





Assessing Pregnant Women's Readiness for Pregnancy-Healthy Nutrition: A Trans-theoretical Model Approach

Rafah Abdulsalam*¹  Yosra Hasni¹ 

PhD Candidate, Farhat Hached University of Sousse, Faculty of Medicine of Sousse, University of Sousse, Tunisia
Associate Professor, Department of Endocrinology, Farhat Hached University of Sousse, Faculty of Medicine of Sousse, University of Sousse, Tunisia

Article information	Abstract
<p>Article history: Received March 09, 2023 Accepted on June 14, 2023 Available online January 12, 2024</p> <p>Keywords: Pregnant women, Trans-Theoretical Model of change, Healthy Nutrition, Readiness, Stages of Change, Decisional Balance, Self-Efficacy, Maternal Health.</p> <p>Correspondence: Rafah Abdulsalam rafah.raad@uoninevah.edu.iq</p>	<p>Background: Pregnant women undergo significant physiological changes, requiring careful nutrition and lifestyle attention. This study explores the readiness of primiparous women to adhere to healthy nutrition during pregnancy, utilizing the Trans-Theoretical Model of Change (TTM) as a theoretical framework. Understanding the various stages of readiness can inform tailored interventions to support pregnant women in adopting and maintaining healthy behavior.</p> <p>Methods: This Study, conducted over a month in Maternity Hospitals in Mosul City, used a descriptive, predictive correlational design. The sample included 300 primiparous women selected from the Al-Salam Teaching Hospital, El-Khansa Teaching Hospital, and Al-Batul Maternity Hospital. The inclusion criteria covered primiparity and gestational age between 13 and 35 weeks. Various instruments were used, including sociodemographic sheets and scales for socioeconomic status, change stages, change processes, decisional balance, and self-efficacy. The ethical considerations included the written and verbal consent of the participants, ensuring the study's adherence to ethical standards.</p> <p>Results: The Study's findings are significant, as they identified different phases of readiness among pregnant women according to the TTM: pre-contemplation (15%), contemplation (22%), preparation (32%), action (28%), and maintenance (3.3%). The key constructs varied significantly between these phases, with decisional balance scores peaking in the preparation phase, perceived benefits highest in maintenance, and perceived barriers most significant during contemplation. Self-efficacy showed the highest levels in the maintenance phase. These findings underscore the importance of tailoring interventions to specific TTM phases to promote healthy behaviors and enhance self-efficacy during pregnancy, providing valuable insights for healthcare providers.</p> <p>Conclusions: The Study highlights the relevance of TTM in understanding pregnant women's readiness to adopt healthy nutrition. Tailored interventions corresponding to each TTM phase are crucial to promoting positive behaviors and enhancing self-efficacy during pregnancy. Healthcare providers should consider these insights to develop targeted strategies to help pregnant women adhere to pregnancy-healthy nutrition guidelines.</p>

DOI: [10.33899/min.2024.182191](https://doi.org/10.33899/min.2024.182191), Authors, 2024, College of Nursing, University of Mosul.
This is an open-access article under the CC BY 4.0 license (<http://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Pregnant women often have unique nutritional needs due to their changing bodies and the needs of their growing baby (Krebs et al., 2023). It is essential for pregnant women to understand the importance of

nutrition during pregnancy and to be aware of the strategies and tools available to help them adhere to pregnancy-healthy nutrition guidelines (Leroy et al., 2023). Pregnant women should discuss any questions or concerns about nutrition during pregnancy with their healthcare provider (Manik et al., 2023). Pregnant

women must be aware of the recommended dietary guidelines for pregnancy, such as increasing their intake of fruits and vegetables, whole grains, lean proteins, and healthy fats (Stickford et al., 2023). Furthermore, pregnant women may benefit from tracking their food intake and keeping a diary to meet their nutritional needs (Banjar, 2023). It is also essential for pregnant women to understand the importance of physical activity and how it can help keep their bodies healthy and active during pregnancy (Cortes, 2023). Pregnant women should speak with their healthcare provider about any physical activity guidelines or restrictions that may apply to them (Sato et al., 2023). Overall, it is essential for pregnant women to be aware of the importance of nutrition and physical activity during pregnancy and to have the support and tools necessary to adhere to pregnancy-healthy nutrition guidelines (Hayman et al., 2023). This study uses the trans-theoretical change model as a theoretical framework to assess pregnant women's readiness to adhere to pregnancy-healthy nutrition.

METHODS

Design of the Study

The study was guided by a descriptive, predictive correlational design and was carried out over a month among first-time mothers at the Maternity Hospital in Mosul City.

The setting of the study

The study was carried out within the consultation departments of designated maternity hospitals. The locations included Al-Salam Teaching Hospital and Elkhansa Teaching Hospital on the left side of the health directories and Al-Batul Maternity Hospital on the right side. This setting was chosen to ensure a complete representation of the study sample from the maternity hospitals' left and proper health directories.

3.5. Sample of the Study:

This study will include a convenient sample of (300) pregnant women who will be recruited from two hospitals (200 women) on the left side of the Al-Salam Teaching Hospital, the El-Khansa Teaching Hospital, and on the right side of the Al-Batul Maternity Hospital (100 women) in Mosul City, as shown in Table (3.3). The sample size was calculated using the G * Power 3.1.9.2 software. Based on a moderate effect size (0.15), an alpha error probability of 0.05, a power of 0.99, the number of predictors tested (eight), and the total number of predictors (eight), the entire sample size would be 211. Considering an attrition rate of 20% (n = 42.2), the final sample size would be 300.

3.6. Inclusion Criteria

1. Primiparous women
2. Gestational age from 13 to 35 weeks

3.7. Exclusion Criteria

1. Multiparous
2. Pregnant women with physical/mental disability
3. Pregnant women with metabolic disorder
4. Pregnant women with chronic diseases

3.8. The study instrument

The study instrument includes the sociodemographic sheet indicating the age and residence of the participants. The Socioeconomic Status Scale, which encompasses the level of education of the level of education of the husband and wife, the monthly income of the family, and the occupation of the household of the household (Shaikh & Pathak, 2017), the Stages of Change Scale for Healthy Pregnancy, The Processes of Change Scale for Healthy Pregnancy, The Decisional Balance Scale for Healthy Pregnancy, and the Self-Efficacy Scale for Healthy Pregnancy.

3.9. Ethical Considerations

1. Written consent was obtained from both left- and right-hand hospitals to collect data.
2. The investigator obtained verbal consent from each study participant. The student researcher explained the study objectives and assured the participants that their participation was voluntary and that all information would be kept secure and confidential during and after this study.

Sociodemographic characteristics:

Reproductive status:

The study instrument also includes women's weight before pregnancy, current weight, height, gravity, parity, abortion, and gestational age (weeks).

The Stages of Change Scale (Short Form)

The Stages of Change Scale to Adopt a Healthy Diet encompasses six discrete questions about individuals' readiness to adopt a healthy diet. The participant must select only one answer that best describes his/her condition accordingly.

The Stages of Change Scale (Continuous Form)

The Stages of Change Scale (Continuous Form) measures participants' willingness to adopt a healthy pregnancy diet. It includes 24 items measured on a 5-point Likert-type scale of 1 for (strongly disagree) to 5 for (strongly agree). The total score on this scale ranges from 24 to 120. A higher score indicates higher stages of change. The Stages of Change Scale (Continuous Form) demonstrated excellent content validity and

internal consistency reliability (Cronbach's alpha = .843) (Abd et al.).

The Processes of Change Scale for Adopting a Pregnancy-Healthy Diet

The Processes of Change Scale to Adopt a Pregnancy-Healthy Diet measures participants' strategies to change their unhealthy dietary behaviors to healthy ones. The Processes of Change Scale for Adopting a Pregnancy-Healthy Diet includes 31 items that are distributed into Consciousness Raising (3 items), Dramatic Relief (3 items), Environmental Reevaluation (3 items), Self-Reevaluation (3 items), Social Liberation (3 items), Counterconditioning (3 items), Helping Relationships (3 items), Reinforcement Management (4 items), Self-Liberation (3 items), and Stimulus Control (3 items). These items are measured on a 5-point Likert-type scale of 1 for (never) to 5 for (repeatedly). The total score on this scale ranges from 31 to 155. A higher score indicates that the individual uses more processes of change and uses more processes of change. The Change Process Scale demonstrated good content validity and internal consistency reliability (Cronbach's alpha = 0.873) (Abd et al.).

Self-Efficacy

The items on the Self-Efficacy Scale were designed to assess situation-specific confidence that people can adopt a healthy diet, regardless of their situation. The initial scale includes 19 items (four items for positive affect situations), (four items for Negative Affect Situations), and (four items for habit situations). These items are measured on a visual analogy scale that ranges from one (not confident at all) to nine (very confident). Self-efficacy scores range from 19 to 95. Higher scores indicate greater self-confidence to adopt a pregnancy-healthy diet.

Decisional Balance Scale

Nineteen items were formulated to represent the Pros (10 items) and Cons (9 items) of adopting the marker behavior (delineated above in Stage of Change) for university students. The Decisional Balance Scale was intended to measure how important each of these items (e.g., Preparing a healthy diet would take a long time; I would feel more optimistic if I eat a healthy diet) represents a thought that might occur to a person who is deciding whether or not to eat a healthy diet and how important each of these statements might be to him/her if he/she was considering a decision to eat a healthy diet. The responses were on a 5- 5-point Likert scale, ranging from 1 = 'not at all important' to 5 = 'extremely

important.' Pros scores range from 10 to 50. Higher scores indicate more incredible pros of the behavior above. The cons score ranges from 9 to 45. Higher scores indicate more excellent Cons of the behavior.

Pilot Study

Completing a pilot study is an essential step that saves later difficulty when the final steps of the research process are implemented. A pilot study may be conducted with several different aims, as no prior research has been conducted on the topic, making power analysis challenging to perform. A pilot study will help estimate the effect sizes needed for an accurate power analysis (Aberson, 2019; Grove & CIPHER, 2020; Hayat, 2013). The objectives of a pilot study may also help identify problems that may interfere with the study's validity or the challenges of using the instruments.

A pilot study is a 'small-scale investigation carried out prior to a subsequent adequately powered trial' (Conn, 2010, p. 991) or another research method. A typical reason for conducting a pilot study is to determine whether the proposed methods effectively locate and obtain consenting subjects and collect valuable data. This type of pilot study is often referred to as a feasibility study. Feasibility studies can determine whether subjects will consent to study participation, how many subjects are available, how much time is required to gather data on one subject, and how well the instruments work. Some pilot studies seek to determine whether an intervention produces a measurable difference in the dependent variable and how significant that difference is. For these studies, the sample size must be carefully considered for meaningful results (Hertzog, 2008). Another reason for a pilot study is to test some aspects of the study. Conducting pilot studies usually results in more robust and more rigorous full-scale studies (Kazdin, 2017). The student researcher conducted a pilot study on a sample of 30 primigravid women who were later excluded from the final sample size. The elements of the study instrument were readable for the study participants, and the time required to answer all elements was between 20 and 25 minutes.

3.15. Data Analysis:

Data will be analyzed using the IBM statistical package for social science and AMOS software. Statistical descriptive frequency, percent, mean, and standard deviation measures will be used. Inferential statistical measures of linear regression, independent sample T-

test, and one-way analysis of variance (ANOVA) will be used. Additionally, structure equation modeling using AMOS software will test the causal relationship

RESULTS

In this study, 300 pregnant women were classified into different phases of the trans-theoretical model (TTM), revealing a significant distribution in the phases of contemplation (15%), contemplation (22%), preparation (32%), action (28%) and maintenance (3.3%) phases. Table 2 highlights the variations in critical constructs in these phases, with decisional balance scores peaking in the preparation phase and lowest in the preparation phase. Perceived benefits were highest in the Maintenance phase and lowest in

between latent factors (stages of change, processes of change, decisional balance, and self-efficacy).

pre-contemplation, while perceived barriers were most significant during contemplation and least in maintenance. Self-efficacy showed the highest levels in the maintenance phase and the lowest in pre-contemplation. The study suggests customized interventions corresponding to each TTM phase may be essential to promote healthy behaviors and increase self-efficacy during pregnancy, as indicated by the significant differences observed in the phases for all measured constructs.

Table 1: Distribution of pregnant women according to the TTM phases

TTM phase	No.	%
Pre-Contemplation	45	15
Contemplation	65	22
Preparation	97	32
Action	83	28
Maintenance	10	3.3
Total	300	100

Table 2: Trans-Theoretical Model Phase (TTM) and Related Constructs' Mean Scores with Standard Deviations (S.D.)

TTM phase	Pre-Contemplation N=45	Contemplation N=65	Preparation N = 97	Action N =83	Maintenance N= 10	Sig
	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	Mean \pm SD	0.00
Decisional Balance	1.22 \pm .41	1.77 \pm .09	2.14 \pm .22	1.88 \pm .22	2.22 \pm .38	0.00
Perceived Benefits	3.55 \pm 1.3	4.14 \pm .47	4.47 \pm .31	4.14 \pm .41	4.71 \pm .11	0.00
Perceived barriers	2.13 \pm . 63	2.34 \pm .39	2.19 \pm .26	2.25 \pm .73	1.64 \pm .13	0.00
Self-Efficacy	1.66 \pm .34	2.34 \pm ..71	2.23 \pm .11	2.66 \pm ..45	2.96 \pm .71	0.00

DISCUSSION

The findings of this study offer valuable information on the distribution of pregnant women in different phases of the Trans-Theoretical Model (TTM) and the associated variations in key constructs, including decisional balance, perceived benefits, perceived barriers, and self-efficacy. These results are of

particular significance when considering the primary objective of the study: the adherence of pregnant women to a healthy diet during pregnancy. The distribution of pregnant women across the TTM phases reveals a diverse landscape of readiness for behavior change among this population. The significant presence of pregnant women in the pre-contemplation

and contemplation phases suggests that a substantial proportion may not yet be fully committed to making the necessary changes to adopt a healthier diet during pregnancy. In contrast, the higher representation of women in the preparation and action phases indicates that many are actively considering or taking steps to improve their eating habits. The lower percentage in the maintenance phase highlights that maintaining a healthy diet can be challenging, and this phase represents a group of women who have successfully adopted and sustained these changes. The diversity of TTM phases underscores the need for customized interventions that recognize and address the unique needs and challenges pregnant women face at different stages of readiness for dietary change. According to previous studies, such as the work conducted by Huang et al. [50], these findings highlight the effectiveness of integrating TTM components into educational materials, underscoring their ability to improve the impact of nursing educational interventions and drive positive behavior change. This supports the idea that a customized approach, aligning interventions with individuals' readiness for change, can be a powerful tool in promoting and maintaining healthier behaviors during pregnancy.

Variations in critical constructs throughout the phases of TTM provide valuable information on the psychological and cognitive aspects of the change in behavior, specifically related to adhering to a healthy diet during pregnancy. The decisional balance, representing the weighting of dietary changes' perceived pros and cons, is highest in the preparation phase. This suggests that women in this stage are more motivated and perceive more significant benefits from adopting a healthier diet. In contrast, women in the pre-contemplation phase report the lowest decisional balance, indicating a lack of motivation and awareness of the benefits of dietary change. This underscores the importance of interventions to increase motivation and awareness among pregnant women in their early readiness to change their diet.

The constructs of perceived benefits and barriers play crucial roles in shaping individuals' intentions and behaviors (Le-Anh et al., 2023; Nga et al., 2023). The highest perceived benefits are reported by women in the Maintenance phase, while the lowest is observed in the Pre-Contemplation phase. This emphasizes the need to highlight and reinforce the benefits of adhering to a healthy diet, especially for those less aware or motivated to make dietary changes. Addressing

perceived barriers, particularly prominent during the contemplation phase, is vital to removing obstacles to dietary change and facilitating progress through the TTM phases.

Self-efficacy, reflecting an individual's belief in their ability to change and maintain dietary habits, demonstrates significant variation across the phases of TTM. The highest self-efficacy scores are found in the maintenance phase, indicating a strong belief in maintaining a healthy diet. In contrast, women in the pre-contemplation phase report the lowest self-efficacy, suggesting a lack of confidence in their ability to change their eating habits. Interventions focusing on self-efficacy, especially among women in the earlier stages of TTM, are crucial for empowering pregnant women to initiate and maintain dietary changes.

These findings align with the results of a previous study conducted by Huang et al., which demonstrated that pregnant women in the study group exhibited significantly higher post-test scores in self-efficacy, decisional balance (specifically pros), and the process of change (both experiential and behavioral aspects) about passive smoking prevention compared to pregnant women in the control group after an intervention grounded in the Trans-Theoretical Model (TTM) (Huang et al., 2013). Furthermore, Mohsen et al., who used TTM to facilitate lifestyle behavior modification, reported statistically significant improvements in the mean scores of participants' self-efficacy, decisional balance (focusing on the pros), and the process of change about dietary management behavior as an outcome of the TTM-based intervention (Carnegie et al., 2002). These studies collectively reinforce the idea that interventions founded on TTM have the potential to improve self-efficacy, modify the decisional balance, and promote positive changes in the process of change, thus corroborating the effectiveness of this framework in encouraging improvements in health behavior among pregnant women.

Conclusion:

In summary, the study's primary objective of evaluating pregnant women's adherence to a healthy diet during pregnancy is significantly influenced by their readiness for behavior change, as represented by the TTM phases. The study findings underscore the importance of recognizing and tailoring interventions to the specific TTM phase of pregnant women, as each phase presents unique psychological characteristics and challenges. By addressing decisional balance, perceived benefits, perceived barriers, and self-efficacy

in a phase-appropriate manner, healthcare providers and researchers can better support pregnant women in adopting and maintaining a healthy diet throughout their pregnancy. This, in turn, can contribute to improved maternal and fetal health outcomes. More research and the development of targeted interventions are needed to build on these findings and promote a change in healthy eating behavior among pregnant women, ultimately improving the well-being of both mothers and babies.

Implications of the Study

The findings of this study have several important implications for both research and practical applications in promoting healthy eating behaviors among pregnant women.

1. **Tailored Interventions:** Recognising the importance of readiness for behavior change, healthcare providers and researchers should focus on tailoring interventions based on the trans-theoretical model (TTM) phases. This customized approach recognizes that pregnant women exhibit unique psychological characteristics and challenges in different phases. By delivering interventions that align with a woman's specific TTM phase, the likelihood of a successful change in diet behavior can be significantly increased.
2. **Enhanced support:** Healthcare providers and practitioners can improve their support for pregnant women by addressing key constructs such as decisional balance, perceived benefits, perceived barriers, and self-efficacy in each TTM phase. This holistic approach acknowledges the multifaceted nature of the change in eating behavior. It allows for targeted support that corresponds to the specific needs and concerns of pregnant women at different stages of readiness.
3. **Maternal and Foetal Health:** Improving adherence to a healthy diet during pregnancy can produce substantial maternal and fetal health benefits. It can lead to a reduced risk of complications, better birth outcomes, and better long-term health for both mothers and infants. Therefore, TTM-based interventions can offer a path to achieving these health benefits.

4. **Future research:** The Study underscores the need for further research. Exploring the long-term effects of TTM-based interventions on maternal and fetal health outcomes, as well as investigating the most effective methods for tailoring interventions to TTM phases, would be valuable. Additionally, understanding the role of cultural, socioeconomic, and individual factors in changing eating behavior during pregnancy could help refine intervention strategies.
5. **Practical Applications:** The Study's findings directly affect the development of educational materials and interventions for pregnant women. As demonstrated in previous studies, incorporating TTM components into these resources can improve their effectiveness in driving behavior change. This can be integrated into prenatal care and health education programs to support pregnant women completely.

DECLARATION SECTION

Acknowledgments

We thank the Deanship of the Nursing College for their valuable support and collaboration throughout the research endeavor. Their efforts in facilitating data collection and furnishing essential resources are acknowledged with great appreciation. Special thanks are extended to the nursing leader who willingly engaged in this study; their cooperation was indispensable, and without it, this research would not have been feasible. Our appreciation also goes to the Ethical Committee for approving this study. Their meticulous evaluation and guidance ensured that the research adhered to ethical principles, prioritizing the rights and well-being of the participants.

Ethical Considerations

The Ninevah Institutional Review Board (IRB) granted approval for this research protocol, designated as Approval No. CCMRE-NUR-23-8, on November 8th, 2023. This endorsement signifies the study's adherence to ethical

standards and the assurance of safeguarding the rights and well-being of participants throughout the entire research endeavor.

Conflict of interest

None to be declared.

Funding:

None to be declared.

Data availability:

Data are available by contacting the corresponding author by email.

Authors contribution

All authors have read and approved the manuscript.

References

- Banjar, H.R. (2023). A Smart Monitoring System for Self-Nutrition Management in Paediatric Patients with Inherited Metabolic Disorders: Maple syrup urinary disease (MSUD). *healthcare*, <https://doi.org/10.3390/healthcare11020178>
- Carnegie, M., Bauman, A., Marshall, A., Mohsin, M., Westley-Wise, V., & Booth, M. (2002). Perceptions of the physical environment, stage of change for physical activity and walking among Australian adults. *Research quarterly for exercise and sport*, 73(2), 146–155. <https://doi.org/10.1080/02701367.2002.10609003>
- Cortes, G. (2023). Adherence to dietary guidelines and nutrient recommendations among New Zealand women: a thesis partially fulfilling the requirements for the Master of Science degree in Nutrition and Dietetics at Massey University, Albany, New Zealand Massey University].
- Hayman, M., Brown, W. J., Brinson, A., Budzynski-Seymour, E., Bruce, T., & Evenson, K. R. (2023). Public health guidelines for physical activity during pregnancy worldwide: a scoping review. *British Journal of Sports Medicine*. <https://doi.org/10.1136/bjsports-2022-105777>
- Huang, CM, Wu, HLM, Huang, SK, Chien, LY & Guo, JLM (2013). Passive smoking prevention program based on trans-theoretical models among pregnant women and mothers of young children. *The European Journal of Public Health*, 23(5), 777-782. <https://doi.org/10.1093/eurpub/cks177>
- Krebs, N. F., Belfort, M. B., Meier, P. P., Mennella, J. A., O'Connor, D. L., Taylor, S. N. & Raiten, D. J. (2023). Infant Factors that Impact the Ecology of Human Milk Secretion and Composition - A report from 'Breastmilk Ecology: Genesis of Infant Nutrition (BEGIN)" Working Group 3. *The American Journal of Clinical Nutrition*, 117, S43-S60. <https://doi.org/10.1016/j.ajcnut.2023.01.021>
- Le-Anh, T., Nguyen, M. D., Nguyen, T. T., & Duong, K.T. (2023). Energy saving intention and behavior in perspective of behavioral reasoning. *Energy Efficiency*, 16(2), 8. <https://doi.org/10.1007/s12053-023-10092-x>
- Leroy, F., Smith, N. W., Adesogan, A. T., Beal, T., Iannotti, L., Moughan, P. J. & Mann, N. (2023). The role of meat in the human diet: evolutionary aspects and nutritional value. *Animal Frontiers*, 13(2), 11–18. <https://doi.org/10.1093/af/vfac093>
- Manik, R. K., Dubey, S., & Joshi, A. (2023). The Effect of Possible Yogic Practices in the Treatment of Pregnancy-Induced Hypertension. *Journal of Fisheries Sciences Survey*, 10 (1S), 4237-4246.
- Nga, N. T. V., Xuan, V. N., Trong, V. A., Thao, P. H., & Doanh, D. C. (2023). Perceived barriers and intentions to receive COVID-19 vaccines: psychological distress as moderator. *Vaccines*, 11(2), 289. <https://doi.org/10.3390/vaccines11020289>
- Sato, T., Kataoka, C., McKay, C., Kizuka, H., Miyachi, M., Furuta, Y., & Ikeshita, M. (2023). The experiences of Japanese health and physical

education teachers who teach sexuality education at the high school level. *Cogent Education*, 10(1), 2167330.

<https://doi.org/10.1080/2331186X.2023.2167330>

Stickford, A. S., Taylor, E. K., Rodriguez, D. V., Stroup, S. & Nunnery, D. L. (2023). Exercise behaviors and beliefs among pregnant women in rural communities. *American Journal of Lifestyle Medicine*, 17(1), 32–40.

<https://doi.org/10.1177/15598276211026591>