Literature Review: The Relationship between Tea Consumption Habits and the Incidence of Anemia in Pregnant Women

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Article Information	ABSTRACT
	Introduction: There was an increase in the prevalence of anemia among pregnant women by 11.8% from 2013 to 2018 in Indonesia. The habit of drinking tea is one of the factors associated with anemia in pregnant women due to tannins in tea that can inhibit iron absorption in the body. This literature study aims to examine the relationship between tea-drinking habits and the incidence of anemia in pregnant women. **Method**: Articles were searched through Google Scholar with the keywords "tea drinking habits, anemia, pregnancy," and "relationship, tea consumption, anemia, pregnant women," as well as "relationship, tea consumption habits, anemia, pregnant women." The inclusion criteria used were articles from 2013 to 2023, full text in Indonesian, cross-sectional research methods, research subjects, namely anemic or non-anemic pregnant women, and indexed by SINTA S1-S4. Based on these inclusion criteria, a total of 10 articles were reviewed. **Result**: Analysis of respondent characteristics showed that 50% of the articles had a respondent age of 20-35 years, 40% had a gestational age of trimester II, and 40% had parity ≥2 children. 50% of the articles showed that pregnant women rarely/never consumed tea, and 40% showed that pregnant women experienced anemia. As many as 7 articles (70%) stated a relationship between tea consumption habits and the incidence of anemia in pregnant women. In comparison, three articles (30%) noted no relationship between tea consumption habits and the incidence of anemia in pregnant women. **Conclusion**: There is a relationship between tea consumption habits and the incidence of anemia in pregnant women.

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INTRODUCTION

The prevalence of anemia in pregnancy globally reaches 36.5% (WHO, 2019). Based on Riskesdas data, there was an increase in the prevalence of anemia in pregnant women

by 11.8% in Indonesia within five years (2013-2018). It was recorded that 37.1% of pregnant women experienced anemia in 2013, which increased to 48.9% in 2018 (Kemenkes RI, 2018).

Anemia in pregnancy affects not only the mother but also the fetus. One of the negative impacts of anemia in pregnancy for the mother is premature birth, while for the fetus, it can cause nutritional disorders and impact uteroplacental oxygenation (Manuaba dkk., 2013). Intrauterine fetal growth and development are not optimal because of insufficient oxygen received due to impaired uteroplacental oxygenation in anemic pregnant women (Azhari dkk., 2016). Based on the results of research by Aditianti & Djaiman (2020), the risk of Low Birth Weight (LBW) in pregnant women with anemia is 1.49 times higher than in pregnant women who are not anemic with a 95% CI confidence level of 1.26-4.60; $p < 0.001$.

Lack of consumption of nutritious food during pregnancy and lack of awareness of the importance of consuming iron (Fe) tablets can result in high rates of anemia in pregnant women. According to research by Sinaga dkk (2015), there is a significant relationship between iron intake and anemia status in pregnant women. One of the factors that increases the risk of maternal death is anemia due to Fe deficiency. One of the steps taken to reduce the risk of maternal death is to provide iron supplements (TTD) (Dinkes SIY, 2017).

One of the habits among the community, adolescents, adults, parents, and pregnant women, is consuming tea. Indonesia ranked 10th worldwide for the most significant tea consumption in 2018, reaching 94 million kg. In 2016-2018, there was an increase in tea consumption per capita in Indonesia by 0.02 kg/capita/year. From 2015 to 2017, tea consumption per capita in Indonesia was 0.34 kg/capita/year (International Tea Committee, 2019). According to research by Ariecha dkk (2020) at the Tebing Syahbandar Health Center, Serdang Bedagai, 62.5% of pregnant women often drink tea. According to research by Iriani & Ulfah (2019), in Ciwangi Village, Blubur Limbangan District, Garut Regency, 46% of pregnant women have a habit of drinking tea.

A negative correlation was found between tea and hemoglobin levels in pregnant women (Utami dkk., 2020). The results of research by Hurrell & Egli (2010), show tea is an inhibitor of iron absorption because, in addition to containing polyphenols, it also contains tannins. If tea consumption increases, it will impact the ability of iron to form hemoglobin. According to Riswanda (2017), low hemoglobin levels are caused by the tannin content in tea. Iron absorption can be reduced because tannins will bind iron into insoluble substances before being absorbed by the intestinal mucosa. As a result, ferritin amounts also decrease, impacting iron deficiency for hemoglobin synthesis and replacement of damaged hemoglobin.

One bag of pure tea dissolved in 200 mL of water contains 0.01207 mg of tannin. Through the Spearman Rank test, it was found that there was a correlation between tannin intake and hemoglobin levels with a significance value of 0.000 (Setyaningsih dkk., 2018). In line with the findings of Batara & Wijayanti (2021) in Samarinda and Sugihastuti dkk (2022) in Bogor, which stated that there was a relationship between tea consumption and the incidence of anemia in pregnant women. In the study by Batara & Wijayanti (2021) a p-value of 0.034 was obtained, while the survey by Sugihastuti dkk (2022), received a p-value of 0.029. In addition, the study by Ariecha dkk (2020), found that drinking tea after eating also affects the incidence of anemia in pregnant women, with a p-value of 0.003.

Research conducted by Resmana (2015) and Herawati dkk (2023) showed different results from the study above. Resmana (2015) found that the habit of drinking tea and the incidence of anemia in pregnant women were unrelated (p = 0.147). These results are supported by the study of Herawati dkk (2023), where a p-value of 0.065 was obtained, so

there was no relationship between the habit of drinking tea and the incidence of anemia in pregnant women.

Several researchers have previously identified the potential negative impacts of excessive tea consumption on the incidence of anemia in pregnant women. In the study by Safitri dkk (2022), through a literature review, researchers determined the extent of the relationship between tea consumption based on the frequency and time of tea consumption and the incidence of anemia in pregnant women. However, a research gap can be further explored in the context of diverse tea consumption habits (frequency) and the incidence of anemia in pregnant women in various regions in Indonesia. The novelty of this study lies in the approach to the frequency of tea consumption by pregnant women, which can be a consideration of factors that can influence the relationship. Based on the information above, through a literature review, the researcher wants to examine the relationship between tea consumption habits and the incidence of anemia in pregnant women (Safitri, Suhartati, & Sarkiah, 2022).

LITERATURE REVIEW

Anemia is when erythrocytes cannot deliver tissue oxygen needs (Wibowo dkk., 2021). According to WHO, if the hemoglobin (Hb) level in pregnant women is <11 g/dL or hematocrit (HCT) <33%, then anemia in pregnancy needs to be confirmed. Likewise, the confirmation of postpartum anemia if the hemoglobin level is <10 g/dL (WHO, 2016). There are several factors related to the occurrence of anemia in pregnant women. Based on the analysis results of Suwardi & Harahap (2021), parity, knowledge, consumption of iron (Fe) tablets, nutritional status, and the role of health workers correlate with anemia in pregnant women with a p-value of each variable of 0.000.

One of the habits among the community, adolescents, adults, parents, and pregnant women, is consuming tea. In addition to containing health benefits, tea contains tannin compounds, whereas pure tea leaves contain 5-15% tannin (Fajrina dkk., 2016). Tannins can react with minerals in food to form bonds that cannot be dissolved in the human digestive system. Tannins can bind iron ions effectively so that complex bonds are formed. Therefore, the bioavailability of iron in food is limited due to its binding properties, resulting in reduced Fe levels and insufficient absorption in the human body (Irianto, 2014).

It is recommended to avoid consuming tea during main meals because it can interfere with the process of iron absorption in the body (Mustika dkk., 2017). Significant variations in iron absorption results have been observed between people who eat with water and those who consume food with black tea. Based on research by Wardiyah dkk (2014), black tea can reduce iron absorption by 70%. The findings showed that people who consumed food with water showed an iron absorption rate of 22.1%, while those who ate black tea experienced a much lower iron absorption rate of 6.9%.

METHOD

The page used for article search is Google Scholar because, in addition to being easily accessible, the page also has a national and international reputation. Keywords in the article search were determined using the PICO method (population, intervention, comparison, and outcome). The keywords in Bahasa Indonesia obtained are *"kebiasaan minum teh, anemia, kehamilan"*; *"hubungan, konsumsi teh, anemia, ibu hamil"*; and *"hubungan, kebiasaan konsumsi teh, anemia, ibu hamil"*.

The inclusion criteria used in selecting journals to be reviewed are the year of publication in the last ten years (2013-2023), full text in Indonesian, using a cross-sectional research method, research subjects are pregnant women who have anemia or who do not

have anemia and have been indexed by SINTA S1-S4. Exclusion criteria are articles that cannot be accessed or downloaded and paid articles. The article search using PRISMA obtained 78 articles, which were then filtered using the following inclusion criteria (IC):

    a. IC1: Articles in Indonesian and published in 2013-2023.

    b. IC2: The article aims to determine the relationship between tea consumption habits and the incidence of anemia in pregnant women.

    c. IC3: Subjects of pregnant women with anemia and those without anemia.

    d. IC4: Indexed by SINTA S1-S4, completeness of respondent characteristics.

Data processing is carried out by creating data extraction in the form of a table. Then, the data is analyzed using a descriptive analysis method. The data results will be presented in the form of a table and a description of the results of the review of several articles and linked to other relevant theories and research (Figure 1).

RESULT AND DISCUSSION

Based on the ten articles obtained, there was 1 article indexed by SINTA 2 (10%), four articles indexed by SINTA 3 (40%), and five articles indexed by SINTA 4 (50%). The study design used in all articles obtained was a cross-sectional study design. The samples in the articles analyzed were pregnant women ranging from 35-230 pregnant women, both those with and without anemia, located in Bogor, Serang, Jakarta, Kendari, Tegal, Maluku, Bengkulu, Semarang, North Lampung, and Sidoarjo. The data from the reviewed articles were from seven articles in the health center's work area. However, two articles took data at the village level and 1 article at the BPS level. Based on the ten articles obtained, only seven articles listed the sampling technique used. There was 1 article using the nonprobability sampling technique, three articles using the total sampling technique, two articles using the simple random sampling technique, and 1 article using the consecutive non-random sampling technique.

Table 1 shows that 50% of articles have respondents aged 20-35 years, with the most significant percentage in the study of Purwaningtyas & Prameswari (2017) 91.9%. In line with the results of the survey by Tanziha dkk (2016), the percentage of pregnant women with the highest age was obtained at the age of 20-35 years, at 75.4%, whereas 37.2% had anemia. In the characteristics of gestational age, 30% did not include the gestational age of the pregnant woman, and there was 1 article (10%) that included the criteria for gestational age that was the research sample but did not include the number in each gestational age group. The gestational age with the highest percentage based on 4 out of 10 journals (40%) was the second trimester with the highest percentage in the study of Septiawan & Sugerta (2015) 100%. As for the characteristics of the parity of pregnant women, 40% of articles had the highest percentage of parity ≥ two children, with the highest percentage in the study of Purwaningtyas & Prameswari (2017) being 91.9%.

Anemia is prone to occur in pregnant women who are too young or too old. The lower pregnancy threshold in women is usually defined as age under 20, while the upper threshold is considered above 35. The age range of 20-35 years is generally considered a safe period for pregnancy because individuals in this range are considered sufficiently prepared both physically and psychologically to face the demands of pregnancy (Kemenkes, 2017). Based on the results of research by Yunida dkk (2022), it was found that there was a relationship between the age of pregnant women and the incidence of anemia where a p-value of 0.049 was obtained with PR = 2.820 with 95% CI (1.102-7.216) which means that the chances of pregnant women aged <20 years and >35 years are at greater risk

of experiencing anemia 2.820 times greater than pregnant women with an age range of 20-35 years.

According to the results of another study by Sari dkk (2022), the highest percentage of parity in non-risk parity is 92.7% (253 respondents), and pregnant women who experience anemia are more likely than those who are not at risk of parity than those who are at risk of parity. The results of the chi-square statistical test showed a p-value = 0.037 with OR = 2.92 (95% CI: 1.13-7.54), indicating a relationship between parity and the incidence of anemia in pregnant women. Specifically, pregnant women with high-risk parity are more susceptible to anemia.
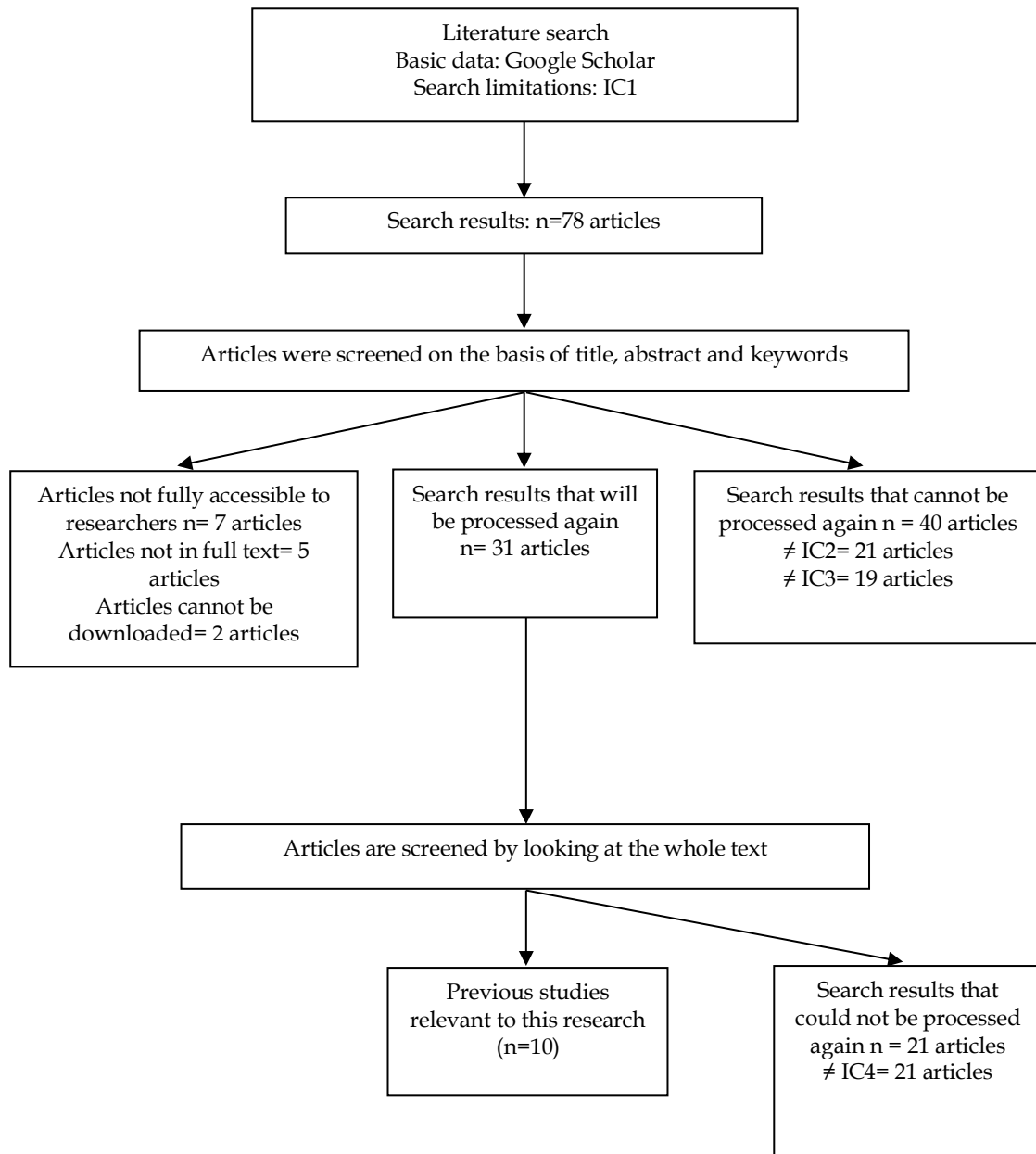

Figure 1. Article Search Strategy

Respondent Characteristics According to Age, Gestational Age, and Parity

The characteristics of respondents according to age, gestational age, and parity of pregnant women can be seen in Table 1.

Table 1. Respondent Characteristics According to Age, Gestational Age, and Parity

Reference	TS	Location	Age (year)	%	GA	%	Parity	%
Dewi, Istianah, & Septiani (2022)	100	Bogor, Jawa Barat	<20 and >35 20-35	23,0 77,0	T-II T-III	None	<2 child ≥2 child	13,0 87,0
Novelia, Rukmaini, & Sulistriani (2022)	120	Serang, Banten	None	None	Not listed	None	None	None
Lisisina & Rachmiyani (2021)	230	Jakarta Barat, DKI Jakarta	None	None	T-III	100	None	None
Afrini (2021)	42	Kendari, Sulawesi Tenggara	20-25 26-30 31-35	57,1 23,8 19,0	T-II T-III	52,4 47,6	None	None
Nisa, Chikmah, & Zulfiana (2019)	38	Tegal, Jawa Tengah	<20 and <35 20-35	21,2 78,9	T-II T-III	47,4 52,6	1 child >1 child	26,3 73,7
Amanupunnyo, Shaluhiyah, & Margawati (2018)	120	Seram Barat, Maluku	<20 and >35 20-35	20,0 80,0	T-I T-II T-III	15,0 45,8 39,2	1-3 child >3 child	82,5 17,5
Darmawansyah, Felizita, & Muryaningrum (2017)	84	Bengkulu	None	None	Not listed	None	None	None
Purwaningtyas & Prameswari (2017)	74	Semarang, Jawa Tengah	<20 and >35 20-35	8,1 91,9	Not listed	None	<2 child ≥2 child	8,1 91,9
Septiawan & Sugerta (2015)	91	Lampung Utara, Lampung	<20 and >35 20-35	35,2 64,8	T-II	100	None	None
Afiyah (2015)	35	Sidoarjo, Jawa Timur	17-25 26-35 36-45	36,1 50,0 13,9	T-I T-II T-III	19,4 52,8 27,8	1 child >1 child ≥5 child	50,0 50,0 0

Abbreviation: a) TS: Total Sampel; b) GA: Gestational Age; c) T: Trimester

Tea Consumption Habits and Anemia Incidence in Pregnant Women

Tea consumption habits in the reviewed articles are divided into 2 to 6 categories. Data on tea drinking habits in pregnant women was collected through questionnaires and food frequency forms, but three articles did not include the instruments used. The incidence of anemia in pregnant women can be seen by measuring the hemoglobin (Hb) levels of pregnant women. The instruments or tools used to obtain data on Hb levels in pregnant women in the reviewed journals vary. There were two articles (20%) that took data from the Maternal and Child Health (KIA) book, 1 article (10%) used digital Hb, 1 article (10%) through medical records, 1 article (10%) used Sahli's Hb, and 1 article (10%) used the cyanmethemoglobin method. Still, four articles (40%) must include the instruments or tools

used to determine hemoglobin levels. The results of tea consumption habits can be seen in Table 2.

Tabel 2. Tea Consumption Habits and the Incidence of Anemia in Pregnant Women

Reference	Total Sampel	Location	Tea Consumption Habits		Incidence of Anemia (%)	
			Category	%	Category	%
Dewi, Istianah, & Septiani (2022)	100	Bogor, Jawa Barat	Rarely	66,0	Not Anemia	58,0
			Often	34,0	Anemia	42,0
Novelia, Rukmaini, & Sulistriani (2022)	120	Serang, Banten	Not Routine	7,5	Not Anemia	79,2
			Routine	92,5	Anemia (Mild, Moderate, Severe)	20,8
Lisisina & Rachmiyani (2021)	230	Jakarta Barat, DKI Jakarta	Rarely (≤200ml/day)	51,7	Not Anemia	67,8
			Often (>200ml/day)	48,3	Anemia	32,2
Afrini (2021)	42	Kendari, Sulawesi Tenggara	Rarely	85,7	Not Anemia	38,1
			Sering	14,3	Anemia	61,9
Nisa, Chikmah, & Zulfiana (2019)	38	Tegal, Jawa Tengah	No/ Rarely	50,0	Not Anemia	23,5
			Yes	50,0	Anemia	76,3
Amanupunnyo, Shaluhiyah, & Margawati (2018)	120	Seram Barat, Maluku	Rarely	40,8	Not Anemia	12,5
			Often (>1 time)	59,2	Anemia (Mild, Moderate, Severe)	87,5
Darmawansyah, Felizita, & Muryaningrum (2017)	84	Bengkulu	Rarely	52,4	Not Anemia	57,1
			Often (≥2 times/day)	47,6	Anemia	42,9
Purwaningtyas & Prameswari (2017)	74	Semarang, Jawa Tengah	Never	33,8	Not Anemia	51,4
			Rarely	2,7	Anemia	48.6
			Sometimes	1,4		
			Normal	8,1		
			Often	52,5		
			Very Often	1,4		
Septiawan & Sugerta (2015)	91	Lampung Utara, Lampung	No	61,5	Not Anemia	68,1
			Yes	38,5	Anemia	31,9
Afiyah (2015)	35	Sidoarjo, Jawa Timur	No	19,4	Not Anemia	36,1
			Sometimes	25,0	Anemia (Mild, Moderate, Severe)	63,9
			Yes	55,6		

Table 2 shows that 5 out of 10 articles (50%) show a high percentage of pregnant women who rarely/do not consume tea, with the highest percentage in Afrini (2021) study of 85.7%. The lowest percentage is in pregnant women who often consume tea, with a percentage of 14.3%. There is 1 article (10%) with balanced results between pregnant women who rarely consume tea and pregnant women who often consume tea.

In the study by Dewi dkk (2022), researchers concluded that pregnant women habitually consume tea because they usually consume it to relieve nausea and drink it with meals. This result should not be done because it can interfere with iron absorption in the

body. Research by Wardiyah dkk (2014), shows a difference between eating with tea and eating with water. If you eat with water, iron absorption will be 22.1%, while if you eat with tea, iron absorption will only be 6.9%.

In addition, Table 2 also discusses the incidence of anemia, where 40% of articles have respondents experiencing more anemia, with the highest percentage of 87.5% in West Seram, Maluku. Based on a review of 10 articles, it was stated that three of them classified anemia into three categories: mild, moderate, and severe. Of the three articles, there was only 1 article, namely a study conducted by Ammanupunyo et al. (2018), which included hemoglobin levels from each category of anemia; anemia was said to be if the Hb level was <11gr%, mild anemia if 9-10gr%, moderate anemia if 7-8gr%, and severe anemia if <7gr%.

Relationship between Tea Consumption Habits and the Incidence of Anemia in Pregnant Women

Table 3 shows the relationship between tea drinking habits and the incidence of anemia in pregnant women based on the reviewed articles. The data in Table 3 shows that the study's results stated a relationship between tea consumption habits and the occurrence of anemia in pregnant women. Based on most of the literature, especially 7 out of 10 articles (70%), there is a correlation between tea consumption habits and the occurrence of anemia in pregnant women (Dewi dkk., 2022; Lisisina & Rachmiyani, 2021; Afrini, 2021; Amanupunnyo dkk., 2018; Darmawansyah dkk., 2017; Septiawan & Sugerta, 2015; Afiyah, 2015). There are three articles (30%) of which include the Odds Ratio (OR) or Relative Ratio (RR) value, where the highest value is in the study by Amanupunnyo et al. (2018) with an OR value = 17.590 with 95% CI (2.061-150.092) which shows that pregnant women who consume tea > 1 time have a 17.6 times higher risk of anemia than pregnant women who rarely consume tea.

This result is in line with research conducted by Choirunissa & Al Zahra (2019) which discovered the impact of drinking tea on anemia in pregnant women. Statistical analysis produced a p-value of 0.001, which showed a significant relationship between drinking tea and anemia in pregnant women at the Salembaran Jaya Health Center, Tangerang, in 2018. In addition, an OR value of 4.641 was also obtained with 95% CI, which means that respondents who consume tea have a 4.641 times greater risk of anemia than respondents who do not consume tea. The difference in OR values may occur due to the more significant number of samples in Amanupunnyo dkk (2018) study, which was 120 respondents, 87.5% of whom had anemia, compared to Choirunissa & Al Zahra (2019) study with 115 respondents, 76.5% of whom had anemia.

The results of the analysis in Table 3 show that 70% of the articles have a relationship between tea consumption habits and the incidence of anemia in pregnant women, which is in line with Fajrina dkk (2016), containing 5-15% tannin compounds in pure tea leaves. Tannins can react with minerals found in food, which are components of iron formation. This interaction will form bonds that cannot be dissolved in the human digestive system. Chemically, tannins can create more complex bonds by binding iron, making it difficult for the iron in food to be absorbed by the human body (Irianto, 2014). When iron absorption is inhibited, this can reduce ferritin production, limiting iron availability for hemoglobin synthesis and replacing damaged hemoglobin in the body. That is one of the factors causing decreased hemoglobin levels in the bloodstream (Riswanda, 2017).

Table 3 also mentions three other articles stating that there is no relationship between tea consumption habits and the incidence of anemia in pregnant women (Novelia dkk., 2022; Nisa dkk, 2019; Purwaningtyas & Prameswari, 2017). Based on the results of the

study by Novelia dkk (2022), it was concluded that the lack of relationship was because respondents gave a time gap of 1 to 2 hours in consuming tea before or after eating. This finding is different from previous research by Rosita, Sumarni, & H (2019) which showed that the habit of drinking tea after eating with the incidence of anemia in pregnant women showed a relationship. In addition, Septiawan & Sugerta (2015) stated that iron absorption can decrease by 85% if you consume tea after eating.

Table 3. Relationship between Tea Consumption Habits and the Incidence of Anemia in Pregnant Women

No	Reference	Location	Tea Consumption Habits	Incidence of Anemia (%)		OR (CI 95%) / RR	p-value
				No	Yes		
1.	Dewi, Istianah, & Septiani (2022)	Bogor, Jawa Barat	Rarely Often	14,7 80,3	19,7 85,3	-	0,000*
2.	Novelia, Rukmaini, & Sulistriani (2022)	Serang, Banten	Not Routine Routine	55,6 81,1	44,4 18,9	-	0,245*
3.	Lisisina & Rachmiyani (2021)	Jakarta Barat, DKI Jakarta	Rarely Often	83,2 5,1	16,8 48,6	-	0,00*
4.	Afrini (2021)	Kendari, Sulawesi Tenggara	Rarely Often	30,6 83,2	69,4 16,7	-	0,023*
5.	Nisa, Chikmah, & Zulfiana (2019)	Tegal, Jawa Tengah	Rarely Often	21,1 26,3	78,9 73,7	-	0,7*
6.	Amanupunnyo, Shaluhiyah, & Margawati (2018)	Seram Barat, Maluku	Rarely Often	2 19,7	98 80,3	17,590 (2,061-150,092)	0,004*
7.	Darmawansyah, Felizita, & Muryaningrum (2017)	Bengkulu	Rarely Often	84,1 27,5	15,9 72,5	13,9 (4,8-40,2)	0,001*
8.	Purwaningtyas & Prameswari (2017)	Semarang, Jawa Tengah	Never Rarely Sometimes Normal Often Very Often	36,9 2,6 0 7,9 50 2,6	30,6 2,8 2,8 8,3 55,5 0	-	0,953*
9.	Septiawan & Sugerta (2015)	Lampung Utara, Lampung	No Yes	76,8 54,3	23,2 45,7	2,785 (1,122-6,916)	0,044*
10.	Afiyah (2015)	Sidoarjo, Jawa Timur	No Rarely Yes	100 33,3 15,0	0 66,7 65,0	-	0,000**

Chi Square Test (p-value <0,05)
**Rank Spearman Test (p-value <0,05)*

Therefore, pregnant women should get used to consuming foods rich in iron and vitamin C, fish, and meat to facilitate the absorption of Fe (Safrudin, 2012). In addition, they are changing their drinking pattern by not consuming tea every day or not at meal times and giving a gap of 1 to 2 hours between drinking tea before and after eating (Rosita dkk, 2019).

CONCLUSION

Based on ten articles reviewed in the literature, the results showed that 70% of the articles stated a relationship between tea consumption habits and the incidence of anemia in pregnant women. Pregnant women should change their tea-drinking patterns by not consuming tea daily or consuming tea not at meal times and giving a tea-drinking gap of 1 to 2 hours before and after eating. Further research can be conducted on the relationship between tea-drinking habits and anemia in pregnant women. They can be expanded by understanding the types and amounts of tea consumed that may affect this relationship.

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