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Factors hindering compliance with hygienic-dietary measures among pregnant women with gestational diabetes in Morocco

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Abstract: Gestational diabetes mellitus is considered one of the most common medical complications of pregnancy, and its prevalence has been rising steadily over recent decades. This analytical study aimed to analyze the factors hindering compliance with hygienic-dietary measures among 201 pregnant women with gestational diabetes in the Rabat-Salé-Kénitra region between October 2024 and April 2025. We collected data using a questionnaire representing a multidimensional assessment tool for compliance with hygienic-dietary measures, structured around 30 variables organized into six theoretical dimensions administered directly to pregnant women. Analysis revealed that individual factors such as personal motivation, understanding of disease and treatment, and emotional state were found to be strongly associated with adherence to hygienic-dietary measures, with large effect sizes (Cohen's d between 1.09 and 1.30). For factors related to treatment and medical follow-up, regular attendance at medical appointments appeared to be a factor strongly associated with compliance in multivariate analysis (OR = 3.951; 95% CI [2.199 - 7.100]). The scope of this research and the innovation of its approaches have opened up a new era in understanding and improving compliance with hygienic-dietary measures in gestational diabetes.

Keywords: *Compliance, Factors, Gestational diabetes mellitus, Hygienic-Dietary measures, Morocco.*

1. Introduction

Gestational diabetes mellitus (GDM) is considered one of the most common medical complications of pregnancy, and its prevalence has been rising steadily over recent decades [1]. According to the criteria of the World Health Organization (WHO) and the American Diabetes Association (ADA), GDM is defined as glucose intolerance diagnosed for the first time during pregnancy [2]. Worldwide, the prevalence of gestational diabetes is estimated at 15.8%. According to the results of systematic reviews and meta-analyses, the prevalence of GDM is represented as follows: in the Eastern Mediterranean region, the overall prevalence of GDM was 11.7% [3]. The total incidence of GDM in mainland China was 14.8% [4]. The prevalence of GDM was highest in Eastern Europe (31.5%), followed by Southern Europe (12.3%), Western Europe (10.7%), and Northern Europe (8.9%) [5]. In Morocco, the figures are unknown, but a study carried out between 2008-2009 at Rabat University Hospital showed that the prevalence of GDM was 8.2% [6] and an another study conducted in Safi between 2018 and 2019 showed a prevalence of 24.5% [7]. There are many risk factors for GDM, including obesity, high maternal age, a history of gestational diabetes, a family history of diabetes, belonging to an ethnic group with a high prevalence of T2DM, polycystic ovary syndrome and persistent glycosuria [8]. GDM can lead to a number of complications for the mother, such as gestational hypertension, pre-eclampsia and eclampsia, the risk of premature delivery and even kidney

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problems, and for the child, respiratory distress due to hyperglycemia and a higher risk of developing type 2 diabetes later in life [9].

In all cases, the management of GDM is based on hygienic-dietary rules, i.e. a regular, balanced diet and regular physical activity [10]. Dietary treatment remains the fundamental and principal measure in the management of GDM, as it helps to maintain stable blood glucose levels and provide optimal nutrition for fetal development and growth, while reducing future risks [11]. However, in women with gestational diabetes, adherence to diet generally remains difficult, as it is influenced by numerous cultural, social and economic factors [12]. Several studies have analyzed the efficacy of dietary interventions, but compliance remains highly variable from one population to another [13, 14]. The difficulty of adhering to a diet in GDM is frequently associated with individual perception of the disease, nutritional knowledge and the support provided by healthcare professionals [15].

Despite a rich literature of epidemiological studies focusing on the management of GDM, the factors influencing patient adherence to prescribed dietary measures are not fully understood [16]. The majority of studies available today focus on general trends and outcomes, rather than on the specific socio-cultural and psychological factors influencing adherence to dietary guidelines [17, 18]. On the other hand, understanding the individual and systemic barriers that influence general adherence to dietary hygiene rules could help develop targeted interventions, and improve therapeutic outcomes.

The aim of this study was therefore to analyze the factors influencing compliance with dietary hygiene rules among pregnant women with gestational diabetes in Morocco.

2. Materials and Methods

2.1. Type of Study and Population

This is an analytical study of 201 pregnant patients diagnosed with gestational diabetes in the Rabat-Salé-Kénitra region. Participants were recruited between October 2024 and April 2025 in 3 hospitals in the Rabat-Salé-Kénitra region.

2.2. Data Collection

We collected data using a questionnaire representing a multidimensional assessment tool for compliance with hygienic-dietary measures, structured around 30 variables organized into six theoretical dimensions administered directly to pregnant women.

The three-part questionnaire was designed to collect the following data:

- Sociodemographic and clinical data (13 variables)
- -Identification: code, origin, age
- Socio-economic: education, profession
- Obstetrical: gestational age, parity,
- Anthropometric: weight, height, BMI, weight gain
- -Therapeutic: type of treatment, etc.
- Individual factors (4 variables)

1. Personal motivation
2. Stress/anxiety level
3. Fatigue
4. Emotional state

- Socio-economic factors (5 variables)

6. Cost of prescribed diet
7. Distance from care center
8. Means of transportation
9. Accommodation
10. Employment status

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- Social and family factors (6 variables)

11. Family support
12. Partner support
13. Support from family and friends
14. Family constraints
15. Social pressure

- Treatment (diet) factors (4 variables)

16. Strict prescribed diet
17. Diet adapted to eating habits
18. Diet adapted to dietary preferences
19. Monotonous diet

- Medical follow-up factors (4 variables)

20. Frequency of appointments
21. Regular compliance with consultation appointments
22. Consultations time
23. Active listening

2.3. Measurement Scale

Each variable is evaluated on a 5-point Likert scale

0	None/Never
1	Low/Rarely
2	Medium/Sometimes
3	Strong/Often
4	Very strong/Always

2.4. Definition of Compliance

Compliance is defined as a composite score based on the 30 variables assessed, enabling patients to be classified into two categories:

- Good compliance: global threshold score determined by ROC analysis
- Poor compliance: global score < threshold

2.5. Ethical Considerations

The study protocol was previously approved by the ethics committee of regional direction of health and social protection rabat sale kenitra (N 7223/2024). All precautions in accordance with the Declaration of Helsinki were taken to protect the privacy and confidentiality of the personal information of those involved in the research. Informed consent was obtained from the participants, who were duly informed of the objectives and potential methods, procedures, benefits and risks.

2.6. Statistical Analyses

Data preparation is a fundamental step in the analysis process, conditioning the validity of all results. This phase began with the creation of a structured database using SPSS version 26.0 software, chosen for its robustness. The structure of the database was designed to facilitate the various types of analysis planned, with a logical organization of variables and the implementation of automatic consistency checks. Qualitative variables were expressed as numbers and percentages, while quantitative variables were presented as means and standard deviations, or medians and interquartile ranges, depending on their distribution. Bivariate analyses were performed to explore the relationship between the various factors and compliance.

The statistical significance level was set at $p < 0.05$.

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3. Results

3.1. Socio-Demographic Characteristics of the Study Population

The mean age of the participants was 32.52 ± 6.12 years. Age distribution reveals a predominance of women in the reproductive age group: 52.2% between 30-39 years, 27.4% between 25-29 years, and 25.9% over 35 years. Analysis of educational level revealed that 26.9% of participants had primary school education, followed by secondary school education with a percentage of 21.4% (Table 1).

Table 1.
Socio-demographic characteristics of the study population.

Characteristic	Percentage (%)
Mean age (Years)	32.52 ± 6.12
Distribution by age group	
25-29 years	27.4
30-39 years	52.2
over 35 years old	25.9
Education level	
Illiterate	13.9
Primary	26.9
High school college	17.9
High school	21.4
Vocational training	6.5
Higher education	10
Not specified	3.5

3.2. Prevalence of Pre-Pregnancy Overweight

Anthropometric parameters confirm the high prevalence of pre-pregnancy overweight, with a mean BMI of 27.37 ± 5.13 kg/m². 36.3% of women were overweight, and 29.9 obese (Table 2).

Table 2.
Distribution of pregestational BMI.

BMI category	N (%)
Underweight (<18.5)	3 (1.5)
Normal weight (18.5-24.9)	65 (32.3)
Overweight (25.0-29.9)	73 (36.3)
Obesity (30.0)	60 (29.9)
Total excess weight	133 (66.2)

3.3. Major Innovation: Multidimensional Structure of Compliance

Principal component analysis of the 30 compliance variables revealed the following results: The first dimension underlines the fundamental importance of cognitive (understanding) and emotional (psychological state) processes in determining compliance with dietary and hygienic measures. The high saturation of "understanding of illness" (0.879) confirms that personal conceptualization of pathology is a major determinant of health behaviors. The second dimension revealed the significant impact of physiological (fatigue) and psychological (stress/anxiety) factors on compliance, underlining the need for therapeutic recommendations to take into account patients' general state and well-being. The third dimension showed high saturation for adaptation to preferences (0.831) and habits (0.738), demonstrating that dietary compliance depends more on personalization than standardization of prescriptions. And for factors related to medical follow-up, a complex three-dimensional structure was revealed, with high saturation for active listening (0.894) and length of consultations (0.967) (Table 3).

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Table 3.
Composition of different dimensions.

Variable	Factorial saturation	Community
Dimension 1: Cognitive and psycho-emotional factors (36.7% variance)		
Understanding the disease	0.879	0.872
Emotional state	0.863	0.873
Understanding treatment	0.620	0.392
Language barrier	0.766	0.592
Dimension 2: Physiological and well-being factors		
Fatigue	0.851	0.747
Stress/anxiety level	0.867	0.763
Dimension 3: Dietary factors		
Diet adapted to dietary preferences	0.831	0.691
Diet adapted to eating habits	0.738	0.544
Monotone diet	0.681	0.464
Strictly prescribed diet	0.585	0.342
Dimensions 4-6: Medical follow-up factors		
Frequency of appointments	0.869	
Regular appointments	0.784	
Active listening	0.894	
Access to information	-0.664	
Duration of consultations	0.967	

3.4. Major Discovery: The Four Independent Determinants of Compliance

Multivariate analysis identified four factors independently and significantly associated with adherence to dietary hygiene measures: 1. Understanding of treatment (OR = 5.292) - Primary determinant : Understanding treatment emerges as the most powerful determinant of compliance, with an odds ratio of 5.292. Regular compliance with consultation appointments, with an odds ratio of 3.951, reflects the behavioral dimension of compliance. Personal motivation, with an odds ratio of 3.872, is the psychological driver of adherence to dietary hygiene measures. This variable encompasses personal commitment, determination to follow recommendations and perseverance in the face of difficulties. The strong association of this factor with compliance underlines the importance of therapeutic approaches focused on reinforcing intrinsic motivation rather than external coercion. Diet adaptation to dietary preferences, although presenting the smallest odds ratio (1.896), remains statistically significant and clinically relevant (Table 4).

Table 4.
Independent determinants of medication compliance.

Determinant	Coefficient β	Adjusted OR	IC 95%	p-value
Understanding treatment	1.666	5.292	[2.665 - 10.507]	<0.001
Regular appointments	1.374	3.951	[2.199 - 7.100]	<0.001
Personal motivation	1.354	3.872	[2.325 - 6.449]	<0.001
Diet adapted to preferences	0.640	1.896	[1.084 - 3.317]	0.025
Constant = -6.588; p < 0.001				

3.5. In-Depth Bivariate Analysis: Identification of Significant Associations

3.5.1. Individual Factors and Compliance: Major Differences

Bivariate analysis of individual factors reveals substantial differences between poor and good compliance groups, with large effect sizes testifying to clinically significant associations: These results reveal a consistent pattern: cognitive (understanding of disease and treatment) and motivational (self-motivation, emotional state) dimensions discriminate strongly between compliance groups, while physiological (stress, fatigue) and communicational (language barrier) factors show no significant association (Table 5).

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Table 5.
Comparison of individual factors by level of compliance.

Individual factor	Low compliance (n=150)	Good observance (n=51)	p-value	Cohen's d	Magnitude
Personal motivation	0.43 ± 0.93	1.78 ± 1.30	<0.001	-1.304	Very large
Emotional state	1.03 ± 1.23	2.55 ± 1.27	<0.001	-1.227	Very large
Understanding the disease	1.05 ± 1.23	2.43 ± 1.38	<0.001	-1.090	Large
Understanding treatment	0.18 ± 0.60	1.25 ± 1.51	<0.001	-1.170	Very large
Stress/anxiety level	1.63 ± 1.40	1.84 ± 1.27	0.346	-0.153	Negligible
Fatigue	1.26 ± 1.30	1.51 ± 1.36	0.242	-0.190	Negligible
Language barrier	0.89 ± 1.08	0.88 ± 1.11	0.950	0.010	Negligible

3.6. Factors Linked to Medical Follow-Up: Assiduity and Communication

Analysis of the factors linked to medical follow-up reveals the importance of the relational and organizational dimension in compliance with dietary hygiene measures: regular attendance at appointments shows the strongest association with compliance (d = -1.429), confirming its role as an independent determinant. This association suggests that regular attendance at consultations is both a marker and a facilitator of overall compliance. Access to information also shows a very strong association (d = -1.210), revealing that compliant patients benefit from more than twice the access to information (2.16 vs. 0.82). Surprisingly, active listening showed only a non-significant trend (p = 0.072), and even a slightly higher score in the low compliance group. This counter-intuitive result could be explained by compensation: less compliant patients could benefit from enhanced listening by caregivers trying to alleviate their difficulties (Table 6).

Table 6.
Medical monitoring factors according to compliance.

Follow-up factor	Low compliance (n=150)	Good observance (n=51)	p-value	Cohen's d
Regular appointments	0.63 ± 0.83	1.88 ± 0.99	<0.001	-1.429
Access to information	0.82 ± 1.02	2.16 ± 1.32	<0.001	-1.210
Active listening	1.10 ± 1.17	0.76 ± 1.07	0.072	0.293

3.7. Dietary Factors: Personalization Versus Standardization

Analysis of diet-related factors confirms the importance of personalization in dietary compliance: adaptation to food preferences emerges as the most discriminating dietary factor (d = -0.788), confirming its inclusion in the final predictive model. This association underlines the fact that dietary compliance depends more on flexibility and personalization than on prescriptive rigidity (Table 7).

Table 7.
Dietary factors according to compliance.

Dietary factor	Low compliance (n=150)	Good observance (n=51)	p-value	Cohen's d
Diet adapted to preferences	1.57 ± 0.95	2.31 ± 0.91	<0.001	-0.788
Diet adapted to habits	1.45 ± 1.02	1.98 ± 1.15	0.003	-0.491
Strictly prescribed diet	0.98 ± 1.18	0.78 ± 1.02	0.273	0.179
Monotone diet	1.82 ± 1.09	1.69 ± 1.21	0.456	0.115

4. Discussion

Our results showed that the average age of the participants was 32.52 ± 6.12 years. Age distribution reveals a predominance of women in the reproductive age group: 52.2% between 30-39 years, 27.4% between 25-29 years, and 25.9% over 35 years. Bivariate analysis revealed that among the individual factors; personal motivation, understanding of disease and treatment, and emotional state were found to be strongly associated with adherence to hygienic-dietary measures, with large effect sizes [19] between 1.09 and 1.30). These results are in line with those of Mirzaei-Alavijeh, et al. [20] using the

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COM-B (Capability-Opportunity-Motivation and Behavior) model, identified motivation as the most powerful predictor of adherence (Beta=0.296), followed by self-efficacy (Beta=0.244) and disease knowledge (Beta=0.157) [20]. These findings, from different clinical contexts, converge to underline the central importance of cognitive and emotional factors in adherence to hygienic-dietary measures, suggesting that interventions to improve adherence should target these dimensions as a priority.

Personal motivation, which showed the strongest association with adherence in bivariate analysis (d = -1.304) and remained significantly associated with adherence in multivariate analysis (OR = 3.872; 95% CI [2.325 - 6.449]), underlines the central role of this factor in the adoption and maintenance of health behaviors. This result is consistent with the principles of self-determination theory [21] which postulates that health behaviors are more likely to be adopted and maintained when they are intrinsically rather than extrinsically motivated.

Understanding of treatment appeared to be the factor most strongly associated with compliance in multivariate analysis (OR = 5.292; 95% CI [2.665 - 10.507]), confirming the importance of cognitive aspects in the management of gestational diabetes. This result is in line with those of Carolan who showed that knowledge of gestational diabetes was positively correlated with compliance with dietary recommendations and self-monitoring of blood glucose [19]. It is also consistent with the health literacy model, which emphasizes the importance of knowledge and understanding in the adoption of appropriate health behaviors [22].

Emotional state, although strongly associated with adherence in bivariate analysis (d = -1.227), did not retain this association in multivariate analysis. This discrepancy could be explained by the strong correlation observed between emotional state and understanding of the disease (r = -0.880), suggesting that these two variables could be measuring related aspects of the same phenomenon. The influence of emotional state on compliance could be mediated by understanding of the disease and other cognitive factors, as suggested by Ajzen [23] in their model of disease as representation.

For factors related to treatment and medical follow-up, regular attendance at medical appointments appeared to be a factor strongly associated with compliance in multivariate analysis (OR = 3.951; 95% CI [2.199 - 7.100]). This result underlines the importance of continuity of care in the management of gestational diabetes. This association is in line with the work of Karter et al. who demonstrated, in a cohort of 84,040 diabetic patients, that a rate of absenteeism of over 30% from scheduled appointments was associated with significantly worse glycemic control, with HbA1c 0.70 to 0.79 points higher than in patients who missed no appointments ($p < 0.0001$) [24]. Keeping appointments may be both a marker of good compliance (with more compliant patients being more likely to keep their appointments) and a factor favouring it (with regular follow-up enabling reinforcement of recommendations and optimal adjustment of treatment). Adaptation of the diet to dietary preferences also emerged as a factor independently associated with compliance (OR = 1.896; 95% CI [1.084 - 3.317]). This result highlights the importance of tailoring dietary recommendations to patients' tastes and cultural habits. Access to information, although strongly associated with compliance in bivariate analysis (d = -1.210), did not retain this association in multivariate analysis. This observation could be explained by the correlation between access to information and understanding of treatment, the effect of the former on compliance being potentially mediated by the latter.

5. Conclusion

The scope of this research and the innovation of its approaches have opened up a new era in understanding and improving compliance with dietary hygiene measures in gestational diabetes. The tools developed and mechanisms identified represent a significant contribution both to fundamental scientific knowledge and to the improvement of clinical practice, with implications that go far beyond the initial context of the study to touch on the very foundations of therapeutic education and behavioral medicine.

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Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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