Article

The relationship between pica and iron deficiency anemia among pregnant women in East Jeddah Hospital

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Abstract: INTRODUCTION. The most common cause of eating non-food items (pica) is specific deficiencies of minerals, such as iron. This study aimed to assess the relationship between Pica and Iron deficiency anemia among pregnant women. METHODS. The study was conducted in the outpatient department, antenatal Clinic at East Jeddah Hospital from July to September 2020. Design: A quantitative descriptive correlation design. Sample size: A total of 400 pregnant women, included anemic pregnant women, ≥18 years-old, with singleton fetus and iron deficiency anemia. RESULTS. The mean age was 32.2 ± 6.6, half of the participants reported food cravings. Ice was the main item in pica followed by clay and chalk. Two-thirds had pica, more than half during the 1st trimester. There is a statistically significant relationship between pica and the history of a family member, parity, and gravidity at (P< 0,001, P <0,001, P <0,005) respectively. Hb and hematocrit in relation to pica reflected a statistically significant relationship (P< 0,001) and (P< 0,001), respectively. The symptoms attributed to iron deficiency was significantly associated with pica (P< 0,006). CONCLUSION. The pica and iron deficiency anemia had a significant association with pregnant women in EJH. RECOMMENDATION. The follow-up visits should integrate the food behavior inquiry to check if the pica existing with anemic or non-anemic pregnant women. Also, increase the awareness among midwives-nurses about the prevalence of pica and iron deficiency anemia among pregnant women.

Keywords: Pica, iron deficiency anemia, Relationship, pregnant women

1. Introduction

Anemia is one of the most common pregnancy problems, affecting 15% to 25% pregnant women. The incidence varies according to geographic location and socioeconomic group. Anemia may be caused by various factors, including nutritional deficits, hemolysis, and blood loss. The most common type of anemia observed during pregnancy is iron-deficiency anemia; less common types are folic acid deficiency, sickle cell disease, and thalassemia (Murray et al., 2019).

The prevalence of anemia among women in Saudi Arabia is highly linked to hereditary factors, particularly iron-deficiency anemia. On the other side, few studies are related to pica behaviors during pregnancy conducted in Saudi   Arabia, and little is known about pica prevalence in a   Saudi obstetric population (Al Hassan, 2015).

Maternal diet is a modifiable factor during pregnancy that impacts the outcome of the birth. Since a pregnant woman's nutritional needs vary during preconception, gestational, and breastfeeding periods, the diet and lifestyle must be optimally adapted under a specialist's personalized nutrition guidance. High-quality diet research during pregnancy remains challenging as nutritional issues also vary according to the pregnant woman's religion, financial income, age, education, and specific traditions of each country (Iordachescu et al., 2020).   However, dietary behavior in pregnancy appears to be

determined by socio-demographic, lifestyle, pregnancy-related, and environmental factors. Practitioners should pay particular attention to younger and less educated women and those showing low levels of health consciousness (Doyle & Spallek, 2016).

Therefore, fetuses depend on the maternal nutritional state on their availability and supply of nutrients status, support feto-placental development and maternal adaptation to pregnancy which depends on its nutrient stores, dietary intake, and mandatory requirements. Moreover, nutrition during pregnancy focuses heavily on the second and/or third trimesters by which key processes such as organogenesis have been completed   (Brannon & Taylor, 2017; Nnam, 2015).

The leading causes of iron deficiency are insufficient consumption of bioavailable iron, increased demand for iron in pregnant women's bodies experiencing rapid growth pregnancies, menstruation, and pathological infections, leading to excessive blood loss. Moreover, the most common cause of eating non-food items (pica) is specific deficiencies of minerals, such as iron and zinc. When placed on iron and zinc replacement therapies in patients with low iron and zinc levels who practiced pica stopped or reduced the intake of non-food items. However, the evidence for iron is more convincing than for zinc (Hommey, 2016).

   Moreover,   women's gastrointestinal symptoms of pregnancy appear to be exacerbated by perceptual changes in smell, taste, and texture(Swift et al., 2017). There may be an increase or a decrease in threshold in perceived tastes of sweet and sour, salty, and bitter (Choo & Dando, 2017). A blunted sense of taste in some women can lead to an increased desire for highly seasoned food. Then pica may occur, which refers to the compulsive craving and consumption of non-food items that are non-nutritive. Aversions and food cravings are commonly reported in pregnancy (Marshall & Raynor, 2020)

The pica etiology is not well known, but various hypotheses are suggested. The hunger hypothesis suggests that pica is motivated by hunger and people engage in pica to replace nutrients not present in their diet. In particular, substances such as clay and earth are eaten to relieve hunger; this hypothesis cannot explain all pica behavior because individuals frequently experience an intense craving for their motivation, not hunger. The nutritional hypothesis suggests that pica is a biological reaction to micronutrient deficiencies such as iron, calcium, or zinc. The protective hypothesis suggests pica relieves short-term illnesses and/or long-term effects of chemicals, pathogens, and parasites (Chung et al., 2019).

Pica was operationalized in two ways: "pica ever" and "pica during the current pregnancy." "pica ever" included those women who experience pica at any point in their life, including during the current pregnancy. In contrast, "pica during current pregnancy" is limited to women who experience pica during the current pregnancy. While the etiology is poorly understood, iron deficiency associations, zinc deficiency, mental and developmental delay, psychosocial issues, and pica family history have been described (Roy et al., 2018).

Moreover, pica has been associated with harmful and potentially healthful consequences. Adverse health conditions possibly attributable to pica include micronutrient deficiencies, particularly iron-deficiency anemia, heavy metal exposure, and intestinal damage. On the other hand, some pica items, e.g., clay-rich earth, may have positive health effects, such as relief from gastrointestinal distresses, preventing exposures to harmful toxins and pathogens, and being a source of micronutrients (Roy et al., 2018).

Although causality cannot be claimed in cross-sectional studies, the positive relationship between pica and iron deficiency anemia could be interpreted as consistent with the hypothesis that pica is motivated by a micronutrient deficiency. The greater prevalence of pica in later pregnancy, when micronutrient needs are higher, supports this hypothesis (Young et al., 2010). Non-food substance interfering with iron absorption by binding iron in the gastrointestinal tract exacerbates the iron deficiency (Advani et al., 2014; Borgna-Pignatti & Zanella, 2016).

Depending on what pregnant women ingest, pica items are diverse and vary according to race/ ethnicity, culture, and geographic location. The substances are often harmless and may include toxic substances such as paint, pencil lead, sharp objects, sand, soap, starch, and chalk, to name but a few. A mother that consumes clay is more at risk for adverse effects than a mother that consumes ice chips. Complications from pica can range from constipation and cramping to intestinal obstruction, infection, and poisoning, since certain non-food items may contain toxic ingredients that can potentially harm both mother and her fetus. So, pica has been linked to both physiological and psychological impairments. Due to the related shame and stigma, it is not easy to diagnose (Johnson, 2017).

Pica is significantly associated with anemia and low Hb, Hct, and plasma Zn. The direction of the causal relationship between pica and micronutrient deficiency is undiscovered (Miao et al., 2015). Some evidence suggested that specific pica items absorb dietary iron, which would worsen rather than improve iron deficiency (Seim et al., 2013; Seim et al., 2016). The directionality of the relationship between pica and iron deficiency, and the underlying mechanisms, are yet to be defined. However, the association is consistent and robust (Roy et al., 2018).

Practitioners and health care professionals, particularly midwives should pay particular attention to younger and less educated women and those showing low levels of health consciousness. In addition to enhance health education on the effects of pica among pregnant women, particularly during all trimesters of pregnancy. While this is done, alternate means of preventing nausea and vomiting in the first trimester of pregnancy should be included in antenatal care education. These alternatives may include eating dry bread, biscuits, or sweets to reduce the effects of pregnancy nausea and vomiting. Health workers should increase health education on pica and its adverse impact on mothers and fetus health (Doyle & Spallek, 2016; Konlan et al., 2020).

This study is important to understand the relation between pica and iron deficiency anemia in pregnant women. It is observed that the prevalence of pica is high among anemic pregnant women. The prevalence of anemia among women in Saudi Arabia is highly linked to hereditary factors, particularly iron-deficiency anemia. On the other side, few studies are related to pica behaviors during pregnancy conducted in Saudi Arabia, and little is known about pica prevalence in a Saudi obstetric population (Al Hassan, 2015; Salih et al., 2015).

SIGNIFICANCE OF THE STUDY

In Saudi Arabia, mainly in the Jazan region, the study was done by (Salih et al., 2015), who found that the anemia among pregnant women is high. Most pregnant women have cravings and aversions that affect their diet, and pica is high. The study results showed the percentage of women who craved non-food items (pica) was 67.3% and similar craving and aversion experience among pregnant women in Jazan compared to studies done in other parts of Saudi Arabia. However, pica is much higher in other studies; the percentage ranged from 8.8% to 13% (Al-Kanhal & Bani, 1995; Almurshed et al.,

2007). These findings indicate the need for appropriate interventions in this area to address females' nutritional habits. Nutritional guidance is recommended for pregnant women during antenatal care visits.

This study aimed to evaluate the relationship between Pica and Iron deficiency anemia among pregnant women through the following objectives

1.To determine the prevalence of pica among pregnant women with Iron deficiency anemia.

2.To assess the association between Pica and Iron deficiency anemia among pregnant

Women.

2. Materials and Methods

RESEARCH DESIGN

A descriptive correlation design was used in this study. When researchers study the effect of a potential cause they cannot manipulate, they use designs that examine relationships between variables, often called correlational designs descriptive correlation, meaning that researchers attempt to explain relationships between variables without attempting to infer cause. Because the goal is not to clarify or understand the underlying causes of interest variables, a descriptive non-experimental design is appropriate (Polit & Beck, 2010). As the current study intended to assess the relationship between Pica and Iron deficiency anemia among pregnant women, a descriptive correlational design was appropriate.

RESEARCH SETTING

The study was conducted in the out-patient department, the antenatal Clinic at EJH. Three to four clinics open daily; a consultant sees all patients. One screening clinic running by specialist serves 20-30 patients. The hospital is a 300-bed capacity that provides medical, diagnostic, surgical, and rehabilitation services as one of the hospitals in Jeddah governorate under the Ministry of Health's umbrella. These services are provided by a distinguished using the latest medical equipment and technologies. The hospital was officially inaugurated on 20 Jumada Al-Akhirah 1437H (March 29th, 2016). Services have been increasing over time to include pediatrics, obstetrics and gynecology, and intensive care for adults, children, and newborns. The out-patient department held a place in a separate building that consists of two floors antenatal clinic located on the second floor, the clinic operated by an obstetrician's consultant, specialist, and resident. The clinics work only in the weekday from 8 a.m. to 4 p.m.

STUDY POPULATION

The study sample included anemic pregnant women presented during the data collection period and agreed to participate in the study. Inclusion criteria were: 1) all women ≥ 18 years., 2) all pregnant women with singleton fetus and iron deficiency anemia. And Iron deficiency was defined as serum ferritin (SF) <45 pmol/L and TS <10%. While exclusion criteria are: 1) pica behavior before pregnancy, 2) pregnant women with chronic diseases (cardiac diseases, hypertension, renal diseases, and diabetes), 3) pregnant women with eating disorders, malabsorption diseases, and self-reported substance abuse and, high-risk pregnancy.

SAMPLING AND SAMPLING TECHNIQUES.

Raosoft® used as a sample size calculator; the following criteria was entered accepted margin of error 5%, confidence level 95%, estimated population size 1600 per two months and response distribution 50%. The recommended sample size by the Raosoft® was 310. The sample size increased to 400 participants to avoid withdrawal cases (Raosoft®, 2004).

Convenience techniques for the non-probable sample of available pregnant women were used for the current study to recruit participants. A convenience Sample (which is also referred to as a haphazard sample or random sample) is a type of sample that is non-probable to occur or non-random to target population members who fulfill specific criteria, such as geographical proximity, easy accessibility, or readiness to participate in the study at a particular time (Etikan et al., 2016). Pro of this sampling technique is created rapidly without adding any additional burden on the available resource. In contrast, the con is the poor representation of the population (Ambekar, 2020; Polit & Beck, 2010).

DATA COLLECTION PROCESS

Data collected through a period of two months from July 2020 to September 2020. The investigator attended the antenatal clinic for five days per week for 7 to 8 hours daily to obtain the study sample. The investigator interviewed conveniently to recruit the anemic pregnant after obtaining the consent form for participation in the study. The consent form includes an explaining of the study purpose. The investigator interviewed the women while they are waiting for their antenatal clinic appointment in the out-patient department (OPD). The investigator introduced herself and explained the purpose of the study to each participant. Then oral and written informed consent (Appendix D) was obtained from the participant who met inclusion criteria. The investigator average time to complete the questionnaire was up to15 minutes. The investigator engaged two volunteers for data collection from OPD nursing staff for assistance in the data collection phase of the study. The data collectors had a full explanation of the study Purpose, inclusion criteria, and data collection questionnaire.

DATA COLLECTION METHODS

A structured questionnaire (Appendix B, C) was developed in English and Arabic version. The investigator assisted the participants in filling the questionnaire and clarified any ambiguous questions or words. The tool consists of ten sections; the first three sections include demographic data (e.g., age, nationality, level of education), family history regarding anemia & pica, and anthropometric measurement of the pre-pregnancy body-weight height. The next four parts are about obstetric history (parity, gravidity, pregnancy trimester, abortion, mode of delivery), biological data, symptom attribute to iron deficiency, and iron supplementation daily. The eighth section is composed of food habits (cravings and aversion). Moreover, the ninth section about pica behavior during pregnancy in terms of type, frequency, and duration, in addition to gestational morbidities like nausea and vomiting.

DATA ANALYSIS

Statistical Package for Social Sciences (SPSS) software version 25 was used for data entry and analysis. Descriptive statistics (e.g., number, percentage) were applied for categorical variables and were presented in tables and graphs. Mean, and standard deviation were used for continuous variables. Analytic statistics using Chi-Square tests ($\chi 2$) to test

the relation and/or the difference between two categorical variables were used. Statistical significance was considered at p-value <0.05 throughout the study.

RELIABILITY AND VALIDITY

The validity content played an important role in creating any new instrument and provides evidence of the instrument's validity by testing the instrument's degree to test the targeted construct. Validity content allows the instrument to be used to make meaningful and relevant judgments and/or decisions from the assessment instruments provided the objective. All elements of the tool (e.g., items, stimuli, codes, instructions, response formats, scoring) can potentially impact the scores obtained, and the interpretations made should be subjected to content validation. Therefore, this study conducted a content validity of the developed tools which based on the previous studies (Roy, Fuentes, Fernald, & Young (2018). Ezzeddina, Zavoshy, Noroozi, Jahanihashemi, & Riseh (2015). Salih, S., Alqahtani, Almalki, Alfaifi, Gazwani, Faqehi, Hakami (2015). The developed tool was distributed to four maternity and nursing specialists to test the right sort of content and the importance of knowledge items included in the tool.

Reliability: A 10% from the participants who met the inclusion criteria were recruited for the pilot study based on the total number of the sample and were included in the total study sample. Ethical consideration was followed throughout the pilot study, which lasted for nine days. The pilot study was conducted to test the following: 1) examine the inclusion criteria, 2) Identify the normal range of study variables, and 3) check for outlier before collecting the whole data. Exploring data using measures of center, variation, and boxplots were conducted to examine the reliability of continuous variables to check for the normal range of values. Also, frequency and percentage distribution for pica variable and confidence interval of percentage of pica were used.

Pilot study:

The pilot study conducted on 40 participants (10%) of the total sample size to assure the reliability and feasibility of the questionnaire However, during data collection, there are two items serum ferritin (SF) and Transferrin Saturation (TS)   has been omitted out of the questionnaire because of unavailability of it in the lab works at EJH. Then the survey analysis results showed that the means and SD of the continuous variables were found within the usual range without outlier values detected. The same findings were found for the categorical variables using the frequency and percentage distribution.

ETHICAL CONSIDERATIONS: The Ethical Committee approved the proposal (Appendix A) at King Saud Bin Abdelaziz University for Health Sciences by KAIMRC; (IRB No, H-01-R-005 (Appendix B). Informed Consent form (Appendix C). The explanation and purpose of the study were provided to the participants to obtain the consent to participate in this study. The data kept in strict confidence and used only for research purposes; the data will be reached only by the researcher. Arabic translated version of the questionnaire provided to the participants and the anonymity of the patient was kept through no name identify in the questionnaire.

3. Results

Basic characteristics of participants included in the study sample, out of 400 participants, 83.5% were Saudi, the mean age was 32.2 ± 6.6, with the most-aged 23 to 35 years old, 38.3% had high school education, with two-thirds (68.5%) unemployed. The vast majority were from cities (99.3%), and about two-fifth had income ranged from 5000 to 15000 SAR (43.3%) (Table, 1).

Table 1. Frequency Distribution of study participants according to their demographic data

Variable	n=400	%
Age	Mean 32.2	SD 6.6
Age categories		
18-22	43	10.7
23-28	102	25.5
29-35	138	34.5
36+	117	29.3
Nationality		
Saudi	334	83.5
Non-Saudi	66	16.5
Level of education		
Illiterate	4	1.0
Elementary	7	1.7
Intermediate	16	4.0
High school	154	38.3
Diploma	102	25.3
University and above	117	29.7
Occupation		
Employed	126	31.5
Not employed	274	68.5
Residence		
City	397	99.3
Village	3	0.7
Income		
< 3000	9	2.3
3000-5000	87	21.6
5000-10000	173	43.3
10000-15000	106	26.5
>15000	25	6.3

Regarding the family and obstetrical history of participants, about two-thirds (64.5%) had no family member with anemia, while about one-third, 35.5%, had a family member with anemia, the majority (90.8%) were 1st-degree relation.   40.4% had a family member with pica. The majority of participants were in the normal range of BMI; the mean was 25.5 ± 3.3. The parity mean was 2.1±1.4, and the mean of gravidity was 3.4 ± 1.5. The pregnancy trimester reflected that about two-thirds (66.5%) of participants were in the third trimester, and 95.3% had symptoms attributed to iron deficiency (Table 2).

Table 2. Frequency Distribution of study participants according to family, and obstetrical history, biological data, and symptoms attributed to iron deficiency of participants

Variable	n=400	%
Is there any family member with anemia?		
Yes	142	35.5
No	258	64.5
If yes, what is the relation		
1st degree	129	90.8
2nd degree	13	9.2
Is there any family member with pica?		
Yes	163	40.4
No	237	59.6
Body Mass Index	Mean 25.5	SD 3.3
Below 18.5	4	1.0
18.5–24.9	189	47.3
25.0–29.9	166	41.5
30.0–36.9	41	10.2
Parity	Mean 2.1	SD 1.4
Gravidity	Mean 3.4	SD 1.5
Abortion		
Yes	100	25.0
No	300	75.0
Pregnancy trimester		
1st	4	1.0
2nd	130	32.5
3rd	266	66.5
Hb Level	Mean 8.9	SD 0.90
Hematocrit level	Mean 28.6	SD 2.6
Symptoms attributed to iron deficiency		
Yes	381	95.3
No	19	4.7
Types of symptoms		
Fatigue	96	25.1
Weakness	103	27.2
Dizziness	73	19.1
Palpitation	69	18.1
Shortness of breath	35	9.2
Others	5	1.3

Concerning the iron supplementation, the vast majority (94.7%) of the participants took iron, followed by folic acid and multivitamins. Half (51.5%) of the participants reported

food cravings, about one-third craving meat (33.3%), while 48.2 % of the participants reported food aversion, especially to milk (38.9%) (Table 3).

Table 3 Frequency Distribution of study participants according to iron supplementation and food habits

Variable	n=400	%
Iron supplementation		
Iron	379	94.7
Folic acid	238	82.0
Multivitamins	176	44.0
Other	10	2.5
Cravings food		
Yes	206	51.5
No	194	48.5
If yes, types		
Eggs	19	9.2
Meat	69	33.3
Milk	29	14.2
Sour	36	17.5
Sweet	25	12.2
Salty	12	5.8
Spicy	8	3.9
Combination	8	3.9
Aversion		
Yes	193	48.2
No	207	51.8
If yes, types		
Beverage	21	10.9
Fruit	3	1.6
Meat	49	25.3
Milk	75	38.9
Tea/coffee	19	9.8
Vegetable	26	13.5

The prevalence of pica among pregnant participants with Iron deficiency anemia was About two-thirds (63.5%) of participants had pica About pica behavior of the pregnant participants included in the sample, ice was found as the main item in pica (70.1%), followed by clay and chalk.   For the time of pica, 53.9% of participants had pica in the first trimester of pregnancy. Most of the participants practiced pica behavior daily (69.3%) (Table 4)

Table 4 Frequency distribution of pica behavior among pregnant participants

Variable	n=254	%
Pica	161	63.3
Non-Pica	93	36.6
Pica items		
Clay	57	22.4
Chalk	13	5.1
Ice	178	70.1
Soap	4	1.6
Coal	1	0.4
Soil	1	0.4
Frequency of pica		
1st trimester	137	53.9
2nd trimester	95	37.4
3rd trimester	22	8.7
Duration		
Daily	176	69.3
Weekly	70	27.6
Monthly	8	3.1

Participants reported gastrointestinal symptoms, nausea (27%), constipation (23.7%), loss of appetite (21.4%), abdominal pain (9.3%), Vomiting (3.2%), and Diarrhea (2.7%). Furthermore, 12.7 % of the participants reported no symptoms (Table 5).

Table 5. The consequences of gastrointestinal system among participants

Variable	n=400	%
Nausea	108	27.0
Constipation	95	23.7
Loss of appetite	85	21.4
Abdominal pain	37	9.3
Vomiting	13	3.2
Diarrhea	11	2.7
NA	51	12.7

Regarding the association between demographic data and pica behavior among participants, no significant associations were identified as indicated by the P values of tests (Table 6).

Table 6. Association between demographic data and pica behavior among participants

Variable	PICA		Non-PICA		P-value
	n	%	n	%	
Age categories					
18-22	28	65.2	15	34.8	0.682
23-28	66	64.7	36	35.3	
29-35	91	65.9	47	34.1	
36+	69	58.9	48	41.1	
Nationality					
Saudi	210	62.8	124	37.2	0.558
Non-Saudi	44	66.7	22	33.3	
Level of education					
Illiterate	2	50.0	2	50.0	0.427
Elementary	3	42.9	4	57.1	
Intermediate	8	50.0	8	50.0	
High school	95	61.7	59	38.3	
Diploma	68	67.3	34	33.3	
University and above	78	67.3	39	33.7	
Occupation					
Employed	85	67.5	41	32.5	0.264
Not employed	169	61.7	105	38.3	
Residence					
City	251	63.2	146	36.8	0.187
Village	3	100.	0	0	
Income					
< 3000	6	66.7	3	33.3	0.731
3000-5000	51	58.6	36	41.4	
5000-10000	115	66.5	58	33.5	
10000-15000	65	61.3	41	38.7	
>15000	17	68.0	8	32.0	

Concerning the association between pica and family and obstetrical history of participants, the relationship between pica and the history of family members reflected a statistically significant relationship at (P< 0,001). The parity in relationship to pica reflected a statistically significant relationship at (P <0,001). The gravidity in relationship to pica reflected a statistically significant relationship (P< 0,005). For blood analysis outcomes Hb and hematocrit in relation to pica reflected a statistically significant relationship at (P< 0,001) and (P< 0,001), respectively.   The symptoms attributed to iron deficiency was significantly associated with pica at (P< 0,006).

However, there was no statistically significant association between the family member with anemia and pregnancy trimester with pica (Table 7).

Table 7. Association between pica and family and obstetrical history

Variable	Pica		Non-pica		P-value
	N	%	N	%	
Is there any family member with anemia?					
Yes	93	65.5	49	34.5	0.539
No	161	62.4	97	37.6	
Is there any family member with pica?					
Yes	123	75.5	40	24.5	0.001**
No	131	55.3	106	44.7	
Parity (mean±SD)	1.9	1.1	2.4	1.5	0.001**
Gravidity (mean±SD)	3.2	1.3	3.6	1.6	0.005**
Pregnancy trimester					
1st	3	75.0	1	25.0	0.410
2nd	88	67.7	42	32.3	
3rd	163	61.3	103	38.7	
Hb Level (mean±SD)	8.6	0.8	9.5	0.6	0.001**
Hematocrit level (mean±SD)	27.9	2.7	29.8	1.9	0.001**
Symptoms attributed to iron deficiency					
Yes	249	65.4	132	34.6	0.006**
No	5	26.3	14	73.7	

** Highly significant at (P< 0,001).

The association between pica and non-pica regarding nutritional supplementation reflected no statistically significant difference among participants in iron, folic acid, multivitamins, and also food habits such as craving food. However, there is a statistically significant difference between the aversion as one of food habit and pica at (P< 0,001) (Table 8).

Table 8. Association between nutritional supplementation/food habits among pica and non-pica participants

Variable	Pica		Non-pica		P-value
Iron supplementation	n	%	n	%	
Iron					
Yes	244	64.4	135	35.6	0.124
No	10	47.6	11	52.4	
Folic acid					
Yes	213	64.9	115	35.1	0.202
No	41	56.9	31	43.1	

Multivitamins					
Yes	119	67.6	57	32.4	0.129
No	135	60.3	89	39.7	
Cravings food					
Yes	129	62.3	78	37.7	0.611
No	123	64.8	68	35.2	
Aversion					
Yes	153	79.3	40	20.7	0.001**
No	101	48.8	106	51.2	

Concerning the association between pica and consequences on the gastrointestinal system; the majority of the participants who had pica reported the following: nausea (27.95%), constipation (25.69%), loss of appetite (22.83%), abdominal pain (11.8%) vomiting (3.14%), and diarrhea (2.3%). Only 6.29 % of the participants with anemia did not report any symptoms. A significant association was identified between the two variables (P-value 0.001) (Table 9).

Table 9 Association between pica and consequences on the gastrointestinal system

Variable	PICA		Non-PICA		P-value
	n	%	n	%	
Nausea	71	27.95	37	34.3	0.001**
Constipation	65	25.69	27	29.7	
Loss of appetite	58	22.83	27	31.8	
Abdominal pain	30	11.8	7	18.9	
Vomiting	8	3.14	7	46.7	
Diarrhea	6	2.3	5	45.5	
NA	16	6.29	36	69.2	

** Highly significant at *(P< 0,001)*

BINARY LOGISTIC REGRESSION OF PICA PREDICTORS:

Regarding the results of multivariate analysis of binary logistic regression of pica predictors, four variables were significantly found as predictors of pica, Hb, hematocrit, symptoms attributed to iron deficiency, and aversion, keeping other variables constant at (p< 0.001), (P<0.002), (p< 0.001), and p< 0.001) respectively. R2 44% of variation in the dependent variable (pics) is was explained by the variables in the model. (Table 10).

Table 10 Significant predictors of pica in a logistic regression model

Variable	B	SE	Wald	P-value	OR
Is there any family member with pica	0.20	0.123	2.67	0.102	
Parity	0.15	0.196	0.58	0.446	
Gravidity	0.09	0.176	0.31	0.579	
Hb Level	0.64	0.191	11.43	0.001**	16.07
Hematocrit level	0.18	0.061	9.15	0.002**	0.02
Symptoms attributed to iron deficiency	1.16	0.355	10.75	0.001**	10.28
Aversion	0.60	0.121	24.98	0.001**	3.34

$R^2 = 0.44$

** Highly significant at (P< 0,001)

4. Discussion

Regarding pica prevalence among pregnant women, the current study reflected a high prevalence of about two-thirds (63.5%) of pregnant women had pica. Similarly, (Salih et al., 2015) study which done in Jizan and showed 67.3%. In the same line, two studies conducted in Ghana (Konlan et al., 2020) and (Hommey, 2016) reported that pica was more than three-quarters among participants of pregnant women. Moreover, studies conducted in Tanzania by (Nyanza et al., 2014) and in Nigeria by (Ekwenchi et al., 2015) which reported that about half of pregnant 53% of women have the urge to eat non-food items or pica. Furthermore, a study conducted by (Lumish et al., 2014) reported that nearly half of the pregnant women engaged in pica behavior during pregnancy.

THE ASSOCIATION BETWEEN PICA AND IRON DEFICIENCY ANEMIA AMONG PREGNANT WOMEN.

Among 400 participants with iron-deficiency anemia based on Hb and hematocrit levels, two-thirds had pica. This study revealed a highly significant association between pica and Hb hematocrit levels (P < 0.001).

The current study finding aligns with (Khoushabi et al., 2014) revealed a significant relationship between pica during pregnancy and Hb level (P<0.05) who reported a significant association between pica and Hb level during the first and third trimester of pregnancy (P< 0.05) for both trimesters. In the same line (Young et al., 2010) revealed that a highly significant association between pica and Hb hematocrit levels (P < 0.001).

In addition, a meta-analysis study conducted by (Miao et al., 2015) reported that pica behavior was significantly associated with a lower level of Hb (P< 0.001), and individuals practicing pica had significantly lower hematocrit levels (P < 0.001). Another meta-analysis conducted by (Fawcett et al., 2016) who concluded that pregnant women with pica have lower hemoglobin level (P < 0.005).

Contradictory to the previous studies, the study by (Roy, et al 2018) did not find a statistically significant association between pica and Hb concentrations. Interestingly, interpreted by the authors, due to the concentration of Hb was predictive of geophagy for are several probable justifications. Such as one-fifth of their study participants had Hb 11 g/dL, which was a lower prevalence than anticipated, such that we were underpowered

to detect differences. Furthermore, the differences in Hb levels with pica behavior may have been apparent in the first trimester. Nevertheless, differences could have been masked by the third trimester (WHO, 2011). In the current study, when we conducted our study interviews, most participants Hb registered in the first trimester, which interpreted the difference between our study and Roy, et al., (2018) study.

Instead of previous studies regarding the relationship between anemia and pica, but the underlying causes still unknown (Golden, et al., 2012). Undeniably, there is an evidence that specific pica substances absorb dietary iron, which would worsen, rather than improve, iron deficiency (Seim et al., 2013, 2016). Therefore, Roy, et al., (2018) concluded that the directivity of the relationship between pica and iron deficiency, and the core mechanism(s), are still need to be identified, however, the association is reliable and strong.

PARTICIPANTS SOCIODEMOGRAPHIC CHARACTERISTICS IN RELATION TO PICA

The results of sociodemographic data in terms of age, nationality, level of education, occupation, residence, and income in relation to pica among pregnant women were not statistically significant. Likewise, other studies were conducted by (Ezzeddin et al., 2015b; Roy et al., 2018; Salih et al., 2015; Young et al., 2010). In contrast, the study conducted by (Hommey, 2016) revealed that education level and occupation were associated with pica practice by pregnant women. This difference may be related to different in the distribution of educational level categories. Regarding occupation, the current study showed 66.5% of the participants were not employed, while the other study was not employed, represent as 1.82% only.

Concerning pica among pregnant women and family history, the current study showed that family history with anemia not significant, while the family history with pica is highly significant. These findings are similar to an ancient study conducted by (Simpson et al., 2000), which suggested that the association between pica activity and having a family history with pica may be a learned behavior.

The current study's findings indicate a significant relationship between pica among pregnant women and the number of parity and gravidity. This finding agreed with another study in parity conducted by (Salih et al., 2015). A study conducted by (Lumish et al., 2014) reported no significant differences in terms of parity and gravidity. The difference may be attributed to parity and gravidity distribution in relatively low participants number (n=158) in the other study SYMPTOMS ATTRIBUTED TO IRON DEFICIENCY

The vast majority experienced symptoms attributed to iron deficiency in terms of weakness, fatigue, dizziness, palpitation, and shortness of breath. The majority of the participants had taken supplementation during pregnancy, including iron followed by folic acid, multivitamins, and other (calcium and vitamin D). About half of the participants had food cravings include meat, sour, milk, sweets, eggs, salt, and spicy. While almost half of the participants reported food averted in the following items: milk, meat, vegetable, beverage, tea/coffee, and fruits.

Similarly, in review article was written by Di Renzo et al., (2015) mentioned that the main manifestations of iron deficiency anemia during pregnancy are pallor, glossitis and which patients complain lassitude, weakness, anorexia, palpitation, and dyspnea. Beyond iron deficiency, a lack of other micronutrients can occur during pregnancy. Roughly 20-30% of women show vitamin defiance. Hence iron supplementation is part of multiple micronutrient supplementation in pregnant women.

FOOD HABIT AND PICA /NON-PICA PARTICIPANTS

Regarding food habits, this study reflected that the majority of participants had food aversion (dislike food), and two-thirds had a food craving. Likewise, Salih et al., (2015) who reported the same. In the current study, food aversion related to milk and meat were the most disliked food among the participants, 38.9% and 25.4%, respectively. While Salih et al., (2015) reported that most food averted by pregnant women were meat (25.2%) and beverage (10.3%).

In the same line, the recent Saudi study evaluated the dietary nutrient intake among pregnant women and the pregnancy outcomes, and it found that the percentage of pregnant women 28.1% had a specific craving for certain foods, 13.2% had pica, and 47.4% had aversions and one-fourth of women craved mainly meat. The author interpreted that difference in food craving and aversion as a response to beliefs about what should be consumed (Almurshed et al., 2007).

In addition, (Weldemariam, 2018) found that the magnitude of anemia was higher among pregnant women who had been taking tea, coffee, and Khat more frequently than less frequent users Consumption of animal product such as red meat, organ meat, and eggless than once per week, vegetables less than once per day, take tea always after a meal were significantly associated with anemia in pregnancy.

The most pica items presented in the current study were ice (70.1%), clay (22.4%), chalk (5.1%), soup (1.6%), and others 0.8% (coal and soil), which was reported by the participants in the current study. Similarly, the study conducted by (Hommey, 2016) revealed that the most reported pica items consumed by pregnant women were ice (61.52%) and clay (52.12%). However, dissimilarly, the most common pica items reported by Salih et al., 2015, were the ice 17.8%, clay 6.5%, chalk 0.9%, and others 39.3 % (gum and sand) as reported in that study.

   Concerning pica and pregnancy trimesters, the current study showed that about half of pregnant women practiced pica during the first trimester (53.9%), followed by second (37.4%) and third trimesters (8.7%). The frequency and times of practice pica showed that most pregnant women practiced pica daily. The present finding seems consistent with other earlier findings reported by (Hommey, 2016); most pregnant women consumed pica daily.

Regarding the relationship between pregnancy trimester and pica among pregnant women, the current study has no statistically significant relationship with all three trimesters.

In the same line, Konlan et al., (2019) study reported that most pregnant women practice pica in the first trimester (47.8%), those who took pica more than once a day (59.5%), and most of them consume pica in between meals (43.4%). The consumption of pica in the first trimester interpreted by the attributed to the physiological changes which may occur, especially during the first-trimester pregnancy due to the influence of the human chorionic gonadotrophin hormone. During this period, women develop cravings for many non-food items simply because they have a nice smell and appealing to eat.

Dissimilarly, (Hommey, 2016) reported that pregnant women practiced pica during the first and second trimesters, 28.48% and 28.79%, respectively. While about one-quarter practiced pica throughout all pregnancy trimesters, only 1.52% reported pica during the third trimester. This difference may be in sampling technique; the current study used a

convenience sample while the other study used systematic random sampling, which may affect pregnant women's presentation in the three trimesters.

On the other hand, the study conducted by Salih et al., (2015) reported a statistically significant association between the first trimester and pica; this difference may be due to the majority of participants were in the third trimester, and only four participants were in the first trimester.

Moreover, according to Nyanza et al., (2014) geophagy is initiated at various times during pregnancy: in the first trimester (54.8%), in the second trimester (36.1%), and in the third trimester (9%). However, (Aslan et al., 2014) study assumed that within the first-trimester pregnancy symptoms are most severe; therefore, pregnant women could be drawn to these non-food items by way of their smell and taste with the perception of reducing these pregnancy symptoms they were experiencing.

NUTRITIONAL SUPPLEMENTS AMONG PICA/NON-PICA PARTICIPANTS

The findings of the current study also investigated the association between pica and non-pica regarding iron supplementation, which reflected no statistically significant difference among participants, all nutritional supplementations of iron, Folic acid, multi-vitamins, and craving food. However, there is a statistically significant difference between the aversion and pica at (P< 0,001).

In the same line, Roy, et al., (2018) reported that women who reported pica during pregnancy experienced greater food behavior than those who did not report pica. Also, they used more nutritional supplements and reflected more iron deficient. Regarding to the Consequences of pica on gastrointestinal system, the findings of the current study revealed a significant association between pica and consequences on the gastrointestinal system (P-value 0.001). Also, the majority of the participants who had pica reported nausea in about one-third, constipation in one-fourth, loss of appetite about one-fifth, abdominal pain about one-tenth, vomiting (3.14%), and diarrhea (2.3%).

Likewise, (Roy, et al., 2018) study reported a statistically significant correlation between gastrointestinal distress and geophagy and amylophagia specifically. Also, Gastrointestinal distress has been found to be associated with pica in several other studies (Young et al., 2011). Awkwardly, our findings did not analyze this relationship with specific types of pica precisely, as data collected based on the consequences generally not explicitly collected to each item of pica and its GIT consequences.

LIMITATIONS

Most pregnant women were recruited during the third trimester due to COVID-19 precaution in EJH, whereas pregnant women in the first and second trimesters postponed their follow-up appointments. This is decreased the variety of participants' and focused on the third trimester only.

5. Conclusions

All the pregnant women who participated in this study were recruited from iron deficiency anemic women to investigate the relationship between iron deficiency anemia and pica. This study concluded that most of the participants had pica, and there is a significant association between anemia and the exciting of pica, and half of them had pica during their first trimester.

Most of the participants experienced changes in their food habits like food aversion toward certain food, mostly toward meat and milk. Also, the findings confirmed that most non-food practices among pregnant women were pagophagia (eating of ice) and geophagia (eating of clay), in addition to other non-food like chalk, soap, coal, and soil. Finally, the practice of pic not related to any of sociodemographic data relation. However, the gravidity and parity has a significant relationship to the pica related to their previous history of pica with the previous pregnancy.

RECOMMENDATIONS

•   The current study suggests a further study in pica to include pregnant women perception regarding pica behavior. As pica practicing is a hidden behavior, and not all pregnant women disclose their eating behavior.

•   The antenatal follow-up should integrate the food behavior inquiry to check if the pica exists with anemic or non-anemic pregnant women.

•   Increase awareness among nurses and healthcare providers about the prevalence of pica and iron deficiency anemia among pregnant women through conducting a workshop and other media form such as posters and brochures to share the main on the outcome of the study among the health care providers in Jeddah hospitals.

IMPLICATION OF THE STUDY

The current study can be implicated in nursing practice, administration, education, and research. In nursing practice, this study encourages the nurse to consider pica as an important element while taking patient history regarding food habits in antenatal clinics. Concerning nursing administration, the current study can also provide a guideline, based on the developed questionnaire from an extensive literature review, including stakeholders' involvement, policymakers, and health care providers in EJH and other hospitals, to include pica behavior in the official element in their antenatal assessment form. Regarding nursing education, as this study is one of a few studies conducted in Saudi Arabia regarding pica practicing during pregnancy, this study adds that information can be a hot topic in nursing education to raise awareness of the strong association between pica and iron deficiency among pregnant women. For nursing research, this study can be replicated in another setting to support the current finding.

6. Patents: All agreements attached

Data Availability Statement: Available when reasonably asked from the editor.

Conflicts of Interest: The authors reported no declarations of interest.

Appendix A: King Saud Bin Abdelaziz University for Health Sciences by KAIMRC

Appendix B: IRB No, H-01-R-005

Appendix C. Informed Consent Form

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