je imelo pričakovano frekvenco manjšo od 5 in najmanjša pričakovana frekvenca je bila manjša od 1.; PA – physical activity/gibalna aktivnost; / – Statistical significance could not be computed due to low frequency./Zaradi nizke frekvence izračun testa statistične značilnosti ni bil možen*

Further, a significant negative correlation was established between a preference for dairy products and older age ($p = 0.046$). Regarding fluid intake per day, a significant negative correlation for age ($p = 0.004$) and a significant positive correlation for educational level ($p = 0.039$) were computed. Finally, food purchasing locations differed significantly according to age ($p = 0.014$) and area of residence ($p = 0.050$), with advanced age and residence in a rural area correlating negatively with purchasing food at shopping centres and positively with producing home-grown foods.

More than half of the elderly (60.5 %) self-reported having sufficient level of physical activity to remain healthy (Table 2). Similarly, 58.6 % of participants reported engaging in physical activity three times a week or more. One in ten participants ($n = 16$) reported being sedentary. Primarily, the duration of a single physical activity intervention was 15-30 minutes (44.8 %), followed by 30-60 minutes (22.1 %).

Non-organised physical activity was the most frequent form of physical activity (96.2 %), performed either individually or with friends and family. In terms of popularity, walking was the preferred physical activity mode among the elderly (51.7 %). Thus, the outdoor natural environment was the overwhelmingly favoured environment for conducting physical activity (93.8 %). Commonly reported reasons for physical inactivity were illness (52.2 %) and lack of company (21.8 %). Most of the encouragement for physical activity came from family members (46.1 %).

Bivariate statistical comparison revealed significant differences among the elderly for all four socio-demographic factors (Table 2). In terms of physical activity mode, a preference for gardening was noted in female elders ($p = 0.027$) and participants residing in rural areas ($p = 0.021$), whereas hiking was preferred by younger ($p = 0.011$) and more educated elders ($p = 0.023$).

Table 3: *Means ($\overline{x}$) and standard deviations (s) for elderly dietary and physical activity variables for each separate Ward's hierarchical cluster*
Tabela 3: *Povprečne vrednosti ($\overline{x}$) s standardnimi odkloni (s) spremenljivk prehranskih in gibalnih navad starostnikov po posameznih skupinah, pridobljenih z Wardovo metodo hierarhičnega združevanja v skupine*

PA patterns-dietary habits/ Gibalna aktivnost in prehranske navade	Total sample $\overline{x}$ (s)	CLU1 $\overline{x}$ (s)	CLU2 $\overline{x}$ (s)	CLU3 $\overline{x}$ (s)	F (p)
Opinion of dietary habits	1.83 (0.38)	2.00 (0.00) +	2.00 (0.00) +	1.42 (0.50) --	58.012 (<0.001)
Diet is connected with health	1.99 (0.11)	2.00 (0.00)	2.00 (0.00)	1.94 (0.25)	2.889 (0.060)
Number of meals per day	2.67 (1.01)	2.89 (0.92) +	2.54 (0.93)	2.68 (1.14)	1.312 (0.273)
Average meal time	3.29 (0.79)	3.47 (0.61) +	3.20 (0.70)	3.16 (0.78)	2.151 (0.121)
Fluid intake per day	2.65 (0.71)	2.89 (0.62) +	2.58 (0.61)	2.61 (0.62)	2.922 (0.058)
Special diet requirements	1.14 (0.35)	1.00 (0.00)	1.02 (0.14)	1.42 (0.50) +	25.373 (<0.001)
Average food cost per month	1.57 (0.61)	1.78 (0.64) +	1.38 (0.49) -	1.90 (0.65) ++	9.145 (<0.001)
Self-evaluation of sufficient PA to remain healthy	1.60 (0.49)	2.00 (0.00) ++	1.48 (0.51)	1.52 (0.51)	18.070 (<0.001)
Frequency of PA	2.80 (0.99)	3.53 (0.65) ++	2.58 (0.73) -	2.97 (0.98) +	15.285 (<0.001)
Duration of single PA intervention	2.42 (0.96)	3.31 (0.75) ++	2.16 (0.68) -	2.32 (0.95)	24.534 (<0.001)
PA form	1.04 (0.19)	1.00 (0.00)	1.00 (0.00)	1.16 (0.37)	8.057 (0.001)
Sum of mean deviations in cluster based on total sample mean		+2.87	-1.06	+0.10	

Legend/Legenda: F(p) – one-way ANOVA/enofaktorska analiza variance; PA – physical activity/ gibalna aktivnost; CLU – cluster/skupina

A negative association at the 1 % level of statistical significance was established between advanced age and inclusion in organised physical activities. Regarding gender, significant differences were revealed in encouragement for physical activity ($p = 0.023$), with females receiving encouragement mainly from friends, family members and centres for retired people, unlike male elders, who mainly received encouragement from family members and health care professionals.

Three major, distinct clusters of elderly participants emerged in a dendrogram of Ward's hierarchical cluster analysis, according to their dietary habits and physical activity patterns (Table 3). The results of variable means for each cluster were ranked on a four-point scale according to the deviation from the total sample mean (Ferligoj, 2011): ++ deviation from the mean > 0.30, + deviation from the mean > 0.15, - deviation from the mean < 0.15, -- deviation from the mean < 0.30).

Cluster 1 was characterised by above-average scores in almost all variables, with the sum of mean deviations exceeding the total sample mean by 2.87 points (Table 3). Overwhelmingly higher than average scores were computed in self-reported sufficient physical activity to remain healthy, frequency of physical activity, and duration of single physical activity intervention. Moreover, the elders grouped into cluster 1 were characterised by a higher than average score in the opinion of dietary habits, the number of meals per day, the average meal time, fluid intake per day, and the average food cost per month. In addition, the elders in cluster 1 did not have any special diet requirements, and they expressed a strong conviction that diet was connected with good health. Thus, cluster 1 was named 'Health Consciousness'.

In contrast, cluster 2 was characterised by below-average scores in almost all variables, with the sum of mean deviations falling short of the total sample mean by 1.06 points (Table 3). In particular, elders grouped in cluster 2 came in below the average in food cost per month, the frequency of physical activity, and the duration of single physical activity intervention. Contrary to their actual dietary habits, the elders in cluster 2 self-reported an above-average opinion of dietary habits and an opinion that diet was connected with good health. Based on these characteristics, cluster 2 was named 'Being At Risk'.

Finally, approximately a quarter of participating elders (26.5 %) was grouped in cluster 3 (Table 3). Above-average results in cluster 3 were reported for the average food cost per month, special diet requirements and frequency of physical activity, whereas the opinion of dietary habits was overwhelmingly below average. This cluster is characterised by special diet requirements influencing diet-related health efforts of corresponding elderly participants, which is why this cluster was named 'Special Requirements'.

Self-reported good dietary habits were significantly higher in clusters 1 and 2 compared to cluster 3 (Table 3). The 'Special Requirements' cluster was characterised by significantly higher adherence to special diet requirements, the average food cost per month, and participation in organised sports or physical activity. Regarding the frequency of physical activity and duration of single physical activity intervention, significantly higher scores were found in cluster 1 compared to other clusters.

Discussion

The results of our research were, compared with other similar studies (Hirvensalo, et al., 2000; Maynard, et al., 2005; Denny, 2008; Hlastan-Ribič, 2008; Gandy, 2009; Tourlouki, 2009; Barnett, et al., 2012), particularly outstanding in terms of the prevailingly good dietary habits and physical activity patterns of the elderly. Most participants reported having the recommended 3-4 meals per day, and their average meal time was also appropriate. However, we should not disregard the 15 % of elders who have only two meals per day — this group is at higher risk for malnutrition, identified by Nykänen and colleagues (2013). Overall, meat was the preferred food type in both male and female participants. A preference for fish was associated with a higher educational level, whereas elders from rural areas reported a preference for fruit and vegetables. Our findings are compatible with results of a previous study conducted by Tourlouki and colleagues (2009) regarding a high preference for meat in the elderly and a negative correlation between fish consumption and advanced age, possibly as a result of limited financial resources. This was pointed out by the authors of this Mediterranean diet study as fish tend to be a more expensive food choice.

The results for physical activity levels of participating elders revealed that out of the 60 % elders who reported having sufficient level of physical activity, only half of them met the levels of daily physical activity recommended by the World Health Organization (2010) and the American College of Sports Medicine (Nelson, et al., 2007), according to their self-reported physical activity levels. Nevertheless, over three quarters of participating elderly met the World Health Organization (2010) recommendations for single physical activity intervention duration of at least 10 minutes. In contrast, 10 % of participants reported being physically inactive. The expected outcomes for these groups of elderly, compared to their peers who engage in physical activity on a regular basis, include more rapid ageing processes, a decline in overall physical functions, and a loss of motor abilities (Hirvensalo, et al., 2000). Accordingly, accessible organised physical activity should be made available during that time. Only 4 % of elderly reported participating in organised physical activity.

Ward's hierarchical cluster analysis yielded three

major separate clusters of elders aged 65 years or more with homogeneous dietary habits and physical activity patterns. Cluster 1 ('Health Consciousness') was characterised by good dietary habits and regular physical activity patterns. In contrast, cluster 2 ('Being At Risk') was characterised by below-average scores for dietary habits and physical activity patterns, but participants grouped in this cluster nevertheless self-reported having good dietary and physical activity habits. Cluster 3 was characterised by special diet requirements and the resulting higher average food cost per month. These findings are compatible with previous research results by Schneider and colleagues (2009), who employed cluster analysis on a sample of German elderly aged 50-70 years. Here, five homogenous clusters of elderly with distinct health behaviour patterns were identified. The first cluster was 'No risk behaviours' and is comparable to our cluster 1 ('Health Consciousness'). The second and third clusters, 'Physically inactive' and 'Fruit and vegetable avoiders' are comparable to our cluster 2 ('Being At Risk').

A limitation in generalising our results is using a non-randomized convenience sample of elderly individuals, as reflected in the socio-demographic sample structure which is dominated by younger elderly aged 65-76 years, elderly with a primary school education or secondary school education, and those living at home. Thus, our empirical survey makes generalisation of results difficult, but it is the first Slovenian study employing cluster analysis to identify significant dietary habits and physical activity patterns among the elderly. It therefore contributes to the understanding and knowledge of behaviour patterns in old age. To understand the stability and change dimensions of dietary habits and physical activity patterns throughout the old age period, a greater number of elderly adults aged over 77 years would have to be included in the survey and a longitudinal study on a representative sample would have to be conducted again on the elderly of different age groups.

Conclusion

In our study, three homogenous dietary and physical activity patterns among the elderly were found. These provide useful starting points for planning targeted health promotion programmes aimed at different groups of the elderly. Special attention should be given to the 'being at risk' elderly group characterised by the elderly group with special dietary and exercise regimen requirements.

Future research in this area calls for a comprehensive investigation on lifestyle behaviours among the elderly in connection with multiple risk factors on representative population samples. Appropriate policies, targeted health promotion and educational programmes, and a supportive setting can all significantly contribute to better dietary and physical activity habits among Slovenian elderly, and, consequently, improve and maintain their overall health.

Acknowledgments

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