

## Prevalence of Pica and its Contributing Factors among Palestinian Pregnant Women

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(Type: Full Article). Received: 21<sup>st</sup> Aug. 2024, Accepted: 3<sup>rd</sup> Oct. 2024, Published: 1<sup>st</sup> Sep. 2025.

DOI: <https://doi.org/10.59049/2790-0231.10.3.2405>

**Abstract:** Pica - craving for non-nutritional substances- is considered a serious eating disorder, occasionally can result in various health issues. This cross-sectional study aimed to estimate the prevalence of pica practice during pregnancy, identify substances most commonly consumed and their prevalence, and to determine risk factors associated with pica practice during pregnancy among Palestinian women. A pre-tested structured questionnaire was used during collection procedure. The collected data consisted of sociodemographic data, medical history and lifestyle habits, data about pregnancy, nutritional status, and data about pica practice. A total of 170 pregnant women, who were attending ten private gynecological clinics in the Hebron city, were included in the study. Pica prevalence of the total sample was 4.7%. Pagophagia (ice cube consumption) was the prevalent type of pica practice by 62.5%, followed by the consumption of dirt, cigarette ash residue, and toothpaste by 12.5%, 12.5%, and 12.5%, respectively. Pica practice was significantly associated with smoking and psychological stress during pregnancy, and low maternal hemoglobin level before and during pregnancy. Moreover, pica practice was related to the dietary intake of milk and fat. Health care professionals need to be conscious of pica practice among pregnant women. The phenomenon needs further research.

**Keywords:** Pica; Pregnancy; Women; Stress, Cross Sectional.

### INTRODUCTION

The majority of pregnant women experience alterations in their normal feeding patterns [1]. Pica has been described as a form of an eating disorder characterized by permanent desire and intentional consumption of non-nutritional items for at least one month at an age in which this attitude is developmentally unsuitable [2]. The patterns of consumption are referred to as "phagias" and may include eating stone (lithophagia), freezer frosts or ice (pagophagia), chalk, soil, clay, or sand (geophagia), laundry starch or corn (amylophagia), faeces (coprophagia), lead (plumbophagia) and so on [3].

Published literature demonstrates that the prevalence rate of pica differs from one place to another and has been stated to range from 0.02 to 74% depending on the characteristics of the populations studied [1]. It was observed in a study performed by Edwards et al [4] that 8.1% of pregnant women practiced pica. A similar low percentage (8.3%) was reported in Tehran [1]. In an American study, it was also observed a low pica prevalence rate (14.4%) among 125 pregnant women [5]. On the otherhand, a high prevalence has been documented in Nigeria (50%) [6], Tanzania (63. 7%) [7], and Kenya (73%) [8].

The exact cause of pica is still unknown [1]. Certain traditions in many African societies, such as folk medicine, ceremonial and spiritual practices, and mud-smearing of the body, may contribute to the high rate of pica on the continent. It is thought that pica practice would be greater in rural communities in comparison with urban communities. Therefore, the pica practice could be affected by some environmental factors [9]. Moreover,

this pervasive eating habit has been linked to an increase in electrolyte disturbances, GIT complication, oral and dental injury, parasitic infection, lead poisoning and iron deficiency anemia [10].

The consumption of non-nutritive substances during conception period may have dangerous adverse effects on the health of both the mother and the fetus. Non-nutritive substances, when ingested in great amounts, can vie for space in the stomach therefore minimizing the stomach's capacity and absorption of nutrients during conception. It can lead to excessive phosphorous, lead poisoning, and hyper or hypokalaemia, and lead poisoning [4]. There has also been an observed decrease in the head circumference of infants whose mothers had pica during pregnancy compared to their counterparts [4]. Concerning pica treatment, it has been proposed that the practice can be reversed by consuming iron supplements. Nonetheless, many aspects involved in pica health approach are still anonymous [10].

The clinical importance of studying pica in pregnant women lies in its association with nutritional deficiencies, particularly iron deficiency anemia [11], which can negatively affect both maternal and fetal health. Furthermore, non-food substances might contain an amount of nutrients which is not tolerated, cause malabsorption, and/or containing toxic substances, consequently, it can lead to serious health complications [7]. It can also influence breastfeeding and affect the fetus and child's health [12]. Pica behaviors increase the risk of maternal infections, gastrointestinal complications, and toxic substance

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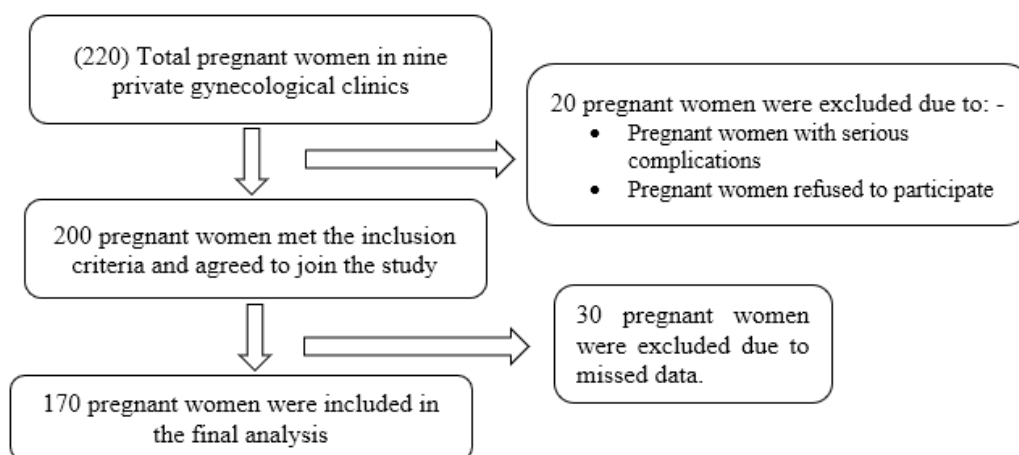
exposure (e.g., lead poisoning), it has been well established that lead causes decreased fertility [13, 14] and readily crosses the placental barrier, causing spontaneous abortion, stillbirth, preterm delivery, and low birth weight [15]. Early detection through prenatal screening, along with appropriate nutritional and medical interventions, is crucial to reducing these risks and improving pregnancy outcomes.

Some studies have indicated that pica is correlated with stress during pregnancy, primarily to raise maternal stress in the 1<sup>st</sup> trimester of pregnancy, when the women need to be involved in a greater controlling diet that would cause irritability and anxiety. According to Young (2010), pica can be seen as an individual response of protection against the psychological distress, like a “stress mediator” which acts on the immune system. Nevertheless, this hypothesis is obscure and the author thinks that it is essential to conduct further studies with longitudinal design and methodological rigor in order to affirm this hypothesis and to explain the associations between pica and pregnancy [16].

To our knowledge, no literature was found regarding the presence of pica among Palestinian pregnant women. Therefore, the main aim of this study is to determine the prevalence of pica among pregnant women in Hebron city, its risk factors, and its association with dietary habits.

## METHODOLOGY

An observational cross-sectional study was conducted among pregnant women who were attending ten different private gynecological clinics along the Hebron city. The sample size was calculated using G power V.3 for infinite population, at alpha level 0.05, power 0.8, and medium effect size 0.5 for independent chi square test. The required sample size was 170 using non-probability sampling method. After considering 10% drop out the required sample was 187 which was rounded to 200 [17]. Women between 18-45 years old without serious complication were selected conveniently, after their signing to consent form. The procedure of recruiting pregnant women is described in (Figure 1).



**Figure (1):** Pregnant women recruitment flow chart.

**Data collection and research tools:** A research team of three undergraduates distributed a pre-tested questionnaire to pregnant women who were attending private gynecological clinics. According to research team's free time, the data were collected over two days weekly within two months starting from February 2020 till March 2020. Furthermore, the data were usually collected in evenings, because the gynecologists were often working at the hospitals and also performing surgeries in the mornings. The collected data included sociodemographic data, self-reported medical history and lifestyle habits, data about pregnancy, nutritional status, and data about pica practice.

**Sociodemographic data & Lifestyle Habits:** Questions regarding sociodemographic data, including age, educational level, family type “nuclear family/ extended family”, monthly income, place of living, employment status was asked for each pregnant woman. **Medical History & Lifestyle Habits:** In this section, health status was determined by asking pregnant women whether they were suffering from chronic diseases; if the answer was yes (name the disease). Lifestyle habits data included several questions about smoking; are you smoker? if yes (How long did you smoke? Are you a shisha smoker or cigarettes smoker? How many times do you smoke cigarettes or shisha per week/day? Is there a smoker in your family? if yes (what is the relationship)). The following questions were also included in this section; 1) Do you do sport? If yes (where do you do sport? How many days per week do you do sport? How many hours per day do you do sport? Do you walk? if yes (How many

days per week do you walk? How many hours per day do you walk?)), and 2) How many hours per day do you spend watching television or using mobile phone?

**Data about pregnancy:** In this section, pregnant women were asked the following questions; 1) What is your gestational age?, 2) How many times did you give a birth?, 3) How many times did get pregnant?, 4) how many times have you miscarried?, 5) what is the gender of the fetus?, 6) Have you had gestational diabetes?, 7) Have you ever had health problems during pregnancy?, 8) Did you take dietary supplements; if yes (mention the dietary supplement that you take), 9) what is your blood pressure?. As former literature suggested that there is a relationship between hemoglobin percentage and pica, the research team found it is important to ask the gynecologist to provide us with hemoglobin percentage for pregnant women before and during pregnancy.

**Nutritional status:** The nutritional status of pregnant women was assessed using the anthropometric measurements (weight and height). The measurements were measured in duplicate then the mean was recorded. Body mass index was calculated as (body weight in kilogram divided by height squared in meter ( $\text{kg}/\text{m}^2$ )) [18], thereafter classified according to WHO cut off points [19]. The research team also assessed the dietary intake of the pregnant women by completing a hard-copy of 24-hours dietary record. The research team gave them instructions on how to complete it, then, they were asked to estimate and document the details of all main meals and snacks. All foods recorded in 24-

hours food record was reviewed by the research team, afterwards, nutrient intake for each pregnant women was computed by NutriSurvey software 2007 (EBISpro, Germany) for total energy (kcal), carbohydrate (g), protein (g), and fat (g).

**Pica questionnaire development:** The items of the questionnaire were developed after reviewing the published papers which explored pica practices among pregnant women [6, 7, 20]. The first draft of the questionnaire was developed by two researchers who are expert of the field and it consisted from 10 items. Face validity was done by sending the questionnaire to five experts (3 nutritionists, 2 measurement experts). After the data collection done, the reliability test was done for the questionnaire using chronbach alpha analysis, which was 0.80.

**Statistical Analysis:** The statistical analysis was done using the statistical package for the social sciences SPSS version 21. Descriptive analysis including the means and standard deviation were used to analyze the continuous variables and categorical variables were described in percentage. Independent t-test was used to investigate the relationship between continuous variables and pica. On the other hand, Chi-Square test was used for analyzing the association between categorical data and pica.

## RESULTS

**Sociodemographic Characteristics:** One hundred and seventy pregnant women included in the study with a mean age of  $26.2 \pm 5.5$  years. Two thirds of pregnant women 110 (64.7%) were within the age range of 21 – 30 years. Nearly half of the pregnant women 100 (58.8%) completed university education. Moreover, family income for three quarter of pregnant women 129 (75.9%) were around 1500 – 5000 NIS per month. About the majority 142 (83.5%) of the pregnant women were housewives, while one-fifths were working 28 (16.5%). The results also reveal that nearly half of the pregnant women 97 (57.1%) were living in the city, and the majority 150 (88.2%) were belonging to a nuclear family.

**Medical History & Lifestyle Habits:** Only 6 (3.5%) of the pregnant women stated that they are smokers. The findings also revealed that around 37 (21.7%) of pregnant women reported that they do physical activity. Moreover, less than the half of the pregnant women 72 (42.4%) don't walk. It was found that the pregnant women have a mean screen time of  $3.2 \pm 3.2$  hour per day. The analysis also pointed out that most pregnant women hadn't chronic diseases 164 (96.5%), and had a normal blood pressure 153 (89.8%). In addition, it was found that the mean percentage of hemoglobin before pregnancy was  $11.7 \pm 1.6\%$ , and the mean percentage of hemoglobin during pregnancy was  $11.5 \pm 1.2\%$ .

**Pregnancy data:** Our data analysis showed that the mean weeks of pregnancy was  $26.7 \pm 7.3$  weeks. Furthermore, the

mean number of previous pregnancies was  $2.1 \pm 1.9$  pregnancy. The results also reveal that the mean number of miscarriages was  $0.4 \pm 0.7$  miscarriage, and the mean number of previous births was  $1.9 \pm 1.7$  birth.

**Nutritional status:** Our results showed pre-pregnancy weight was considered normal for 96 (56.5%) of the sample, and overweight for 40 (23.5%) of the sample. The results also revealed that the mean weight gain during pregnancy was  $7.8 \pm 9.9$  kg.

**Prevalence of pica:** Findings shows that a majority of 162 (95.3%) pregnant women denied any experience of pica during pregnancy, while only on 8 (4.7%) pregnant women reported practicing pica during pregnancy. Pica prevalence categorized by substances ingested as reported by pregnant women was as follows: ice cube 5 (62.5%); dirt 1 (12.5%); cigarette ash residue 1 (12.5%); toothpaste 1 (12.5%) (Table 3). Minority of women who practiced pica also reported pica in previous pregnancy 3 (37.5%), and health problems related to pica 3 (37.5%). Moreover, our analysis reveals that majority of women 6 (75%) reported ingesting the substance in the first trimester, while the rest experienced pica during the second trimester (Table 1).

**Table (1):** Characteristics of pica practice among Palestinian women.

		Number (n)	Percentage (%)
Ingested substances	Ice cube	5	62.5
	Dirt	1	12.5
	Cigarette ash residue	1	12.5
	Toothpaste	1	12.5
	Wall paint	-	-
	Metal part	-	-
	Soup	-	-
	Hair	-	-
	Clay	-	-
	Sand	-	-
	Chalk	-	-
Onset of pica practice	First	6	75.0
	Second	2	25.0
	Trimester	-	-
Pica in a previous pregnancy	Yes	3	37.5
	No	5	62.5
Adverse health effects related to pica (after ingestion of the substances)	Yes	3	37.5
	No	5	62.5

## Relationship between pica and selected variables

Women with pica during pregnancy had similar age, pre-pregnancy BMI, income and education level compared with non-pica mothers. Our findings shows that women with pica have significantly lower hemoglobin level before and during pregnancy in comparison to women with non-pica (Table 2).

**Table (2):** Relationship between Pica and selected variables.

	Have pica (n = 8)	No pica (n = 162)	p-value
Age [years, mean $\pm$ SD]	26.6 $\pm$ 4.44	26.1 $\pm$ 5.45	0.501
<b>Educational level</b>			0.780
Primary [n (%)]	0 (0.0)	3 (1.9)	
Secondary [n (%)]	4 (50.0)	63 (38.9)	
University/ diploma [n (%)]	4 (50.0)	96 (59.3)	
<b>Area of living</b>			0.061
City [n (%)]	2 (25.0)	95 (58.6)	
Village/ camp [n (%)]	6 (75.0)	67 (41.4)	
<b>Family type</b>			0.290
Nuclear family [n (%)]	0 (0.0)	20 (12.3)	
Extended [n (%)]	8 (100.0)	142 (87.7)	
<b>Family income</b>			0.656
<1500 NIS [n (%)]	1 (12.5)	14 (8.6)	

	Have pica (n = 8)	No pica (n = 162)	p-value
1500- 5000 NIS [n (%)]	5 (62.5)	124 (76.5)	
More than 5000 NIS [n (%)]	2 (25.0)	24 (14.8)	
Former abortion			
Yes [n (%)]	2 (25.0)	50 (30.9)	0.725
No [n (%)]	6 (75.0)	112 (69.1)	
Former pregnancy			
Yes [n (%)]	7 (87.5)	123 (75.9)	0.451
No [n (%)]	1 (12.5)	39 (24.1)	
Prepregnancy weight [kg, mean $\pm$ SD]	60.1 $\pm$ 8.12	63.4 $\pm$ 14.3	0.383
Prepregnancy BMI [kg/m <sup>2</sup> , mean $\pm$ SD]	23.5 $\pm$ 4.1	24.2 $\pm$ 7.09	0.638
Hemoglobin before pregnancy [g/dL, mean $\pm$ SD]	10.60 $\pm$ 1.96	11.81 $\pm$ 1.54	0.019 <sup>*</sup>
Hemoglobin during pregnancy [g/dL, mean $\pm$ SD]	10.50 $\pm$ 0.85	11.57 $\pm$ 1.24	0.008 <sup>*</sup>
Smoking			
Yes [n (%)]	2 (25.0)	3 (1.9)	0.000 <sup>*</sup>
No [n (%)]	6.0 (75.0)	156 (98.1)	
Stress during pregnancy			
Yes [n (%)]	6 (75.0)	36 (22.2)	0.001 <sup>*</sup>
No [n (%)]	2 (25.0)	126 (77.8)	
Blood pressure			
Low [n (%)]	0 (0.0)	12 (8.1)	0.140
Normal [n (%)]	7 (87.5)	134 (89.9)	
High [n (%)]	1 (12.5)	3 (2.0)	

Data are presented as *n* (%) or mean  $\pm$  SD. Pearson chi-square test is employed for categorical variables and independent *t*-test for continuous variables.\* *p* < 0.05. NIS: Israeli New Shekel; SD = standard deviation

**Relationship between pica & dietary Intake:** Table 3 demonstrates that there was significant association between the presence of pica and the consumption of milk and fat (*p* < 0.05).

**Table (3):** The relationship between pica and dietary intake.

	Unit	Have pica	No pica	p-value
Total calories	Kcal/day	1108 $\pm$ 1111	1210 $\pm$ 583	0.063
Carbohydrate	gm/day	111 $\pm$ 71	133 $\pm$ 67	0.892
Protein	gm/day	37 $\pm$ 19	53 $\pm$ 23	0.272
Fat	gm/day	58 $\pm$ 92	53 $\pm$ 43	0.003 <sup>*</sup>
Vegetables	cup/day	1 $\pm$ 1.6	1.2 $\pm$ 1.3	0.527
Fruits	cup/day	1.5 $\pm$ 2	1.2 $\pm$ 1.4	0.099
Milk	cup/day	0.25 $\pm$ 0.46	0.51 $\pm$ 0.70	0.045 <sup>*</sup>

\*Significant at *p*-value < 0.05 using independent *t*-test.

## DISCUSSION

The existing study was performed originally to determine the prevalence of pica behaviour during pregnancy and to identify the substances usually consumed. Further, the study investigated its risk factors, and whether it is correlated with dietary habits or not.

The study has established that the prevalence of pica practice is low. Nearly 8 (4.7%) of pregnant women reported practicing pica during pregnancy. A low prevalence of pica was also reported in Iran [1] and Denmark by 8.33%, and 0.02%, respectively. The finding is consistent with what was documented by Smulian et al [5] that the prevalence of pica during pregnancy range between 0 and 68% depending on the characteristics of the population studied. The finding from the current study is suggestive that pica prevalence is not static.

The result on pica prevalence is however inconsistent with former studies carried out in Africa [6, 8, 21, 22] and Western countries [23, 24] and Arabic countries including Sudan [25], and Nigeria [6] which reported both the existence as well as high prevalence of pica during pregnancy among their respective pregnant women.

Pagophagia and geophagia are the most common forms of pica worldwide. Simpson and his colleagues stated that dirt consumption is more common in rural countries, while ice

consumption is preferred in urban regions [23]. In the current study, it was found that pagophagia was the main form of the pica practice, and dirt, cigarette ash residue, and toothpaste were identified as the second ingested substances by the following percentages 12.5%, 12.5%, 12.5%, and 12.5%, respectively. In the current sample, it was found that chalk consumption was not reported by any women; however, this practice has been reported by Grigsby et al. (1999) as a frequent type of pica in a sample of pregnant women from Georgia, USA [26]. Another study conducted in Zahedan, Iran, founded that The prevalence of pica among pregnant women was 15.5%, in which 25.3% of them ate dirt, 60.9% ice, and others substances such as chalk, rosary praying clay, freezer frost, tea stuff and other non-food substances [27].

Some researchers have indicated that there is an association between education and pica practice, especially in the Western societies [28], as well as, African societies [20]. A study done in Ghana concluded that pica practice is prevalent among the uneducated and poor communities [20]. On the contrary, the current study didn't find a significant relationship between education and practicing pica during pregnancy. This finding maybe related to the different cultures and practices between societies.

The effect of pica practice on the mother and the fetus are still unclear. Newborns of pregnant women, who practiced pica during their conception period, are at an increased risk of perinatal mortality, irritability, reduction of cephalic perimeter, low neonatal weight, and prematurity [2, 29, 30]. However, pregnant women who eat non-nutritive substance may be susceptible to intestinal obstruction, hyperkalemia, constipation, teeth damage, and toxicity with aluminum, lead, or other environmental toxins [31, 32].

In the current study, it was failed to find any statistically significant association between pica practice during conception and maternal anthropometry. This finding corroborates the findings of many recent studies [2, 33]. This finding indicates that pica maybe associated with other factors including psychological factors.

Moreover, it was found that hemoglobin level before and during pregnancy was significantly lower among pica mothers compared to non-pica mothers. This result was consistent with former studies where it was pointed out that pica practice is

correlated with a higher risk of anemia and with decreased maternal hemoglobin levels [34, 35]. Additionally, prospective cohort research was carried out in five health care centers in Zahedan City, Iran. The results imply that pica practices during pregnancy are linked to significantly lower head circumferences of neonates as well as lower levels of maternal hemoglobin during the pregnancy [36]. It is necessary to explain that other clinical outcomes associated to infant weight and neonatal cognitive development that have not been assessed in the current study could be associated to pica practice, even though literature about this topic is rare.

Moreover, the results revealed that practicing pica during pregnancy is associated with psychological stress. This association, between the consumption of non-nutritive substances and anxiety or stress, has also been reported in other countries in Latin America [23] and in Brazil [33]. Moreover, Bhatia and Gupta (2009) indicated that stress may promote pica in some adults and that such feelings have impulsive/compulsive characteristics. In addition, they pointed out that suitable management of stress may help relieve the symptoms of pica [37]. A cross-sectional study was conducted among pregnant women attending the antenatal unit of a tertiary care hospital in Chennai, India. 220 (29.7%) of the 739 pregnant women were found to practice pica. Women experienced low anxiety at a rate of about 40%, moderate anxiety at 43%, and severe anxiety at 17% [38]. Furthermore, the current study found that smoking was significantly associated with pica. The relationship between smoking and pica practice should be understood and managed.

Our findings also indicated that there were no significant differences in total energy, protein, carbohydrate, vegetables and fruits consumption between pica and non-pica mothers. However, women with pica showed lower intakes of total fat and milk. In a sample of 71 Argentinian pregnant women presenting pagophagia and other forms of pica, it was found that women practicing pica significantly consume lower amounts of total carbohydrates compared to non-pica women [39].

## Limitations

There were several limitations in this study. Firstly; the principal limitation of the present study resides in its design. Being cross-sectional, one cannot infer causal relationships. Secondly; the study only included one region in Palestine so the findings are limited to one region. Nonetheless, the current study has provided baseline data for further research on pica practices and related issues among pregnant women in Palestine. There is a need for more studies establish possible health consequences on mother and child associated with pica practices. There is also necessity for further research to associate month of pregnancy with women's pica behavior. Moreover, future studies should focus on clarifying the causal relationship for better understanding of pica.

## CONCLUSION

The current study has established that pica exists and nearly 4.7% of pregnant women were practicing pica behavior during pregnancy. The most common form of pica was pagophagia. It was also found that pica practice is not influenced by educational background or place of residence of the individual. Pica behavior is possibly expedited by a complex array of factors that we do not fully comprehend. Until more compelling evidence of its reason makes treatment probable, each pregnant woman should be questioned about her experience with pica. Health care professionals need to be conscious of the presence of this behavior. The phenomenon obviously merits further research and raised clinical vigilance.

## Disclosure Statements

- **Ethics approval and consent to participate:** The study protocol was approved by the Scientific Research Ethical Committee at Palestine Polytechnic University committee. Permissions and approval to conduct the study were also obtained from the Palestinian Ministry of Health. All pregnant women who were regularly attending private gynecological clinics were invited to join the study, and they were informed that their participation was optional, and the data would only be used for research purposes. Pregnant women who signed the written consent form, placed on the first page of the questionnaire, were included in the data collection.
- **Consent for publication:** We, as authors of the article entitled 'Prevalence of pica and its contributing factors among Palestinian pregnant women,' hereby give our consent for the publication of the article in the Palestinian Medical and Pharmaceutical Journal (Pal. Med. Pharm. J.)
- **Availability of data and materials:** Data and materials are available upon request and with permission of Dr. Manal Badrasawi, m.badrasawi@najah.edu
- **Author contributions:** **May Hamdan:** was responsible for proposal revision and methodology optimization, supervision of data collection, and data analysis. read and approved the final manuscript. **Souzan Zidan:** was responsible for proposal revision and methodology optimization, supervision of data collection, data analysis, and writing the first draft. read and approved the final manuscript. **Khawla Talahmeh, Remaa Manasrah and Asia Rawashdeh:** were responsible for writing the review, drafting the proposal, collecting data, and data entry, and assisting in writing the proposal. Manal Badrasawi generated the idea for the study and formulated a research plan, supervised the project and data collection, read and approved the final manuscript.
- **Competing interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
- **Funding:** Not applicable
- **Acknowledgements:** We would like to express our gratitude to the Palestinian pregnant women who agreed to participate in this study. We would like to acknowledge the students who helped the researchers in data collection. Thanks, are also to all co-researchers and fieldworkers involved in this study.

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## References

- 1] Ezzeddin, N., et al., *Prevalence and risk factors for pica during pregnancy in Tehran, Iran*. Eating and Weight

- Disorders-Studies on Anorexia, Bulimia and Obesity, 2015. 20: p. 457-463.
- 2] Corbett, R.W., C. Ryan, and S.P. Weinrich, *Pica in pregnancy: does it affect pregnancy outcomes?* MCN: The American Journal of Maternal/Child Nursing, 2003. 28(3): p. 183-189.
  - 3] Rose, E.A., J.H. Porcerelli, and A.V. Neale, *Pica: common but commonly missed*. The Journal of the American Board of Family Practice, 2000. 13(5): p. 353-358.
  - 4] Edwards, C.H., et al., *Pica in an urban environment*. The Journal of nutrition, 1994. 124: p. S954-S962.
  - 5] Smulian, J.C., S. Motiwala, and R.K. Sigman, *Pica in a rural obstetric population*. Southern medical journal, 1995. 88(12): p. 1236-1240.
  - 6] Sule, S. and H. Madugu, *Pica in pregnant women in Zaria, Nigeria*. Nigerian journal of medicine: journal of the National Association of Resident Doctors of Nigeria, 2001. 10(1): p. 25-27.
  - 7] Myaruhucha, C., *Food cravings, aversions and pica among pregnant women in Dar es Salaam, Tanzania*. Tanzania Journal of Health Research, 2009. 11(1).
  - 8] Ngozi, P., *Pica practices of pregnant women in Nairobi, Kenya*. East African medical journal, 2008. 85(2): p. 72-79.
  - 9] Danford, D.E., J. Smith Jr, and A.M. Huber, *Pica and mineral status in the mentally retarded*. The American Journal of clinical nutrition, 1982. 35(5): p. 950-957.
  - 10] HATA, T., et al., *A rapid recovery from pagophagia following treatment for iron deficiency anemia and TMJ disorder accompanied by masked depression*. 川崎医学会誌, 2009. 35(4): p. 329-332.
  - 11] Ellis, C.R., et al., *Eating disorder: pica*. Emed J, 2002. 3: p. 1-12.
  - 12] Torgersen, L., et al., *Breastfeeding practice in mothers with eating disorders*. Maternal & Child Nutrition, 2010. 6(3): p. 243-252.
  - 13] Lancranjan, I., et al., *Reproductive ability of workmen occupationally exposed to lead*. Archives of Environmental Health: An International Journal, 1975. 30(8): p. 396-401.
  - 14] Min, Y.-I., A. Correa-Villasenor, and P.A. Stewart, *Parental occupational lead exposure and low birth weight*. American journal of industrial medicine, 1996. 30(5): p. 569-578.
  - 15] Hu, H., L. Pepper, and R. Goldman, *Effect of repeated occupational exposure to lead, cessation of exposure, and chelation on levels of lead in bone*. American journal of industrial medicine, 1991. 20(6): p. 723-735.
  - 16] Young, S.L., *Pica in pregnancy: new ideas about an old condition*. Annual review of nutrition, 2010. 30(1): p. 403-422.
  - 17] Lohr, S.L., *Sampling: design and analysis*. 2021: Chapman and Hall/CRC.
  - 18] Lee, R.D. and D.C. Nieman, *Nutritional assessment*. 2007: McGraw-Hill Boston, MA, USA:.
  - 19] Friedman, G.D., *Body mass index and risk of death*. 2014, Oxford University Press. p. 233-234.
  - 20] Mensah, F.O., et al., *Pica practice among pregnant women in the Kumasi metropolis of Ghana*. International health, 2010. 2(4): p. 282-286.
  - 21] Geissler, P.W., et al., *Perceptions of soil-eating and anaemia among pregnant women on the Kenyan coast*. Social science & medicine, 1999. 48(8): p. 1069-1079.
  - 22] Konlan, K.D., et al., *Practices of pica among pregnant women in a tertiary healthcare facility in Ghana*. Nursing Open, 2020. 7(3): p. 783-792.
  - 23] Simpson, E., et al., *Pica during pregnancy in low-income women born in Mexico*. Western Journal of Medicine, 2000. 173(1): p. 20.
  - 24] Rainville, A.J., *Pica practices of pregnant women are associated with lower maternal hemoglobin level at delivery*. Journal of the American Dietetic Association, 1998. 98(3): p. 293-296.
  - 25] Ahmed, S., H. Abdullahi, and I. Adam, *Practice of pica among pregnant women in Khartoum, Sudan*. International journal of gynaecology and obstetrics, 2012. 118(1): p. 71.
  - 26] Grigsby, R.K., et al., *Chalk eating in middle Georgia: a culture-bound syndrome of pica?* Southern medical journal, 1999. 92(2): p. 190-192.
  - 27] Mortazavi, Z. and M. Mohammadi, *Prevalence of pica in pregnant women referred to health care centers in Zahedan, Iran (2002-2003)*. Afr J Food Sci, 2010. 4(10): p. 642-645.
  - 28] Lacey, E.P., *Broadening the perspective of pica: literature review*. Public Health Reports, 1990. 105(1): p. 29.
  - 29] Hamilton, S., et al., *Neonatal lead poisoning from maternal pica behavior during pregnancy*. Journal of the National Medical Association, 2001. 93(9): p. 317.
  - 30] Morales, L. and D. Hayes-Bautista, *Pica may be harmful to the fetus and mother*. Western Journal of Medicine, 2000. 173(1): p. 25.
  - 31] Johnson, C.D., et al., *An uncommon dental presentation during pregnancy resulting from multiple eating disorders: pica and bulimia: case report*. General dentistry, 2006. 54(3): p. 198-200.
  - 32] Luoba, A.I., et al., *Earth-eating and reinfection with intestinal helminths among pregnant and lactating women in western Kenya*. Tropical medicine & international health, 2005. 10(3): p. 220-227.
  - 33] Saunders, C., et al., *Pica: epidemiology and association with pregnancy complications*. Revista Brasileira de Ginecologia e Obstetrícia, 2009. 31: p. 440-446.
  - 34] Baig-Ansari, N., et al., *Anemia prevalence and risk factors in pregnant women in an urban area of Pakistan*. Food and nutrition bulletin, 2008. 29(2): p. 132-139.
  - 35] López, L., et al., *Characteristics of pica practice during pregnancy in a sample of Argentine women*. Journal of Obstetrics and Gynaecology, 2012. 32(2): p. 150-153.
  - 36] Khoushabi, F., et al., *Pica practices among pregnant women are associated with lower hemoglobin levels and pregnancy outcome*. Open Journal of Obstetrics and Gynecology, 2014. 2014.
  - 37] Bhatia, M.S. and R. Gupta, *Pica responding to SSRI: An OCD spectrum disorder?* The World Journal of Biological Psychiatry, 2009. 10(4-3): p. 936-938.
  - 38] Francis, S., et al., *The influence of pica practice on nutritional status, stress and anxiety of pregnant women*. Clinical Epidemiology and Global Health, 2022. 17: p. 101133.
  - 39] López, L., M. De Portela, and C. Soler, *Nutrient intake in women with pagophagia and other forms of pica during the pregnancy*. Nutricion Hospitalaria, 2007. 22(6): p. 641-647.