nutrición clínica y Dietética Hospitalaria

Artículo Original

Nutr Clín Diet Hosp. 2024; 44(2):91-98
DOI: 10.12873/442ibrahim

Dietary intake of macro and micro-minerals among participants with alexithymia in Jordan: A cross-sectional study

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Recibido: 19/enero/2024. Aceptado: 22/marzo/2024.

ABSTRACT

Introduction: Alexithymia is a condition characterized by inability in explaining and describing feelings, distinguishing bodily sensations, and expressing feelings toward others. The relationships between alexithymia and dietary intakes of minerals among Jordanian people have not been well-characterized. Therefore, the aim of the study was to investigate the associations between dietary intakes of macro- and micro-minerals and alexithymia.

Methods: Seven hundred and fifty three Jordanian adults completed face-to-face interviews through cross-sectional study conducted among voluntary participants aged 18-64 years. Every participant was asked to fill in questionnaires regarding their socio-demographic characteristics, anthropometric measurements, and dietary intakes. The 20-item Toronto Alexithymia Scale (TAS-20) was used for measuring alexithymia among participants. Data analysis was conducted using SPSS (version 25). Independent sample t-test and one-way ANOVA tests were used to determine significance mean differences between different subgroups of each categorical variable based on TAS-20 scores. Logistic regression analyses were conducted to find out the association between quartiles of dietary intakes of minerals and the risk of alexithymia. Statistical significance was set at p-value <0.05.

Results: Findings of the study indicated that about 10.4% of Jordanian adults classified with having alexithymia with scores of (TAS-20) Scale ≥ 61. Females, participants with monthly incomes higher than 700 JOD, participants with low educational levels, and obese participants scored significantly higher scores of (TAS-20) scale in comparison to other groups for each variable. Odds ratios for associations between alexithymia quartiles of dietary intake of minerals were calculated after adjusting for gender, education level, physical activity, and BMI. By comparing highest intake (Quartile 4) with the lowest intake (Quartile 1), adjusted odds ratios have shown that two macro-minerals (calcium and magnesium) and three micro-minerals (iron, zinc, and selenium) have significant negative association with alexithymia.

Conclusion: The distribution of alexithymia among Jordanian adults was very low. Mental conditions require appropriate dietary interventions that assure the maintaining of healthy weight and the consumption of adequate intakes of nutrients especially macro- and micro-minerals. Further observational and experimental studies are highly recommended to explore the role of action and specific mechanisms of these minerals with mental conditions such as alexithymia.

KEY WORDS

Alexithymia, TAS-20, calcium, magnesium, iron, zinc, selenium.

INTRODUCTION

Alexithymia is a personality dimension characterized by difficulties recognizing, differentiating, and verbalizing emotional experiences[1]. Lifestyle, socioeconomic status, and cultural beliefs are among the most crucial factors that are associated with prevalence of alexithymia[2]. Alexithymia is further developed and being associated with a many different somatic and psychiatric syndromes and illnesses[3]. Several mental health conditions are associated with alexithymia such as depression, anxiety, addiction and eating disorders[4]. There is no diagnostic criteria for alexithymia in the DSM-5 because it is a symptom rather than a condition[5]. However, persons with alexithymia are more frequently suffering from binge eating disorders[6].

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Studying the association between dietary nutrients and psychiatry health is an important field of research due to its contribution in discovering nutrients relevant to mental illness, irritability, and mood problems[7]. Moreover, it is documented that prevention and treatment of brain-based disorders is affected by dietary patterns and food choices[8]. The role of each dietary factor toward mental conditions including depression, anxiety, and sleep disorders provide a fascinating body of evidence[9]. Key micronutrients play a role in regulating stress responses by enhancing production and metabolism of neurotransmitters[10]. Blampied et al.[11] indicated that Broad spectrum micronutrient interventions have shown effectiveness for reducing symptoms associated with some mental illnesses including stress and anxiety. A recent study demonstrated the significance of optimizing the homeostasis of trace minerals for the preservation of mental health[12].

Alexithymia as a symptom can aggravate and lead to mental illnesses such as depression, anxiety, burnout, stress, social isolation, subjective distress, and psychological diseases[5,13]. One of the major underlying causes of worldwide disability is depression[14]. Positive associations have proven between alexithymia and depressive mood among persons suffering from depressive disorders[15]. Honkalampi et al.[16] reported that alexithymia is strongly associated with the severity of depression. The role and mechanisms of action were discussed briefly for some macro- and micro-minerals concerning depression. In contrary, it appears that a few studies regarding the role of these macro- and micro-minerals concerning alexithymia[13]. Therefore, the aim of the research was to measure distribution of alexithymia and sociodemographic factors associated with alexithymia among a sample of study participants from Jordan. Moreover, the study aimed to find out the associations between alexithymia and dietary intakes of macro- and micro-minerals.

MATERIALS AND METHODS

Study Design and Participants

The study was a cross-sectional study and carried out during the period of August 2023 to November 2023. Targeted population comprised of 753 Jordanian volunteers aged 18-64 years (students and employees) through face-to-face interviews. The sample size was calculated based on an alpha (α) probability of 0.05 and G*Power of 0.8. Ethics Committee of the Faculty of Agriculture/Mu'tah University approved the study. All participants signed informed consent form before participation in the study and the aim of the study was briefly explained for each participant. Exclusion criteria were applied for participants that reported a psychiatric or mental disorder, or having minerals supplements as part of their medical prescription. Pregnant women were also excluded from the study. Moreover, the exclusion criteria includes participants that were unable to complete the measurement tool that was used to measure alexithymia.

Data Collection

A questionnaire consisted from three sections was used in this study. The first section composed from questions regarding sociodemographic characteristics which includes age, gender, marital status, employment status, monthly income, education level, and smoking. This section also includes information regarding performing regular physical activity and anthropometric measurements. Heights of participants were measured to the nearest millimeter, while their weights were taken to the nearest 0.1 kg. Body mass index (BMI) was calculated by the ratio of weight in kilograms to the square of height in meters according to WHO guidelines[17]. The second section was for measuring alexithymia among participant by using the 20-item Toronto Alexithymia Scale (TAS-20)[4]. This scale composed of three subscales, which are difficulty in identifying feelings (DIF) that includes 7 items, difficulty in describing a feeling (DDF) that includes 5 items, and externally oriented thinking (EOT) that includes 8 items. It is a self-report scale consisting from 20 items that are rated using a five-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. Items number (4،5،10،18،19) are negatively keyed. The total score of TAS-20 is ranging from 0 to 100. The cut-off scores for this scale differentiate people into three subgroups. Scores ≤51 are group with no alexithymia and scores ≥61 are for group with alexithymia. Scores between (52-60) indicate group with possible alexithymia. TAS-20 is considered the standard measure for alexithymia because of its good internal consistency and test–retest reliability. In this study, the measured Cronbach's alpha of Alexithymia Scale (TAS-20) was 0.83. The third section of the questionnaire was used for dietary assessment by validated food frequency questionnaire (FFQ)[18] to estimate dietary intakes of macro-minerals and micro-minerals. Moreover, food composition tables for the Middle East (which includes composition of specific Jordanian foods) were also used in the estimation of dietary intakes. Food models and standard measuring tools were both used to estimate portion size. ESHA's Food Processor SQL (version 10.1.1, Salem, Oregon, USA) was used as a software in dietary analysis[19].

Statistical analysis

The analysis of collected data was performed by the statistical package (SPSS; version 25, IBM, NY). Sociodemographic characteristics and distribution of study population based on scores of TAS-20 were presented as frequencies and percentages. Independent sample t-test and one-way ANOVA tests were both used to find out the differences in means of TAS-20 scores based on sociodemographic characteristics and anthropometric variables. Adjusted odds ratios (AOR) and 95% confidence interval (95% CI) between dietary intake of minerals and alexithymia were explored by conducting binary logistic regression test. The lowest quartile (Q1) of dietary intake of minerals was used as reference for next quartiles;

second quartile of dietary intake of minerals (Q2), third quartile of dietary intake of minerals (Q3), and the highest quartile of dietary intake of minerals (Q4). For all tests, p <0.05 was considered as indicator of statistical

RESULTS

In our study, results of sociodemographic characteristics in Table 1 indicated that the majority (40.2%) of the participants were between 25-34 years old. Concerning marital status, employment status, and education level, most of the participants were married (62.6%), had a work (68.5%), and had high education level (48.2%). Higher parentages of participants with values of 72.5% and 64.9% were reported among participants performed regular physical activity and nonsmokers, respectively, among their variable subgroups. On the other hand, anthropometric measurements of our study revealed that most of the study participants classified as obese based on their BMI calculations. Results in Table 2 illustrated that the prevalence of alexithymia (TAS-20 scores ≥61) was 10.4% of the participants in our sample. Meanwhile, the majority of participants (60.9%) were not classified with alexithymia (TAS-20 scores ≤51).

Table 1. Sociodemographic characteristics and anthropometric measurements of the study participants (n=753)

Variables		Frequency	Percentage (%)
Age	18-24 years	169	22.5
	25-34 years	288	38.2
	35-44 years	206	27.4
	45-64 years	90	11.9
Gender	Male	348	46.2
	Female	405	53.8
Marital status	Single	177	23.5
	Divorced	105	13.9
	Married	471	62.6
Employment status	Working	516	68.5
	Retired	237	31.5
Monthly income	> 700 JOD	429	56.9
	< 700 JOD	324	43.1
Education level	Low	99	13.1
	Moderate	291	38.7
	High	363	48.2
Regular physical activity	Yes	207	27.5
	No	546	72.5
Smoking	Non-smoker	264	35.1
	Smoker	489	64.9
BMI	Underweight	33	4.4
	Normal	159	21.1
	Overweight	219	29.1
	Obese	342	45.4

Table 2. Alexithymia distribution among the study participants (n=753)

TAS-20 total score	Frequency	Percentage (%)
Non-alexithymia (≤51)	459	60.9
Possible alexithymia (52–60)	216	28.7
Alexithymia (≥61)	78	10.4

As shown in Table 3, based on gender variable, females significantly ($p < 0.001$) sored TAS-20 scores higher than men with a mean value of 52.33±10.50. Regarding variable of monthly income, the mean scores of TAS-20 were significantly higher with a $p < 0.001$ among participants that had monthly income lower than 700 JD. Moreover, participants with low educational level reported the highest mean of TAS-20 scores in comparison to participants with medium or high educational levels with a significant value of $p= 0.007$. On the other side, obese participants reported significantly ($p=0.003$) the highest mean scores of TAS-20 among our sample participants. The mean scores of TAS-20 among underweight, normal, overweight, and obese participants were 47.86±8.24, 38.61±10.12, 58.95±8.84, and 65.53±9.73, respectively. Meanwhile, insignificant differences of mean scores of TAS-20 were shown within subgroups of the variables that include age, marital status, employment status, physical activity, and smoking.

As shown in Table 4, the associations between alexithymia and quartiles of minerals intakes adjusted the variables that indicated significant difference in the mean scores of TAS-20, which includes age, gender, education level, physical activity, and BMI. By comparing to quartile 1 (Q1), a negative associations were shown among higher dietary intake of calcium, magnesium, iron, zinc, and selenium. A significant negative association with alexithymia was reported for quartile 4 (Q4) for all of the aforementioned minerals. Odds ratios for asso-

Table 3. Association of sociodemographic and anthropometric variables with Score of (TAS-20) among study participants (n=753)

Variables		TAS-20 total score		
		Mean	SD	*p*-value
Age	18-24 years	49.76	9.64	0.699
	25-34 years	51.71	8.45	
	35-44 years	51.45	6.32	
	45-64 years	52.63	7.93	
Gender	Male	43.71	9.64	< 0.001*
	Female	52.33	10.50	
Marital status	Single	50.88	8.14	0.652
	Divorced	51.64	11.31	
	Married	48.93	12.93	
Employment status	Working	52.33	8.91	0.585
	Retired	50.42	10.83	
Monthly income	> 700 JOD	43.98	11.13	< 0.001*
	< 700 JOD	55.48	10.24	
Education level	Low	54.48	12.14	0.007*
	Moderate	51.34	10.21	
	High	44.63	11.23	
Regular physical activity	Yes	52.83	9.63	0.484
	No	49.92	11.43	
Smoking	Non-smoker	50.63	7.61	0.788
	Smoker	51.62	9.33	
BMI	Underweight	47.86	8.24	0.003*
	Normal	38.61	10.12	
	Overweight	58.95	8.84	
	Obese	65.53	9.73	

*: Statistical significance at p-value ≤ 0.05. Independent Samples t-test, one-way ANOVA test.

ciation between dietary intake of minerals and alexithymia were adjusted for gender, education level, physical activity, and BMI. The adjusted ORs (95% CI) for alexithymia were for Q4 of calcium, magnesium, iron, zinc, and selenium [0.23 (0.16–0.52), 0.39 (0.26–0.73), 0.51 (0.31–0.92), 0.56 (0.30–0.86), 0.32 (0.18–0.63), respectively]. In the same context, sodium, potassium, chloride, phosphorus, manganese, iodine, and chromium had shown negative associations with alexithymia but these associations were not significant. Surprisingly, both copper and fluoride revealed insignificant positive associations with alexithymia and higher quartiles of these minerals. The adjusted ORs (95% CI) for alexithymia were 1.02 (0.56–2.30) and 1.02 (0.75–1.53), for Q4 of copper and fluoride respectively.

Table 4. Associations between alexithymia and quartiles of minerals intakes

Minerals	Quartile	AOR (95% CI) [a]	*p* value
Macro-minerals			
Sodium (mg)	Q1	Reference	
	Q2	0.72 (0.46–1.28)	0.15
	Q3	0.87 (0.60–1.62)	0.42
	Q4	0.68 (0.54–1.23)	0.31
Potassium (mg)	Q1	Reference	
	Q2	0.68 (0.31–0.96)	0.15
	Q3	0.62 (0.44–0.90)	0.12
	Q4	0.56 (0.31–0.82)	0.32
Chloride (mg)	Q1	Reference	
	Q2	0.78 (0.37–0.97)	0.17
	Q3	0.87 (0.52–1.32)	0.51
	Q4	0.62 (0.36–1.03)	0.28
Calcium (mg)	Q1	Reference	
	Q2	0.92 (0.39–1.24)	0.77
	Q3	0.68 (0.58–0.88)	0.68
	Q4	0.23 (0.16–0.52)	0.03*
Phosphorus (mg)	Q1	Reference	
	Q2	0.82 (0.59–1.34)	0.57
	Q3	0.78 (0.58–1.18)	0.23
	Q4	0.53 (0.46–0.92)	0.08
Magnesium (mg)	Q1	Reference	
	Q2	1.09 (0.66–1.53)	0.49
	Q3	0.91 (0.75–1.37)	0.62
	Q4	0.39 (0.26–0.73)	0.02*
Micro-minerals			
Iron (mg)	Q1	Reference	
	Q2	0.97 (0.58–1.42)	0.63
	Q3	0.73 (0.42–1.16)	0.32
	Q4	0.51 (0.31–0.92)	0.02*
Micro-minerals			
Zinc (mg)	Q1	Reference	
	Q2	0.84 (0.53–1.26)	0.45
	Q3	0.66 (0.47–1.31)	0.22
	Q4	0.56 (0.30–0.86)	0.03*
Copper (µg)	Q1	Reference	
	Q2	0.86 (0.44–1.51)	0.56
	Q3	0.93 (0.68–1.92)	0.83
	Q4	1.02 (0.56–2.30)	0.66
Manganese (mg)	Q1	Reference	
	Q2	0.82 (0.49–1.62)	0.71
	Q3	0.78 (0.68–1.53)	0.58
	Q4	0.63 (0.56–1.41)	0.32
Iodine (µg)	Q1	Reference	
	Q2	1.12 (0.5–51.43)	0.53
	Q3	0.71 (0.65–1.27)	0.62
	Q4	0.62 (0.38–0.93)	0.33
Selenium (µg)	Q1	Reference	
	Q2	1.02 (0.65–1.63)	0.12
	Q3	0.81 (0.45–1.27)	0.42
	Q4	0.32 (0.18–0.63)	0.01*
Fluoride (mg)	Q1	Reference	
	Q2	0.66 (0.34–0.98)	0.36
	Q3	0.73 (0.51–1.26)	0.82
	Q4	1.02 (0.75–1.53)	0.61
Chromium (µg)	Q1	Reference	
	Q2	0.64 (0.43–1.02)	0.73
	Q3	0.56 (0.37–0.81)	0.52
	Q4	0.46 (0.21–0.76)	0.44

AOR, adjusted odds ratio; CI, confidence interval. [a]: adjusted for Gender, Monthly income, Education level, and BMI. *: Statistical significance at p-value ≤ 0.05.

DISCUSSION

In the modern era, diet is considered the most crucial risk factor for non-communicable diseases (NCDs)[20]. About 255 million Disability-Adjusted Life-Years and 10.9 million deaths are attributed to dietary factors[20]. Nowadays, there is an increase concern in the concept of "nutritional psychiatry", which study the association between some dietary factors and mental illnesses[21]. There is a growing need for effective strategies for optimizing physical and mental health. One of these strategies concerned with dietary intake of crucial nutrients, including minerals, that most related to psychiatric health. Assessment the dietary intake of minerals of both categories, macro- and micro-minerals and its association with prevalence of mental illnesses is highly important in planning future strategies for prevention or treatment of such illnesses. It is highly important to prevent the occurrence and impact of serious problems on next generations through early detection of symptoms of mental disorders, clarifying risk factors, and development of appropriate interventions to modify chronic exposure to these factors[21].

Over the last decade, alarming trends of mental health diseases have been registered in developing countries[22]. To the best of our knowledge, this is the first study addressing the associations between dietary intake of minerals (macro- and micro-) and alexithymia. The present study addressed the prevalence and association of dietary intake of macro and micro-minerals among Jordanian participants that suffering from alexithymia. Our study indicated that only about 10.4% of participants were classified with alexithymia. Our result was not in accordance with results of a study conducted by Hamaideh[13] who reported that the prevalence of alexithymia among a sample of students in Jordanian university (with a mean of age 20.1 years) was 24.6%. Meanwhile, our results was in accordance with results of another study that was conducted by Qaisy and Abu Darwish which reported that 11% of undergraduate students had a high level of alexithymia[23].

In our study, among sociodemographic and anthropometric variables, four variables (including gender, educational level, physical activity, and BMI) have been illustrated significant differences among subgroups of each variable. Concerning gender variable, our study results revealed that female had the higher mean scores in comparison to males. Our result was in agreement with results of a study conducted by Hamaideh[13] who documented that mean scores of alexithymia was higher in females than males (57.24 for females and 54.53 for males). In contrast, results of Gilbert et al.[24] indicated that higher scores of alexithymia were reported among males. Based on monthly income variable, our study findings indicated that participants with lower monthly income had higher mean scores of alexithymia. This finding was in accordance with results of a study conducted by Obeid et al.[25] which demonstrated that higher incomes were associated with lower prevalence of alexithymia. In our study, we found a significant association between alexithymia and lower educational level. Similarly, Kokkonean et al.[26] reported that poor education level is highly associated with alexithymia. On the other hand, our results illustrated that higher BMI values are associated with higher mean scores of alexithymia and that obese person had the highest scores. Meanwhile, two recent studies demonstrated that there were no significant associations between scores of alexithymia and values of BMI[27,28].

From nutritional point of view, specific nutrients considered important in maintaining homeostasis of central nervous system (CNS) and brain health[12]. Our study indicated that higher dietary intakes of five minerals were negatively associated with mean score of alexithymia. As mentioned before, to the best of our knowledge, no previous studies have been concerned regarding the association of dietary intake of minerals and incidence or prevalence of alexithymia. Actually, our study reported that potassium, calcium, magnesium, iron, zinc, and selenium had shown significant associations with mean scores of alexithymia. Several of these minerals, such as magnesium, zinc, iron, and selenium, have been observed as key regulators of cell function, antioxidant activity, and neuromodulation[29]. In a recent review investigated by Shayganfard[30], it was noticed that zinc, iron, and selenium are cofactors for many biological enzymes and may play a crucial role in proposed mechanisms related to brain health. On the other hand, calcium play a key role in regulation synthesis and release of neurotransmitter, which is important in mood regulation and neuronal activation[31]. Our research open a new field of research and investigation to understand more the underlying biological mechanisms beyond the role of these minerals as protective factors from alexithymia.

CONCLUSION

The novelty of this study was in studying the association between one important class of nutrients in human health and alexithymia. The prevalence of alexithymia was very low among Jordanian adults but this percentage may increase if there is not extra concerning and awareness about modifiable risk factors including that may play a role in increasing the incidence of new cases. Weight management and following suitable weight loss programs is one of the most important strategies for reducing the prevalence of alexithymia due its association with higher BMI. Moreover, an awareness should be higher regarding the appropriate dietary intakes of dietary factors including minerals and the significance of these intakes in preventing or treatment alexithymia. In addition, further awareness is needed regarding the significant food sources of such minerals and appropriate methods of storage and preparation to save these minerals from deterioration. It was concluded form our study that after controlling for major socio-demographic and anthropometric factors including gen-

der, education level, physical activity, and BMI, the dietary intakes of five macro- and micro-minerals (calcium, magnesium, iron, zinc, and selenium) were associated with low values of alexithymia. Further studies are highly recommended to explore the mechanisms of action not for minerals only but for the other classes of nutrients.

ACKNOWLEDGEMENTS

The author thanks Mu'tah University for ethically approving to conduct this cross-sectional study. Beside this, the author highly appreciate the efforts of all participants in the study during interviewing, during filling questionnaires, and during taking anthropometric measurements.

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