Prevalence of Malnutrition Among Individuals with Down Syndrome in Zliten City: A Study of Relevant Factors

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انتشار سوء التغذية بين أفراد متلازمة داون في مدينة زليتن: دراسة العوامل ذات الصلة

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Abstract

Down syndrome (DS) is a type of disability that can affect quality of life and performance and create health and economic bur-dens in the community, particularly when associated with nutritional issues. The study aims to assess the nutritional status and related factors to highlight the malnutrition issue in this group. The study relied on the descriptive analytical approach, conducted on 38 individuals with DS (IDS) in Zliten City of both genders and aged 4-22 years. The data was obtained from their parents using a questionnaire tool, which included age, gender, family size, health problems, food habits that hinder eating, physical activity, and attitudes toward certain types of foods. Categorized study individuals were the three groups: children, adolescents, and adults. The calculated body mass index (BMI) to a known nutritional status. The data were analyzed using the correlation coefficient and T-test by SPSS program version 23 (2015). The results revealed that normal, overweight, and obesity represented 47.4, 21, and 31.6% respectively. The children group had the majority obese and 65.8% relied on self-feeding, 84.2% were not on a

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special diet and 78.9% had difficulty chewing and swallowing. Statistical analysis at P ±0.05 showed that family size had a significant effect on following a diet, increasing family members leads to less attention to diet, and other factors have no significance. Malnutrition is a prevalent problem in IDS. The family size and elevated percentage of not following a diet are determinants of malnutrition in the current study.

Keywords: *Down syndrome, Nutritional status, Malnutrition, Anthropometric measures, Family size.*

الملخص

متلازمة داون هي نوع من الإعاقة التي يمكن أن تؤثر على جودة الحياة والأداء وتخلق أعباء صحية واقتصادية في المجتمع، خاصة عندما ترتبط بمشاكل تغذوية. تهدف الدراسة إلى تقييم الحالة التغذوية والعوامل المرتبطة بها لتسليط الضوء على مشكلة سوء التغذية لدى هذه المجموعة. اعتمدت الدراسة على المنهج الوصفي التحليلي على 38 فردًا مصابين بمتلازمة داون في مدينة زليتن من كلا الجنسين تراوح أعمارهم بين 22-4 سنة. تم الحصول على البيانات من والديهم باستخدام أداة الاستبيان، شملت معلومات عن العمر والجنس وحجم الأسرة واضطرابات الصحية والعادات الغذائية التي تعيق تناولهم للأكل، كذلك معرفة النشاط البدني ومدى تقبلهم لأنواع معينة من الأغذية. تم تصنيف أفراد الدراسة إلى ثلاث مجموعات: أطفال ومراهقين وبالغين. تم تقدير مؤشر كتلة الجسم (BMI) لتحديد الحالة التغذوية. تم تحليل البيانات باستخدام معامل الارتباط واختبار T بواسطة برنامج SPSS الإصدار 23 (2015). بينت النتائج أن الوزن الطبيعي والوزن الزائد والسمنة يمثلون 47.4، 21و 31.6% على التوالي. كانت أكثر أعداد مصابة بالسمنة في مجموعة الأطفال، كما بلغت نسبة الاعتماد على الذات أثناء تناول الوجبات 65.8%، ونسبة الذين لم يتبعوا نظاماً غذائياً بلغت 84.2%، نسبة الذين يعانون من صعوبة في المضغ والبلع كانت 78.9%. أظهر نتائج التحليل الإحصائي عند مستوى معنوية 0.05 ± P أن حجم الأسرة كان له تأثير معنوي على اتباع النظام الغذائي، فزيادة عدد أفراد الأسرة يؤدي إلى قلة الاهتمام باتباع النظام الغذائي، أما بقية العوامل الأخرى ليس لها أي تأثير معنوي. سوء التغذية هو مشكلة سائدة لدى أفراد متلازمة داون. حيث زيادة عدد أفراد الأسرة وارتفاع نسبة عدم اتباع نظام غذائي من محددات سوء التغذية في الدراسة الحالية.

الكلمات الدالة: متلازمة داون، الحالة التغذوية، سوء التغذية، القياسات الجسمانية، حجم الأسرة.

1. Introduction

DS (also known as trisomy 21) is a defect of birth caused by the presence of extra genetic material of chromosome 21. It is the most common chromosomal abnormality among newborns. Its incidence ranges from 1 in 700−1500 live births (Białek-Dratwa et al., 2022). According to Centers for Disease Control and Prevention, IDS have similar facial features, the most common of which are: small head, short neck, flattened back of head, large and protruding tongue, upward slanting eyes, small ears, and short stature (Petrova & Pipere, 2024). Malnutrition is a prevalent problem in IDS, they are generally heavier than others without DS because of low muscle tone, rejection of healthier foods and bone problems that may affect their physical activity (Farha & Said, 2021). IDS often face various medical conditions and health challenges. In addition to intellectual disabilities, they have approximately 50% higher risk of congenital heart diseases and a 10% risk of gastrointestinal conditions, likely to experience thyroid disorders, sleep apnea and diabetes mellitus (Ghazza et al., 2022). Most IDS suffer from feeding and swallowing problems, oral motor difficulties, and

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common pharyngeal dysphagia with difficulties in chewy, firm, and rubbery food texture (Nordstrøm et al., 2020). Malnutrition occurs among IDS and increases with age and low economic status, as proven by micronutrient deficiencies and anthropometric measurements. IDS are malnourished compared to non-disabled children and are more prone to poor nutritional care. Evaluating the eating habits of IDS is crucial, as food intake may be influenced by any atypical development. Reduced food intake due to malnutrition or feeding problems results in decreased fat and muscle mass or poor growth (Ghazza et al., 2022). Proper diet is necessary to avoid additional conditions, such as becoming overweight or obese, hence IDS has a higher risk of than healthy individuals (Białek-Dratwa et al., 2022). Nutritional care is not clearly defined for IDS. This study aims to assess the nutritional status, prevalence of malnutrition, and related factors among IDS in Zliten City.

2. Materials and Methods

The data related to the study's hypotheses collected by the questionnaire tool included demographic frame information: age, gender, BMI, and family size. Information on health problems and nutrition practices that hinder eating and food habits. Also, physical activity and attitudes toward certain types of foods. Review a questionnaire by experts: The Therapeutically Nutrition Department of the Faculty of Health Science, the Statistics Department of Science Faculty at Alasmarya Islamic University, and the Public Health Department of the Faculty of Medical Technology at Nalut University. The questionnaire was translated into Arabic, distributed manually, and filled out by the parents, who informed them about the purpose of the study and data for scientific purposes, height, and weight taken to estimate BMI. Centers for Child Health are considered underweight among children when the percentile BMI is 0–10%: normal- weight is 10–85%, overweight is 85–95, and obesity is 95–100% (World Health Organization, 2006). In adults, a BMI of 18 and over age. Underweight <18.5, normal-weight 18.5-24.9, overweight 25-29.9, and obesity 30-40 kg/m^2(world Health Organization, 2006). The materials used and device type: Wunder Seca, made in Italy, and Salters Seca, made in Germany, both scales measuring height and weight.

2.1. Research Design
The study relied on the descriptive analytical approach to determine the prevalence of normal, overweight, and obesity among IDS and know the effect of factors such as age, gender, food habits, and health problems that hinder eating on BMI. Diet compliance and the relationship of family size with it. Also, age groups' relationship with physical activity. Acceptable and unacceptable certain types of food by IDS. Data was analyzed, following statistical processing methods to the outcomes. The frequencies **(F)** and percentages **(%)** describe the study individuals. Analyzed using the correlation coefficient and **T-test at (p ≤0.05)** by

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SPSS program version 23 (2015). Finding statistically significant differences between the variables was studied to determine whether there is a relationship between them or not.

2.2. Study Population and Sampled

The study included 38 IDS, 4-22 years old, at five special needs care centers in Zliten City.

2.3. Ethical Considerations

Obtained approval from the Faculty of Health Sciences at Alasmarya Islamic University and five special needs centers with DS. The study continued and collected data over two months, from February to April 2024.

3. Results and Discussion

In the current study, the participants' ages ranged from 4 to 22 years, with a mean of 10. The age groups of study individuals are classified as ≤ 13 children, 14-17 adolescents, and ≥ 18-year-old adults, as given in Table (1). The child group had the highest number of respondents, with 30, representing 78.9%, indicating most respondents were in the children group, a result of a rising interest in IDS in Zliten City. The adult group had the lowest individuals, 3 representing 7.9%, and adolescent individuals, 5 representing 13.2%. These results agree with (Białek-Dratwa et al., 2022) and disagree with (Doğan et al., 2020), where 50% of the participants were children, and the other half were adults. The highest numbers of normal, overweight, and obese recordings in the child group were 9, 7, and 14 individuals, representing 23.6, 18.4, and 36.8%. The BMI categories earlier mentioned in the adolescent group were 1, 1, and 3 individuals, representing 2.6, 2.6, and 7.8%. The adult groups were 2, 0, and 1 individual, representing 5.2, 0, and 2.6%, respectively. The highest frequency was in the normal weight category, with 18 individuals representing 47.4%. The overweight category had the lowest 8, representing 21%. Obesity was 12 individuals, representing 31.6%. On the other hand, the total of overweight and obese individuals was 20, representing 52.6%, which agrees with (Gazza et al., 2022) and differs from (Doğan et al., 2020), where the number of overweight and obese individuals was higher percentiles in comparison to the Normal- weights, which only constituted 20%. Statistical analysis shows a P value of 0.605, indicating no significant difference. The age group variable did not affect the BMI category. There is a weak relationship between the age groups and the BMI categories, with r- value of 0.087. Despite the lack of a relationship between them, obesity was most prevalent in the child group as a number; in the adolescent group, it was higher as a percentage. BMI likely remains stable until puberty, then elevated (Ptomey et al., 2023). These results align with those (Oulmane et al., 2021) and differs from (do Prado Nascimento et al., 2021) a significant effect and relationship between age and BMI.

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Table 1. The effect of gender and age groups/years on BMI.

Items	Subjects F (%)	BMI Categories			Corr.	P-Value
		Normal weight F (%)	Overweight F (%)	Obese F (%)		
Age groups						
≤13 *children*	30 (78.9)	14 (36.8)	[7 (18.4)	9 (23.7)		
14-17 *adolescents*	5 (13.2)	3 (7.9)	1 (2.6)	1 (2.6)	*0.087*	**0.605**
≥18 *adults*	3 (7.9)	1 (2.6)	0 (00)	2 (5.3)		
Gender						
Male	25 (65.8)	11 (28.9)	4 (10.5)	10 (26.3)		
Female	13 (34.2)	7 (18.4)	4 (10.5)	2 (5.3)	*0.187*	**0.261**
Total	**38 (100)**	**18 (47.3)**	**8 (21)**	**12 (31.6)**		

Regarding gender, the majority of males were 25 individuals, representing 65.8%, while females were 13, representing 34.2%. The ratio of males to females was 1.9:1, indicating that males were more responsive than females in the current study. These findings agree with the results of (Ghazza et al., 2022) but differ from those of (Doğan et al., 2020), where 60% were females in their study. The BMI categories according to gender are given in Table 1. The numbers of normal, overweight, and obesity among males were 11, 4, and 10 individuals, representing 28.9, 10.5, and 26.3% and females were 7, 4, and 2, representing 18.4, 10.5, and 5.2%, respectively. Statistical analysis shows a P value of 0.261, indicating no significant difference; thus, gender did not affect the BMI categories. The correlation coefficient between gender and BMI categories of the study individuals was **a r- value of 0.187**. Although males generally exhibited higher BMI values. The results of the current study show no significant relationship between these variables. These findings are consistent with (Oulmane et al., 2021) and inconsistent with (Pierce et al., 2019) results, which showed a significant relationship between BMI and gender. The obese are the majority in the female category.

The numbers of meals consumed per day by individuals are classified as one, two, and three meals per day, as shown in Table (2). The highest numbers of normal, overweight, and obese were in the answers that consumed three meals, with 16, 6, and 11 individuals representing 42.1, 15.7, and 28.9%, and the answer two meals were 2, 2, and 1 individual representing 5.2, 5.2, and 2.6%, respectively. There were no responses for the one-meal category. Statistical analysis shows **a P value of 0.481**, indicating no significant difference. Therefore, the number of meals eaten per day does not affect the BMI categories of the study individuals. Also, a weak correlation coefficient between the number of meals consumed /day and the BMI category was **a r - value of 0.007**.

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Table 2. The relationship between food habits and BMI of study individuals.

Items	Subjects F (%)	Normal weight F (%)	Overweight F (%)	Obese F (%)	Corr.	P-Value
		BMI Categories				
No-of meals/day						
One	0 (00)	0 (00)	0 (00)	0 (00)		
Two	5 (13.2)	2 (5.3)	2 (5.3)	1 (2.6)	*0.007*	*0.481*
Three	33 (86.9)	16 (42)	6 (15.8)	11(28.9)		
Dependence on meal consumption						
Self-reliant	25(65.8)	13(34.2)	6(15.8)	6(15.8)		
Somewhat need to help	11(28.9)	4(10.5)	1(2.6)	6(15.8)	*0.122*	*0.467*
Always with help	2(5.3)	1(2.6)	1(2.6)	0(00)		

Moreover, the question-answer of the dependence on meal consumption habits is categorized as follows: self-reliant, sometimes needing help, and always with help, as shown in the table mentioned earlier. Self-reliance had the highest 25 individuals, representing 65.8%, and numbers of normal-weight, overweight, and obese were 13, 6, and 6, representing 34.2, 15.7, and 15.7%, respectively. Always with help was the lowest 2, representing 5.2%, and the number of BMI categories was 1, 1, and 0 individuals, representing 2.6, 2.6, and 0%, respectively. The frequency of sometimes needing help was 11, representing 28.9%, and the numbers of BMI categories earlier mentioned were 4, 1, and 6, representing 10.5, 2.6, and 15.7%, respectively, with a p-value of 0.468. Therefore, the meal consumption habits did not significantly affect BMI. The weak relation between them was r= 0.122. Despite the lack of a significant relationship between these variables, most participants were self-reliant during meal consumption. Categories of Somewhat needing help and always with help may parents monitor to prevent eating unhealthy foods by their sons (Ghazza et al., 2022).

Health problems that hinder eating include teeth or jaw defects, chewing or swallowing defects, and respiratory disorders illustrated in Table (3), the chewing or swallowing defects had the most problems (30) individuals, representing 78.9%. 14, 7, and 9 were the normal, overweight, and obese, respectively. 7, representing 18.4%, suffer from defects in the teeth or jaw. 4, 1, and 2 were normal, overweight, and obese, respectively; the one subject, representing 2.6%, had disorders of the respiratory system who were obese, consistent with the results of (Roccatello et al., 2021; and Nordstrøm et al., 2020). A P value of 0.406. indicates the health problems that hinder eating do not significantly affect the BMI categories. A weak correlation coefficient r = 0.128. Although most previous studies did not indicate the relationship between these disorders and BMI, the current study fully understands the effect of disorders on nutritional status.

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Table 3. The effect of health problems that hinder eating on BMI.

Item	subjects F (%)	BMI categories			Corr.	P-Value
		Normal weight F (%)	Overweight F (%)	Obese F (%)		
Teeth or jaw defects	7(18.4)	4(10.5)	1(2.6)	2(5.3)		
Chewing or swallowing	30(78.9)	14(36.8)	7(18.4)	9(23.7)	*0.128*	*0.406*
Disorders of respiratory	1(2.6)	0(00)	0(00)	1(2.6)		

The answers to compliance to diet, classified as Yes and No, appear in Table (4). The frequencies were 6 and 32, representing 15.8 and 84.2%, respectively. The majority of study individuals do not follow the diet. The relationship between following a diet and the number of family members with parents is shown in the table mentioned. Family size, classified as ≤3, 4-5, 6-7, and 8 or above individuals. The "yes" answers 6, representing 15.8%. The frequencies were 0, 5, 1, and 0 members, respectively, by family members. The "no" answers were 32, representing 84.2%; the frequencies according to family members were 2, 4, 15, and 11 members, respectively. The highest answers were 15 individuals not following a diet by the family having 6-7 members. **A P value of 0.02 is** less than 5%, indicating a significant effect of the number of family members with parents on following a diet, a relationship between the number of family members and following a diet, and **a value of r = 0.377**. An increasing number of family members is leading to a decrease in following the diet.

Table 4. The effect of family members with parents on following diet.

Following diet	Subjects F (%)	Number of Family Members, Including Parents				Corr.	P- value
		≤ 3 F (%)	4-5 F(%)	6-7 F (%)	≥ 8 F (%)		
Yes	6(15.8)	0(00)	5(13.2)	1(2.6)	0(00)		
No	32(84.2)	2(5.2)	4(10.5)	15(39.5)	11(28.9)	*0.377**	*0.02*
Total	38(100)	2(5.2)	9(23.7)	16(42.1)	11(28.9)		

The physical activity of study individuals compared to their siblings depends on age groups, age groups classified as earlier mentioned in Table (1). Physical activity categories are less, equivalent, and hyperactivity, as shown in Table (5). The frequencies of the children group by physical activity were 4, 9, and 17 individuals, representing 10.5, 23.6, and 44.7%. The frequency of the adolescent group was 0, 1, and 4, representing 0, 2.6, and 10.5%. The adult group was 0, 0, and 3 individuals, representing 0, 0, and 7.8%, respectively. The study individuals were equivalent to their sibling 24, representing 63.2%, hyperactive 10, representing 26.3%, and less than their siblings 4, representing 10.5%. The results showed a P value = 0.092, up than the 5% significance level, indicating no significant differences between age groups and a weak

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relationship between age groups and physical activity, r = 0.262. These results are inconsistent (do Prado Nascimento et al., 2021), where there was a relationship between physical activity and age, and findings DS individuals were mostly sedentary.

Table 5. The relationship between age groups and physical activity in comparison to their siblings.

Age/y Groups	Physical Activity				Corr.	P- value
	F (%)	Less F (%)	Hyperactivity F (%)	Equivalent F (%)		
≤ 13 Children	30(78.9)	4 (10.5)	9 (23.7)	17 (44.7)		
14-17 Adolescents	5 (13.2)	0 (00)	1 (2.7)	4 (10.5)	0.26	0.092
≥ 18 Adults	3 (7.9)	0 (00)	0 (00)	3 (7.9)		
Total	38 (100)	4 (10.5)	10 (26.3)	24 (63.2)		

Attitudes of study individuals toward certain food types by the acceptable and unacceptable foods types are clearly shown in Table (6), the meat groups. The percentage acceptable of red meat, representing 97%, because of its preferable smell compared to fish, representing 24%, is unacceptable for the study individuals, as indicated (Roccatello et al., 2021). Fruits constituted a higher percentage, representing 92% as acceptable and 8% as unaccepted. The vegetable represented 89% as accepted and 11% as unaccepted. The reason for preferring fruits over vegetables could be their soft texture and preferred smell (Roccatello et al., 2021). Also, the current study found that 78.9% had chewing and swallowing problems, and 18.4% had teeth and jaw defects.

Milk and dairy products were most accepted among food by participants, representing 100%, which aligns with (Doğan et al., 2020) finding of high milk and dairy products consumed in the meals group. Rice, pasta, couscous, and bazin represented 79, 81, 81, and 66% of accepted, while unaccepted were 21, 19, 19, and 34%, respectively. Pastries, and juices & drinks. Also, Sweets and Baked scored high percentiles as accepted, representing 81, 90, 81, and 84%, while unacceptable, representing 19, 10, 19, and 16%, respectively. Because of hard consistency and required more chewing, nuts were 74% accepted and 26% unaccepted, as suggested (Ptomey et al., 2023).

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Table 6. Acceptable and unacceptable food types by study individuals.

Items		Acceptable F (%)	Un acceptable F (%)
Meats Group	Red meat	37 (97)	1 (3)
	White meat	36 (95)	2 (5)
	Fish	29 (76)	9 (24)
Vegetables		34 (89.5)	4 (10.5)
Fruits		35 (92)	3 (8)
Milk and dairy products		38 (100)	0 (00)
Meals	Rice	30 (79)	8 (21)
	Pasta	31 (81)	7 (19)
	Couscous	31 (81)	7 (19)
	Bazin	25 (66)	13 (34)
	Pastries	31 (81)	7 (19)
Juices and drinks		34 (89.5)	4 (10.5)
Nuts		28 (74)	10 (26)
Sweets		31 (81)	7 (19)
Baked		32 (84)	6 (16)

4. Conclusion

Our findings reveal a significant presence of malnutrition in this population in Zliten City, with family size identified as key factor influencing dietary habits, specifically, larger family sizes appeared to impact the ability to adhere to a proper dietary plan. While no other factors under study had significant effect on prevalence of malnutrition among the study participants. These results emphasize the need for targeted interventions considering family dynamics to improve the nutritional status of IDS. Further studies should explore additional factors to develop more effective dietary and health promotion programs. The descriptive design of this study and lack of control group limits comparisons. Furthermore, relying on parents' answers about the physical activity may not reflect an individual's actual activity level, is one major limitations of the current study.

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