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The Association between Body Weight, Mental Flexibility and Dementia among Older Adults

Samia E., Khaton[1], Faten T., Qonsouh[2], Shimaa, SH., Khater[3]
[1]*Assistant professor of Community Health Nursing, Faculty of Nursing, Tanta University, Egypt*
[2] *Assistant professor of Psychology, Faculty of Art, Kafer Elshekh University, Egypt*
[3] *Assistant professor of Psychology, Faculty of Art, Tanta University, Egypt*
Corresponding author :- Dr\ Samia Ebrahim Khaton

Abstract:- *Dementia is a huge public health challenge as the increase in aging rates worldwide in tandem with the increasing rates of dementia incidences. The link between body weight and mental flexibility and development of dementia is a challenge.* ***The aim of the study*** *was to assess and analyze the association between body weight, mental flexibility and dementia among older adults.* ***Subjects and Methods:*** *Analytic cross sectional study design was used in this study. This study was conducted in 7 Residential Elderly Settings and 7 Private Neurological Clinics.* ***249*** *elders were included in the study including two groups, Dementia group (118 elders) and Normal Elderly group (131 elders). Four tools were used; tool I questionnaire sheet contain socio-demographic data and medical history; Tool II Cognitive impairment assessment using Mini–Mental State Examination (MMSE) and Eight-item Interview to Differentiate Aging and Dementia (AD8); Tool III Body Mass Index (BMI) assessment ;Tool IIII:- Mental Flexibility Assessment Using the Trail Making Test (TMT).* ***Results****: dementia group performed significantly poor on MMSE (t=47.499, P=.000) and on AD8 (t=-41.780, P=.000). There was a significant correlation between cognitive function (AD8 and MMSE) and overweight, obesity and mental flexibility (TMT); significantly higher correlation was obtained between MMSE and obesity.* ***Recommendations:*** *The inclusion of weight loss and promoting mental flexibility in any future preventive trials carried out in mid-life to prevent dementia could be supported. Further researches are recommended for investigating the role of mental flexibility in the progress of dementia.*
Key words*: Dementia, cognitive function, Body mass Index, Mental Flexibility.*

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I. Introduction:-

Dementia is a broad category of brain diseases that cause a long term and often gradual decrease in the ability to think and remember that is great enough to affect a person's daily functioning [(1)]. Other common symptoms include emotional problems, problems with language, and a decrease in motivation. The most common type of dementia is Alzheimer's disease, which makes up 50% to 70% of cases [(1,2)]. There were an estimated 46.8 million people worldwide living with dementia in 2015 and this number increased to be close to 50 million people in 2017. These numbers will almost double every 20 years, reaching 75 million in 2030 and 131.5 million in 2050. There are over **9.9 million new cases of dementia each year worldwide**, implying one new case every 3.2 seconds. Much of the increase will be in developing countries. Already 58% of people with dementia live in low and middle income countries, but by 2050 this will rise to 68% [(3,4)].

A systemic review study of the prevalence of dementia in Egypt that done by Elshahidi MH et.al (2017), revealed that, the dementia prevalence among non-hospitalized individuals ranged from 2.01% to 5.07%. Dementia increased with age, with the rapid increase among those aging ≥80. Also, its prevalence was higher among illiterate groups than among educated groups [(5)]. Dementia becomes more common with age. About 3% of people between the ages of 65–74 years, 19% between 75 and 84 and nearly half of those over 85 years of age have dementia. As more people are living longer, dementia is becoming more common in the population as a whole [(6)]. The increase in aging rates worldwide in tandem with the increasing rates of dementia incidences makes dementia a huge public health challenge for the developing countries.

In the early stage of dementia, the person begins to show symptoms noticeable to the people around them. The symptoms of early dementia usually include memory difficulty and problems with planning and organizational skills (executive function). One very good way of assessing a person's impairment is by asking if he or she is still able to handle his/her finances independently. This is often one of the first things to become problematic. Other signs might be getting lost in new places, repeating things, personality changes, social withdrawal and difficulties at work [(7)]. In Middle and late stages of dementia progress, the symptoms first experienced in the early stages generally worsen and the patients cannot usually function outside their own home, and generally

should not be left alone and begin to require assistance for personal care and hygiene other than simple reminders [8].

The first symptoms for older people at risk for dementia are a reduced cognitive capacity reserve. Difficulty multi-tasking and handling complex tasks and lack of mental flexibility are mostly presence with dementia [9]. The executive system is a global system divided in three components and three main executive functions, inhibition of automatic responses, updating the content of working memory, and mental flexibility which is one of the executive functions that refers to the ability to switch between cognitive tasks or mental sets. It prescribed as the mental ability to switch between thinking about two different concepts, and to think about multiple concepts simultaneously. Cognitive flexibility varies during the lifespan of an individual [10,11].

Little studies found to indicate the relation between lack of mental flexibility and development of dementia. Gelberto lyve et. al 2002, indicate in their results that impairment in verbal memory and neuropsychological tests suggestive of executive dysfunction was associated with the development of dementia [12]. Also, Agata Kowalczyk et. al.2012, reported that mental flexibility as measured by Trial Making Test (TMT) were found to be sensitive to cognitive decline in dementia [13].

Underweight, overweight, and obesity have been related to all-cause mortality risk [14] and to various poorer health outcomes [15] but their impact on the risk of dementia remains debated [16]. Indirect evidence has shown an association between western high fat diet and impaired cognitive functions [17].Based on body mass index (BMI) data, individuals who are overweight or obese, fall in the lowest quartile of global cognition, verbal fluency, delayed recall, immediate logical memory, and intelligence [18].

BMI increase is associated with lower metabolic activity in the prefrontal cortex and cingulate gyrus, smaller gray matter volume in many brain regions (particularly prefrontal cortex), and deficient white matter integrity in the uncinated fasciculus which is a structure connecting the frontal and temporal lobes [19–23] . Smaller gray matter volume in the left orbit frontal region is related to poorer executive performance in obese women [22] .

Epidemiological studies addressing the risk of overweight/ obesity and dementia have reported equivocal results, particularly when the risk is considered with regard to the age at which the presence of overweight/obese is assessed. The evidence from different studies is rapidly expanding and has become highly conflicting.

Positive studies, such as a study done by Fitzpatrick et. al 2009 which suggested that obesity in mid-life is related to a greater risk of subsequent dementia [24]. Also, systematic review and meta-regression analysis of 589,649 men and women followed in longitudinal studies done by Emiliano Albanese et. al (2017) indicated that obesity in midlife increases the risk of dementia and the association between underweight and dementia remains controversial [25].

On the other hand, Albanese E.et.al (2015) indicates in their results a nonlinear relationship between overweight and obesity in mid life and dementia [26]. Also, A review by Anstey et. al (2011) did look by at BMI in mid-life and late life reporting that continuous BMI was not associated with dementia in late life, although that due to small numbers of studies the generalisability of the findings was reduced and that additional studies were warranted [27].

Identifying factors that associated with development of dementia may help in conducting proper control and early intervention. **The aim of this study** was to assess and analyze the association between body weight, mental flexibility and occurrence of dementia among older adults.

II. Material and methods

Material:

 Study design: Analytic cross sectional study design was used in this study.

 Setting**: -** in order to get the needed subjects the researchers attend a lot of settings. This study was conducted in

I - **Residential elderly settings**, including

-El-Saada Geriatric Home in Tanta City;
- General Association of Elderly Care in Tanta city;
- Ladies Association of Happy Family, Gharbia governorate;
- Resala Association in kaffer Esaam, Gharbia governorate;
- El-Wafaa Geriatric Home in Kaffer Al-sheikh;
- Resala Association in Kaffer Al-sheikh;
- Al-Mawasah Islamic Association in Kaffer Al-sheikh.

II- **Private Neurological clinic**, including

- Professor Doctor Gamal Yusuf Neurological clinic.
- Professor Doctor Ahmed Gaber Amar Neurological clinic.
- Professor Doctor Mohamed Saleh Neurological clinic.
- Professor Doctor Ahmed Hamdy Abo-Elata Neurological clinic.
- Professor Doctor Mustafa Abd-Elhameed Shalaby Neurological clinic.

- Professor Doctor Abas Sabry Hamoda Neurological clinic.
- Professor Doctor Azaa Abas Ghaly Neurological clinic.

 Subjects: - 249 elders were included in the study. They include two groups, Dementia group (118 elders) aged between 60-89 years with a mean age 69.36 years and Normal Elderly group (131 elders) aged between 60-83 years with a mean age 68.55 years.

Dementia group, participants include 43 female and 75 male who diagnosed with dementia based on medical and psychological history, neuropsychological performance and medical tests.

Normal elderly group, participants include 69 female and 62 male who living independently and have no current psychological or central nervous system abnormalities, have no complaint of any cognitive complaint during history taking, and have no physical problems that may affect cognition (chronic medical illnesses were not excluded unless they sever enough to have potential effect on cognitive state). Those who have Parkinsonism, brain stork or head injury were also excluded.

 Tools of the study:

All participants were assessed individually through interview to get background information regarding their socio-demographic data, medical history, cognitive functioning, BMI, and mental flexibility using the following tools.

Tool I: - Questionnaire sheet, which developed by the researchers to assess socio demographic data and medical history: (data collected either from the elders or from their care givers when they have no ability to answer, such in dementia cases).

It consists of **3 parts**;

Part 1: - Socio demographic data such as age, sex, education, number of family members and family income.

Part 2: - Medical history for most chronic diseases such as hypertension, heart disease, depression and diseases that may affect cognition such as Parkinsonism, brain stork, head injury..etc.

Part 3:- Medical history of dementia includes history of forgetfulness attacks and the ability of the person to conduct different daily living activities, bathing, using toilet, wearing clothes, cooking, taking medications, driving, going outside or managing financial issues.

Tool II:- Cognitive impairment assessment;

Two tests were used to assess presence of cognitive impairment;

1- Mini–Mental State Examination (**MMSE**):-

The Mini–Mental State Examination (MMSE) [(28)] was originally introduced by Folstein *et al.* in 1975. It is a 30-point questionnaire test that is used extensively in clinical and research settings to measure cognitive impairment. It is commonly used in medicine and allied health to screen for dementia. Administration of the test takes between 5 and 10 minutes and examines functions including registration (repeating named prompts), attention and calculation, recall, language, ability to follow simple commands and orientation. In this study we use the Arabic translated version of the test that translated by El-Sabwa M et.al, [(29)]. It consists of 29 questions.

Each correct answer or right response was given 1; the total was 29 point for 29 questionnaires. **The interpretation of the MMSE was as follow**:-

- 24-29 refers to ….No cognitive impairment
- 18-23 refers to …. Mild cognitive impairment
- 0-17 refers to ….Severe cognitive impairment

2- Eight-item Interview to Differentiate Aging and Dementia (AD8):-

(AD8) was developed by Galvin, Roe, Xiong & Morris (2006) [(30)] as a brief instrument to help discriminate between signs of normal aging and dementia. In contrast with other instruments, the AD8 assesses intra-individual change across a variety of cognitive domains compared to previous levels of function and is sensitive to early signs of dementia. It contains 8 items that test for memory, orientation, judgment, and function. The AD8 was originally validated as an informant-based interview, completed by a spouse, adult child, friend who knew the older adult well. If an informant is not available, the AD8 may be administered to the patient. It takes on average 3 minutes to complete, and requires no advanced training. The tool was translated in to Arabic by the researchers.

-When administered to an informant, specifically ask the respondent to rate change in the patient.

-When administered to the patient, specifically ask the patient to rate changes in his/her ability for each of the items, without attributing causality.

Scoring
The final score is a sum of the number items marked "Yes, A change".
Interpretation of Results
- 0-1 ----- Normal cognition
- 2 or greater ……. impairment in cognition

Tool III:- Body Mass Index (BMI) assessment:-
In which participants were assessed for their weight & height and calculate BMI. In case of overweight or obesity check since what time the obesity is present.
BMI was classified according to W.H.O cut-off point in to:-
- Under weight…….. BMI < 18.5
- Normal weight…… BMI 18.5 < 25
- Over Weight…… BMI 25 < 30
- Obese …….. BMI ≥ 30

Tool IIII:- Mental Flexibility Assessment:-
The **Trail Making Test (TMT)** was used to assess mental flexibility of the studied sample. It was developed by Rietan, 1955 [(31)]. It is a validated test consists of two parts part A and part B. Part (B) of the test which target executive task is used in this study. It consists of a standard page contain circles, some of them contain numbers from 1-13 and others contain letters from A - L. The alteration between serial sequence of letters and numbers is thought to require executive control and flexibility of thinking. This test measures the subject's ability to connect numbers and letters, the participants were asked to draw lines connecting numbers and letters, alternating numbers in ascending order and letters in alphabetical order, for example, e.g. 1-A-2-B-3-C and so on. The researcher asked elder person to begin and when he or she reached to 13 they asked to stop and time recorded. A maximum time of 300 seconds was allowed before asking participants to discontinue. The direct scores for the test were the time in seconds that spent to complete the task.

Methods
 Both the translated tools and those developed by the researchers were validated by a jury to ensure their content validity. The jury consisted of five experts in the gerontology and psychology fields. The required correction and modifications were carried out accordingly.
 Before starting the study, an official letter was addressed from the deans of the faculties of Nursing and Literature to the directors of geriatric home and doctors of neurological private clinics to request their permission and cooperation to collect data from the selected settings.
 Ethical considerations: - Informed consent to participate in the study was obtained from the study subject after explanation the purpose of the study. They were also assured about the confidentiality of the obtained data. As well the elder's privacy was always respected.
 A pilot study was carried out on 10 elders after taking their approval to ascertain clarity and applicability of the study tools. In addition it serves to estimate approximate time required for interviewing the study subjects.
Collection of the data:-
 Interviews were conducted with the participants individually in the selected settings by the researchers. In which they collect socio-demographic data and medical history of the participants.
 Then, the researchers applied MMSE test and Eight Item interview to assess presence of cognitive impairment.
 After that, weight and height were measured for each participant and BMI was calculated.
 At the end, the researchers asked the participant to conduct (TMT) task and recorded the time taken by the participant to determine the mental flexibility.
 The total time spend with each elder was from 30 to 45 minutes.
 The overall duration of the study was 3 month.
Statistical analysis: Data was collected, tabulated and analyzed using SPSS V20. Statistical presentation and analysis of the present study was conducted, using the mean, standard error, student t- test, Paired t-test., correlation between variables was evaluated using Pearson's and Spearman Correlation Coefficient (r). A significant was adopted at P= < 0.05. However a strong significance was adopted at P < 0.01.
Results
Table (1) shows mean and stander deviation of age and education among dementia and normal group. Comparing the dementia group and normal elderly group using series of t tests shows no differences in age or education of the two groups t= -1.934, 2 .952; P=.705, .595 respectively.

Table (1): Mean and stander deviation of age and education among dementia and normal group

Variables	Dementia (118)		Normal Elderly (131)		T	Sig P
	M	SD	M	SD		
Age	70.8475	7.99746	68.9084	7.81069	-1.934	.705
Education	11.4407	2.96862	12.5420	2.91220	2 .952	.595

Table (2): shows mean and stander deviation of cognitive function, mental flexibility and BMI among dementia and normal elderly group. In relation to the cognitive status, the t test shows a significant mean difference in the cognitive function as measured by the Mini–Mental State Examination (MMSE) and Eight-item Interview (AD8) between the two groups; dementia group performed significantly poor on MMSE (t=47.499, P=.000) and on AD8 (t=-41.780, P=.000). Also, the table shows a statistically significant mean difference in the level of mental flexibility as measured by the Trail Making Test (TMT) between dementia and normal elders; dementia group takes prolonged time to end the tasks of TMT than normal group (t= -27.737, P=.004) . On the other hand, the t test shows no difference in the mean of body mass index (BMI) between the two groups t= .780, p= .206. However, mean of BMI is higher in dementia group than normal one.

Table 2:- Mean and stander deviation of cognitive function, mental flexibility and BMI among dementia and normal elderly groups.

Variables		Dementia (118)		Normal Elderly (131)		T	Sig P
		M	SD	M	SD		
Cognitive Function	MMSE	9.0254	4.07926	27.6336	1.76812	47.499	.000
	Interview (AD8)	6.7542	1.17624	0.9771	0.72818	47.089	.000
Mental Flexibility (TMT)		256.7712	35.90286	137.2824	32.07546	-27.737	.004
BMI		29.7740	7.23315	28.9720	8.97191	.780	.206

Table (3) shows the correlation between cognitive function and mental flexibility and body mass index among dementia and normal elderly. It was observed that in dementia group, there was a significant correlation between cognitive function, as measured by Eight-item Interview (AD8) and Mini Mental Status Examination (MMSE), and overweight and obesity. Moreover, significantly higher correlation was obtained between MMSE and obesity. The table shows also that, in dementia group the cognitive function by Eight-item Interview and MMSE is significantly correlates with mental flexibility (Trial Making Test (TMT). However, in normal elderly neither overweight nor obesity are correlated with cognitive function by Eight-item Interview or MMSE. Also, no correlation found between mental flexibility (TMT) and cognitive function (AD8 and MMSE) in normal elderly.

Table 3:- The correlation between cognitive function and mental flexibility and body mass index among dementia and normal elderly.

Sample			Cognitive function	
			Interview	Mini
Dementia (118)	BMI	Normal (40)	.061	-.226-
		Over (43)	.309*	-.306-*
		Obese (35)	.316*	-.424-**
	Mental Flexibility (TMT)		.219*	.399*
(Normal 131)	BMI	Normal (40)	. 091	-.098-
		Over (42)	.102	-.065-
		Obese (49)	.121	-.165-
	Mental Flexibility (TMT)		. 151	.192

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table (4) shows correlation between age and education of dementia group and their cognitive function, mental flexibility, and body mass index. The table illustrated that, there was a highly significant correlation between the age of demented elderly and their cognitive function and their mental flexibility. However, no significance correlation found between their age and their body mass index. Regarding education, the results reported a significant correlation between the education of demented elderly and their cognitive function and their BMI. Highly significant correlation was found between education and mental flexibility.

Table (4) correlation between age and education of dementia group and their cognitive function, mental flexibility, and body mass index

Variables	Age	education
Cognitive function(MMS)	.436-**	.290*
Flexibility	.391-**	.330**
BMI	.070	.201-*

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table (5) shows mean and stander deviation of cognitive function, mental flexibility, body mass index in relation to sex among dementia group. It was observed that there was a significant mean difference in the mean of cognitive function between males and females ($p< 0.05$) that the mean was 10.8077±3.87571 for males compare to 8.6515±7.81069 for females. Moreover, the table illustrated a significant mean difference in the mean of mental flexibility and BMI of demented elders between males and females (233.2692±37.77234 and 22.7462±2.68112 for males and 261.6212±36.32112 and 33.8773 ±9.15480 for females) respectively.

Table (5): Mean and stander deviation of cognitive function, mental flexibility, body mass index in relation to sex among dementia group

Variables	male(52)		Female (66)		T	Sig
	M	SD	M	SD		
Cognitive function	10.8077	3.87571	8.6515	7.81069	3.062	.003*
Flexibility	233.2692	37.77234	261.6212	36.32112	8.479	.000*
BMI	22.7462	2.68112	33.8773	9.15480	4.136	.000*

III. Discussion

Dementia has a negative impact on more aspects of the persons' health than he\she may realize. Identifying factors that may increase the risk of dementia occurrence may help in its control. The aim of this study was to assess presence of association between body weight, mental flexibility and dementia among older adults. The results of this study reported a significant correlation between cognitive function and overweight and obesity as well as with mental flexibility in dementia group. However, in normal elderly neither overweight nor obesity or mental flexibility are correlated with cognitive function.

Dementia is a disorder that is characterized by a decline in cognition involving one or more cognitive domains [(32)]. In the present study, dementia group were diagnosed and selected based on neurological and medical ground. In contrast, the normal elderly were free from any neurological conditions or signs of cognitive decline. The absence of dementia in normal elders was supported by the findings of Mini–Mental State Examination (MMSE) and Eight-item Interview (AD8) cognitive tests which the researchers used to differentiate cognitive status among the two groups.

The results showed that the normal elderly had the higher mean score for MMSE and the lower mean score for AD8 which indicated good cognitive function. There was a significant mean difference in the cognitive

function between normal elderly and dementia group. This is in agreement with Agata Kowalczyk et.all, 2012 who reported that all his normal elderly participants were scored above standard cutoff point on MMSE [(13)].

Both age and BMI contribute independently to decreased brain volume in middle and older adulthood [(33).] It is more likely for an older adult to have lower cognitive abilities if he/she was overweight or obese during middle age [(34, 35)]. As regard the correlation between BMI and cognitive function among dementia and normal elderly groups, the present study reported a statistically significant correlation between overweight & obesity and cognitive function among dementia group and significantly higher correlation was obtained between MMSE and obesity.

This in agreement with\and supports the results of most of meta-analysis studies that investigate the correlation between BMI and risk of cognitive impairment (dementia). For example, Emiliano A et al. (2017) [(25)] conduct a comprehensive systematic review on 19 cohort studies and indicate that while being overweight does not and being obese in midlife does confer a significant increased risk of developing dementia at older ages[)]. Other several studies showed that obesity increased the risk of dementia at old age [(36-39)]. Moreover, Jason C. D. et.al, 2014 concluded that in human clinical studies, obesity has been shown to increase the risk of the development of mild cognitive impairment, in the form of short-term memory and executive function deficits, as well as dementia and Alzheimer's disease [(40)].

This supported by the current trends in the prevalence of obesity within many societies that can be expected to impact further on the predicted increase dementia from ageing alone. With the current levels of obesity, it has been suggested that the number of those with dementia could be up to 9–19% higher than the number predicted based on ageing alone. However, the reverse should also be considered. Reducing obesity prevalence to 20% over the next 10 years could lead to a 10% reduction in the number of people aged 65–69 with dementia in 2050 [(41)].

Executive functioning refers to capacities that allow a person to successfully engage in independent, appropriate, purposive, and self-serving behavior. This includes a wide range of cognitive abilities such as the ability to self-monitor, plan, organize, reason, be mentally flexible, and problem-solve. Research has shown that concept formation, abstraction, and mental flexibility decline with age, especially after age 70, as older adults tend to think more concretely than younger adults. However, this is not always occurs with all health individuals [(42,43)].

The result of the present study revealed a statistically significant mean difference in the level of mental flexibility as measured by the Trail Making Test (TMT) between dementia and normal elders; dementia group takes prolonged time to end the tasks of TMT than normal group. This in agreement with Debette **S et** all., 2009 who found that parental dementia and Alzheimer disease (AD) were associated with worsening performance in executive function [(44)].

Libon DJ et al., reported that mental flexibility time as a neuropsychological test can be distinguish between normal and demented people and between different types of dementia [(45)]. The present study found that in dementia group the cognitive function by Eight-item Interview and MMSE is significantly correlates with mental flexibility as measured by TMT while, no correlation found between mental flexibility and cognitive function in normal elderly. This agreement with Agata K et all., 2012 who found that Trial Making Test is a sensitive to cognitive decline in demented elderly[(13)].Virigini et al., 2013 reported also that AD patients showed impairments in the neuropsychological tests evaluating mental flexibility [(46)]. Decreasing in mental flexibility gradually can affect cognitive status and associated with dementia.

When we Interprete results of the risk of dementia for sexes, the present study revealed that there was a significant mean difference in the mean of cognitive function, mental flexibility and BMI of demented elders between males and females. The mean of cognitive function (MMSE) among females is lower than males and mean of mental flexibility and BMI are higher in females than males which supports also the correlation between these three variables. Potential mechanisms by which overweight and obesity increases the risk of compromised brain functioning in later life include vascular disease, the risk of hypertension, diabetes mellitus and stroke which all are known risk factors for dementia.

This result is in agreement with result of the study done by Hayden KM, et.al [(47)], who reported greater risk for women than men. However this contradicts with Hassing LB et.al [(48)] who reported that regarding the risk of dementia, the same pattern was found for men and women. This may be due to the difference in the age of screening that they screen subjects from 45 -65 years.

Regarding the influence of age and education, the present study revealed that there was a highly significant correlation between the age of demented elderly and their cognitive function (MMSE) and their mental flexibility (TMT). Regarding education, the results reported a significant correlation between the education of demented elderly and their cognitive function and their BMI. Highly significant correlation was found between education and mental flexibility.

These results were agreement with Agata K et.al,[(13)] who found that performance on TMT influenced also by age and education of elders that the total time for completing the TMT is longer for older participant

than younger ones and individuals who have fewer years of formal education performed significantly slower on TMT than their more educated counterparts. Also, Emiliano A et.al,[(25)] and Sharp ES et.al[(49)] reported that educational level is strongly associated with both BMI and dementia.

Cognition is critical for functional independence as people age, including whether someone can live independently, take medications correctly, and manage finances. In addition, intact cognition is vital for humans to communicate effectively, including integrating sensory information, processing and responding appropriately to others. It is important to understand what types of changes in cognition are expected as a part of normal aging and what type of changes might suggest the onset of a brain disease and predisposing factors to these diseased changes. The matter is not to increase our knowledge regarding the clinical and basic science of these conditions—what really matters is how our increasing understanding contributes to alleviating the problems of people with dementia.

IV. Conclusion &Recommendations

The study concluded that over body weight and obesity and decreased mental flexibility are significantly correlated with dementia. Based on the results of this research, we recommended that reducing the impact of overweight, obesity and impaired mental flexibility on incidence and prevalence of dementia should be priority for health providers, governments and general public. The inclusion of weight loss and promoting mental flexibility in any future preventive trials carried out in mid-life to prevent dementia could be supported. Further researches are recommended for investigating the role of mental flexibility in the progress of dementia.

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