Original Research / Orijinal Araştırma

Relationship Between Obesity and Cognitive Functions of Individuals Aged 65 Years and Above Living in a Residential Home

Huzurevinde Yaşayan 65 Yaş ve Üzerindeki Bireylerde Obezitenin Bilişsel Fonksiyonlar ile İlişkisi

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Abstract

Objectives: Cognitive functions are one of the crucial factors affecting the quality of life of the elderly and are affected by factors like age, gender, socio-economic level, and comorbidity. Some studies indicate that obesity can also affect them. This study aims to demonstrate the relationship between cognitive functions and obesity. Methods: A questionnaire including the participants' socio-demographic characteristics, past obesity history and also Standardized Mini-Mental State Examination (MMSE), neuropsychological tests evaluating memory, attention, and executive functions (Stroop Test, Three words-Three Shapes Test, Digit Span Test), were applied to 315 elderly living in Narlidere Residential and Nursing Home. Besides weight, height, and waist circumference of the participants were measured. Results: According to the assessments performed with MMSE and neuropsychological tests, 107 elderly were classified as cognitive impairment and 208 were as cognitively normal. Sociodemographic characteristics of the elderly were similar except for age, as the mean age of cognitive impairment (79.49±7.06) was higher than cognitively normal (76.25±7.38) and it was significant ($p<0.001$). Past obesity history was significantly higher in the cognitive impairment ($p<0.001$). There was also a statistically significant relation between cognitive impairment, aging (age 85≥ yearsoddss ratio [OR], 3.95; %95 confidence interval [CI] 1.52-10.26) and obesity history ([OR], 9.15; %95 [CI], 5.25-15.93) in logistic regression model. Conclusion: It is important to indicate the risk factors of dementia. Family physicians evaluating obese patients should take action for the maintenance of cognitive functions and healthy aging.

Key words: cognitive functions, elderly, obesity, primary care.

Özet

Amaç: Bilişsel fonksiyonlar yaşlıların yaşam kalitesini etkileyen en önemli faktörlerden biridir. Bilişsel fonksiyonlar yaş, cinsiyet, sosyoekonomik düzey, komorbid hastalıklar gibi faktörlerden etkilenmektedir. Günümüzde yapılan bazı çalışmalar obezitenin de bilişsel fonksiyonları etkileyebileceğini işaret etmektedir. Bu çalışmada, 65 yaş ve üstü bireylerin bilişsel fonksiyonları ile obezite durumları arasındaki ilişkinin ortaya konulması amaçlanmıştır. Yöntem: Bu çalışma Narlıdere Huzurevi Yaşlı Bakım ve Rehabilitasyon Merkezi'nde kalan 65 yaş ve üzerinde 315 bireyle tamamlanmıştır. Katılımcıların kilo, boy, bel çevresi ölçümleri yapılarak kaydedilmiş, Standardize Mini Mental Teste ek olarak katılımcıların dikkat, hafıza, yürütücü bilişsel fonksiyonlarını değerlendiren Stroop Test, WMS-V Sayı Menzili Testi, Üç Kelime Üç Şekil Testi, Geriyatrik Depresyon Ölçeği, Günlük Yaşam Aktiviteleri Testi , Enstrümental Günlük Yaşam Aktiviteleri Testi ve araştırmacı tarafından hazırlanan, katılımcının sosyodemografik özelliklerini ve geçmiş obezite öyküsünü içeren anket formu yüz yüze uygulanmıştır. Bulgular: Standardize Mini Mental Test ve nöropsikolojik test sonuçlarına göre 107 katılımcı "bilişsel fonksiyonları azalmış" ve 208 katılımcı "bilişsel fonksiyonları normal" gruplarına ayrılmıştır. Her iki grupta katılımcıların sosyodemografik özellikleri yaş haricinde benzer bulunmuştur. Bilişsel fonksiyonlarda azalma olan gruptaki katılımcıların yaş ortalaması (79.49±7.06), bilişsel fonksiyonları normal olan gruptaki katılımcıların yaş ortalamasından (76.25±7.38) yüksek bulunmuştur ve bu fark istatistiksel olarak anlamlıdır ($p<0.001$). Bilişsel fonksiyonlarda azalma olan grupta geçmiş obezite öyküsü olanların oranı yüksek bulunmuştur ve bu fark istatistiksel olarak anlamlıdır ($p<0.001$). Lojistik regresyon modelinde bilişsel fonksiyonlarda azalma ile yaş (85≥ yaş odss oranı [OR]-_3.95; %95 güven aralığı [GA] 1.52-10.26) ve geçmiş obezite öyküsü- ([OR]- 9.15; %95güven aralığı [GA] 5.25-15.93) arasında anlamlı ilişki bulunmuştur. Sonuç: Günümüzde demansı tetikleyen faktörlerin açığa çıkarılması önemlidir. Birinci basamak hekimleri obez hastaları değerlendirirken, bilişsel fonksiyonları korumaya ve sağlıklı yaşlanmaya yönelik tedbirler almalıdır.

Anahtar kelimeler: kognitif fonksiyonlar, yaşlı, obezite, birinci basamak.

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Introduction

Aging and absolute number and percentage of elderly aged 65 years and above increases in Turkey. In 2014, they constituted 8% of the population and they were estimated as 10% in 2025.[1] It is generally recognized that prolongation of life expectancy and increase the in elderly population will result in an increase of the incidence of chronic diseases.[2] One of these chronic diseases known to affect mortality and morbidity is obesity. As well-known, obesity has cardiovascular, and endocrine complications but also it is thought to contributethe to dementia so that it impairs quality of life and increases mortality risk in the elderly.[3] Considering the fact that incidence and prevalence of dementia are high in the elderly, the answer to the question of whether it occurs as a complication of obesity or a physiological part of the aging process is significant for clinical practices, early phase treatment, and community health .[4]

As dementia progresses, cognitive impairment, loss of autonomy, and behavioral problems are seen. Cognitive impairment that does not exceed the border of dementia, mainly a transition area between normal and dementia, is named 'mild cognitive impairment'. When mild cognitive impairment develops in a person, then his/her risk for developing dementia increases.[5,6] Prevalence of mild cognitive impairment (MCI) ranges from 3 to 19% in adults older than 65 years. There are studies assessing the relation of obesity with cognitive functions in different ways. One of these studies determined an increase in the risk of dementia in individuals above the age of 50 with a body mass index (BMI) >30 compared to normal weights.[7] In an 18-year follow-up study, it was demonstrated that increased BMI at the age of 70 increased dementia risk.[8]

Determining complications of obesity and its effects on cognitive functions and the dementia process is significant, especially for primary prevention. For this reason, an association of cognitive functions with obesity in elderly individuals should be studied and this is the first large-scale study on this topic in Turkey.

Materials and Methods

1. Study design and population

The research was planned as a descriptive cross-sectional study and participants aged 65 years and above were recruited from Narlidere Residential and Nursing Home. The study population included the elderly who live in the residential home and who can perform daily living activities and take care of themselves. Exclusion criteria were being below 65 years of age (as legally institution admits elderly aged 60 years and above), living at the nursing home part of the facility, mental dysfunction, learning difficulty, sensory dysfunction, and being at risk of depression according to the geriatric depression scale (as this needs differential diagnosis for cognitive dysfunction) and mid-advanced stage dementia diagnosed before the study.[9]

2. Data collection

Ethical approval was obtained from Dokuz Eylul University Non-invasive Studies Ethics Committee while written official permission was obtained from the Ministry of Family and Social Policies. A statement explaining the aim of the study and a written informed consent form were given to all participants and their consents were obtained. A questionnaire including socio-demographic characteristics, geriatric depression scale, Standardized Mini-Mental State Examination, neuropsychological tests (Wechsler Adult Intelligence Scale, Revised, Stroop test, 3 words 3 shapes test), Activities of Daily Living and Instrumental Activities of Daily Living tests were filled out by the researcher by face-to-face interviews. The weight, height, and waist circumference of the participants were also measured and recorded. The World Health Organization (WHO) classification according to BMI and waist circumference was used as obesity definition. A BMI ≥30, waist circumference above 102 cm in men and above 88 cm in women were classified as obese, was taken as the limit value.[10] 'Past history of obesity' was the hardest issue to ask as for this generation culturally and socially obesity is an acceptable and most of the time appreciated feature. So BMI formula while accepting BMI is at least 30.0 was used to calculate the weight for each participant and they were asked 'whether they had ever weight this calculated weight and above during their adulthood'. If their answer was 'Yes' then they were accepted as having an 'obesity history'.

3. Survey Instruments

For the assessment of cognitive functions Standardized Mini-Mental State Examination (SMMSE) test and neuropsychological tests were used. SMMSE was performed to assess comprehensive cognitive function including orientation, memory recall, and calculation ability.[11]

Attention and concentration were also assessed by digit span tests of the Wechsler Adult Intelligence Scale, Revised (WAIS-R).[12] Stroop test was performed to assess attention and mental control, withstanding deteriorating effect of automatic process and changing the perception target in line with the changing demands.[13] For the assessment of oral-visual memory processes and non-oral material in the same modality, 3 words 3 shapes test was used.[14]

Activities of daily living (ADL) and instrumental activities of daily living (IADL) tests were applied to the participants for the evaluation of functional dependency on daily activities.[15]

4. Statistical Analysis

Statistical Package for Social Sciences (SPSS) version 15.0 was used for statistical analysis. Chi-square test was used to compare rates in binary analysis for the relationthe between dependent variable and independent variable, t test was used to compare means and logistic regression model was used for multivariable analysis. Statistically significant p value was accepted as <0.05.

Results

1. Study Groups and Characteristics of Study Subjects

We recruited 390 elderly residents of Narlidere Residential and Nursing Home, however as 75 of them scored ≥ 6 from the geriatric depression scale, the study was completed with thorough cognitive assessments of 315 elderly residents. Cognitive assessment results are given in Table 1. According to these assessments done with SMMSE, Stroop test, digit span test, 3 words 3 shapes test 107 elderlies were classified as cognitive impairment and 208 were as cognitively normal.

Table 1. Distribution of cognitive assessment by the results of SMMT and neuropsychological tests

		n	(%)
SMMT	24-30 points	263	(67.44)
	18-23 points	118	(30.26)
	17 points and below	9	(2.31)
WMS-5			
Simple attention (forward number group)	Deterioration	177	(56.19)
	No deterioration	138	(43.81)
Complex attention (forward-backward number group)	Deterioration	300	(95.24)
	No deterioration	15	(4.76)
Three words three shapes test			
Short-term memory	Deterioration	59	(18.73)
	No deterioration	256	(81.27)
Long-term memory	Deterioration	276	(87.62)
	No deterioration	39	(12.38)
Recognition	Deterioration	140	(44.44)
	No deterioration	175	(55.56)
Stroop test	Inhibition control	79	(25.08)
	No inhibition control	236	(74.92)

Values are presented as number (%),
SMMT: Standardised Mini Mental Test,
WMS: Wechsler Memory Scale

The mean age of the cognitive impairment group was 79.49±7.06 years while the mean age of the cognitively normal group was 76.25±7.38. The mean age of the cognitive impairment group was higher than the cognitively normal group and this difference was found to be statistically significant ($p<0.001$). Comparisons of cognitive impairment and cognitively normal groups are given in Table 2. A statistically significant difference was not found for sex ($p=0.273$), educational level ($p=0.207$), marital status ($p=0.223$), monthly income ($p=0.701$), profession ($p=0.322$), and term of stay at the residential home ($p=0.152$) between cognitive impairment and cognitively normal groups. While hypertension frequency observed in the cognitive impairment group was 70.1% (n=75), it was 80.8% (n=168) in the cognitively normal group ($p=0.033$). There was not a statistically significant difference in terms of diabetes ($p=0.499$), renal failure ($p=0.298$), thyroid dysfunction between cognitive impairment and cognitively normal groups ($p=0.745$). The cognitive impairment group 15% (n=15) and 13% of cognitively normal group (n=27) used regular medicine due to their psychiatric problems but it wasn't statistically significant ($p=0.797$).
There was no difference in the cognitive impairment and cognitively normal groups in ADL and IADL indexes measuring self-care sufficiency level of participants ($p=0.122$).

Table 2. Distribution of cognitive impairment and cognitively normal groups by socio-demographic features, profession, and term of staying at the residential home

		Cognitive impairment		Cognitively normal		p-value
		n	(%)	n	(%)	
Sex	Man	45	(42.1)	101	(48.6)	0.273
	Woman	62	(57.9)	107	(51.4)	
Educational level	Primary school	38	(35.5)	56	(26.9)	0.207
	High school	40	(37.4)	79	(38)	
	University-master	29	(27.1)	73	(35.1)	
Marital status	Single	15	(14)	24	(12)	0.223
	Married	41	(38.3)	101	(48.6)	
	Widowed	51	(47.7)	82	(39.4)	
Monthly income	1500 TL and below	7	(6.5)	19	(9.1)	0.701
	1501-3000 TL	61	(57)	112	(53.8)	
	3001 TL and above	39	(36.4)	77	(37)	
Profession	Housewife	31	(29)	55	(26.4)	0.322
	Civil servant (Bank employee, accountant, teacher)	65	60.7	115	(55.3)	
	Senior civil servant (Engineer, doctor, judge)	5	4.7	19	(9.1)	
	Soldier	6	5.6	19	(9.1)	
Term of stay at the residential home	1-5 years	59	55.1	130	(62.5)	0.152
	6-10 years	32	29.9	61	(29.3)	
	11-15 years	16	15	17	(8.2)	

Values are presented as number (%). P value from x^2 *test*

2. Association of Obesity and Cognitive Functions

Comparison of current BMI, waist circumference measurements, and past obesity history of both groups are given in Table 3. There was no significant difference for current BMI (p=0.876) and waist circumference measurements (p=0.244), however, past obesity history was statistically significantly higher in the cognitive impairment group than cognitively normal group (p<0.001).

Table 3. Distribution of cognitive impairment and cognitively normal group by the body mass index, waist circumference and gaining weight identified as obesity in the past (obesity history)

		Cognitive impairment		Cognitively normal		p-value
		n	(%)	n	(%)	
Body mass index (kg/m^2)	18.5-24.9	13	(12.1)	22	(10.6)	0.876
	25-29.9	61	(57)	124	(59.6)	
	30 and above	62	(30.8)	33	(29.8)	
Waist circumference	Normal	39	(36.4)	90	(43.3)	0.244
	Central obesity	68	(63.6)	118	(56.7)	
Gaining weight identified as obesity in the past (obesity history)	Obesity history	71	(66.4)	37	(17.8)	<0.001*
	No obesity history	36	(33.6)	171	(82.2)	

Values are presented as number (%), *P<0.05 (p value from x^2 *test*)

Age, sex, current BMI, waist circumference and past obesity history were added to the model and evaluated with logistic regression analysis. In the last model, only age and past obesity history were found to be significant. According to this model, cognitive impairment risk increased 3,953 times for 85 years old and above taking 65-69 age range as the reference (p=0.005) and 9,15 times (p<0.001) in the event of past obesity history taking no past obesity history as the reference (Table 4).

Table 4. Multi-variable analysis of variables related to cognitive impairment (age groups, gaining weight identified as obesity [obesity history])

		Odds ratio	(%95 confidence interval)		p-value
Age groups	65-69	Reference	-	-	-
	70-74	1.171	(0.444-	3.090)	0.749
	75-79	1.974	(0.727-	5.362)	0.182
	80-84	2.101	(0.840-	5.255)	0.112
	85 and above	3.953	(1.522-	10.269)	0.005*
Gaining weight is identified as obesity (obesity history)	No	Reference	-	-	-
	Yes	9.150	(5.255-	15.931)	<0.001*
Constant		0.112	-	-	-

*P<0.05 (p-value from logistic regression analysis)

Discussion

In this study, the relationship between obesity and cognitive functions in individuals aged 65 years and above was analyzed and it was determined that individuals with cognitive impairment more frequently identified

themselves as obese in the past than their counterparts. A negative effect of the age on cognitive impairment accompanied this finding.
Physicians should consider the fact that cognitive impairment process occurs depending on the age and chronic condition and it is a risk factor for dementia. In a study assessing 2.313 individuals above the age of 65 without the cognitive disorder, it was determined that advanced age was a leading risk factor for dementia.[16] In this study also, the mean age of the individuals with cognitive impairment was higher than cognitively normal individuals, similarly.

In concordance with the previous studies, we did not find a statistically significant difference in terms of gender for cognitive function loss or dementia risk between the cognitive impairment and cognitively normal groups.[17] Cognitive impairment and cognitively normal groups' sociodemographic features were also similar. There are studies in the literature showing that cognitive functions deteriorate more in individuals being single and with low educational level and monthly income.[18,19] However, these results cannot be supported by our data which can be related to the place of the study. This is a residential home admitting retired civil servants and therefore sociocultural levels of the participants are high and the group is homogenous.

As it is known, one of the significant risk factors of vascular dementia and other dementia is hypertension and, also mid- age hypertension leads to dementia in the advanced age. Studies show controversial results about the relationship between hypertension and dementia in the elderly. In a study conducted in Italy, in 1999 with individuals above the age of 65, a strong relationship between increased blood pressure and vascular dementia was found.[20] In our study, although hypertension is higher in the cognitively normal group, since blood pressure values of these individuals are followed regularly and under control, we think that hypertension does not deteriorate brain perfusion. At this point, it can be considered that an effective follow-up may reduce the risk of dementia due to hypertension.

In our study, no associations can be shown between the cognitive functions of the elderly and their chronic diseases such as diabetes, chronic renal failure, thyroid dysfunction, and psychiatric disorders. In the literature, however, there are studies that showed chronic diseases are the risk factors for dementia.[21,22] At this point, controversy in the literature may depend on different study designs and their sampling procedures, especially. Regular health follow-up of the elderly, having the opportunities to affect the course of chronic diseases positively such as healthy nutrition and regular exercise may affect our results positively. Our study was conducted with a group of whom socio-economic level can be accepted as higher compared to the society. We believe that both follow-up and healthy living behaviors should be emphasized for preventing complications in the event of chronic diseases and protecting health.

Impairment of simple attention processes, recognition by the memory processes, and inhibition control (color-word interference) in the cognitive impairment group compared to the cognitively normal group was statistically significant. In the prospective study conducted in 2015 in the USA with the elderly population, it was revealed that performance of memory processes, managerial functions, and total cognitive functions were the processes affecting Alzheimer's type dementia development in the advanced period.[23]

According to the literature data, it is reported that instrumental activities of daily life covering financial work, use of the telephone, shopping, and driving a car, begin to deteriorate in the event of cognitive function disorders. It is pointed out that deterioration of activities such as eating, wearing, undressing, toileting, and taking a bath included in the activities of daily life become apparent in patients showing more advanced cognitive disorder. In our study, a significant difference was not found between cognitive impairment and cognitively normal groups considering ADL and IADL indexes. It may arise from institutional peculiarities. Most of the individuals staying at this institution are the individuals who have spent their lives working actively and most of them are in the group of mid-high educational and economic levels. These individuals are the ones staying at the residential home and can sustain physical activity despite a number of chronic diseases, sustaining is supported by any way. For this reason, individuals who do not have physical restriction-dependency and maintenance of daily simple physical activities can be associated with not having advanced-level cognitive disorders.

Although no association was found between current BMI, waist circumference measures, and cognitive

functions, elderly with a history of obesity showing low cognitive functions is a remarkable finding. Although the protective effect of adipose tissue is seen in elderly individuals, it appears that being overweight and obese in middle ages increases the risk of dementia as getting older. It should not be ignored that obesity creates vascular damage and cognitive impairment is a chronic and progressive process. This finding is supported by literature data.[24,25] In a study that 2.000 persons participated in England and evaluated mid-age cognitive functions and increase in BMI lifetime, an increase of BMI in the age range of 26-36 was related to the low memory processes and oral fluency scores.[24] In a cohort study carried out for 12 years in the USA, the reduction of dementia test scores was higher for obese participants than normal-weight participants.[25]

The limitation of our study is that it was carried out with an institutional population. Because of this, the results of this study cannot be extrapolated and generalized for the community-dwelling elderly people. Additionally, features of the institution also support this distinction as most of the residents are at a mid-upper level in terms of socio-cultural aspects with similar characteristics (profession, educational level, monthly average income, and daily living activities performed).
In our study, past obesity history was learned based on statements of the elderly. In this case, the memory factor may be a confounding factor. However, it is applicable for both cognitive impairment and cognitively normal groups. On the other hand, based on the memory of the long history deteriorates later; we believe that it does not have a significant effect on the results.

Conclusion

Dementia syndromes, mainly Alzheimer's disease are one of the leading factors affecting the life quality of the elderly population. While hypertension, coronary artery disease and diabetes are the main known risk factors for dementia, the number of studies indicating that obesity might be another risk factor for dementia is increasing. In this study, it was found that 65 years old and above individuals with increasing age and obesity history are at significant risk for dementia. A healthy adulthood period is necessary for healthy aging and at this point, obesity is considered a serious risk factor for advanced age. For this reason, all family physicians should be aware of not only known complications of obesity such as cardiovascular, endocrine, and respiratory system complications but also early period cognitive disorders resulting in a decreasinof cognitive functions and life qualities in the advanced ages and should be attentive about informing and following the patients.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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