OPEN ACCESS

Indonesian Journal of Human Nutrition
P-ISSN 2442-6636
E-ISSN 2355-3987
www.ijhn.ub.ac.id
Artikel Hasil Penelitian

Contribution of School Canteen's Snacks to The Iron Fulfillment in Malang High Schools

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Diterima: Maret 2022 Direview: Agustus 2022 Dimuat: Desember 2022

ABSTRACT

Inadequate dietary iron, impaired iron absorption, bleeding, or loss of body iron in the urine may cause anemia. The prevalence of anemia due to iron (Fe) deficiency in Indonesia reaches 22.7% in females and 12.4% in males. Indonesian students spent 7-8 hours/day, mainly the iron daily intake influenced by school canteen snacks. This study aimed to determine the contribution of Fe content in canteen snacks in high schools in Malang. This research was an analytic observational study using a cross-sectional design with the AAS (Atomic Absorption Spectrometry) method as a quantitative iron analysis technique. Food samples were selected purposively according to the inclusion criteria from 10 high schools consisting of junior high and senior high school groups. The snack samples studied were fried chicken, fried Tempe, and noodles. The average Fe content in snacks was analyzed using the independent T-test in the junior and senior high school groups. The iron content in fried Tempe and noodle showed a significant difference with p> 0.05, while the iron content in fried chicken in the two school groups did not show different results. However, the percentage contribution of Fe to the Nutrition Adequacy Rate (RDA) is still minimal, with the most significant contribution coming from noodles, reaching 17.85% in the male group.

***Keywords**: anemic, iron, school snack, school canteen*

ABSTRAK

Zat besi yang tidak adekuat, gangguan penyerapan zat besi, perdarahan, atau kehilangan zat besi tubuh melalui urin dapat menyebabkan anemia. Prevalensi anemia akibat defisiensi besi (Fe) di Indonesia mencapai 22,7% pada wanita dan 12,4% pada pria. Pelajar Indonesia menghabiskan waktu 7-8 jam/hari, terutama asupan zat besi harian dipengaruhi oleh jajanan kantin sekolah. Penelitian ini bertujuan untuk mengetahui kontribusi kandungan Fe pada jajanan kantin di SMA se-Malang Raya. Penelitian ini merupakan penelitian observasional analitik dengan desain cross sectional dengan metode AAS (*Atomic Absorption Spectrometry*) sebagai teknik analisis kuantitatif besi. Sampel

DOI: https://doi.org/10.21776/ub.ijhn.2022.009.02.4

makanan dipilih secara *purposive* sesuai dengan kriteria inklusi dari 10 SMA yang terdiri dari kelompok SMP dan SMA. Sampel jajanan yang diteliti adalah ayam goreng, tempe goreng, dan mie. Kandungan Fe rata-rata pada makanan jajanan dianalisis menggunakan independent T-test pada kelompok SMP dan SMA. Kandungan besi pada tempe dan mie goreng menunjukkan perbedaan yang bermakna dengan p>0,05, sendangkan kandungan besi pada ayam goreng pada kedua kelompok sekolah tidak menunjukkan hasil yang berbeda. Namun persentase kontribusi Fe terhadap Angka Kecukupan Gizi (AKG) masih minim, dengan kontribusi terbesar berasal dari mie yaitu mencapai 17,85% pada kelompok laki-laki.

Kata kunci: anemia, jajanan sekolah, kantin sekolan, zat besi

INTRODUCTION

Anemia is a condition in which the haemoglobin level in the blood is lower than average according to age group and gender, and all age groups can experience this condition (1). The most common causes of anemia include nutritional deficiencies, particularly iron deficiency. Moreover, folate, vitamins B12 and vitamin A are also fundamental causes. Hemoglobinopathies and infectious diseases, including malaria, tuberculosis, HIV, and parasitic infections, also contribute to the anemia. Previous studies mention that 50% of the anemia burden is related to iron deficiency (ID) (2).

Anemia in reproductive women and children is included in the WHO Global list of 100 core health indicators. In 2019, global anemia prevalence was 29.9% (95% uncertainty interval (UI) 27.0%, 32.8%) in women of reproductive age, equivalent to over half a billion women aged 15-49 years (3). Based on Basic Health Research in 2018, the prevalence of anemia in Indonesia reached 48.9% in the age group 15-24 years, and this number increased from 37.1% in 2013 (4).

The anemia problem can be overcome by increasing iron (Fe) by consuming balanced nutrition and iron supplementation foods (5). However, the National Agency for Drug and Food Control (BPOM Indonesia) surveyed school children's snack habits and showed that 90.65% of school children always consume snacks in the school canteen (6). A similar survey also showed that 43.76% of students did not eat breakfast. This habit dramatically influences children's daily iron fulfillment because children spend 7 to 8 hours daily at school. Previous research about the analysis of snack consumption against teenage nutrition fulfillment showed that school snacks only contribute 6.56% of the standard daily Fe intake (7).

The standard of compliance recommended for School Children's Snack Food for iron is 4 mg/ day. Snacks for school children contribute to the fulfillment of daily nutritional adequacy ranging from 15-20%, affecting iron intake. According to the Minister of Health, Republic of Indonesia No. 75 of 2013, the iron adequacy rate for adolescents aged 13-15 years in Indonesia is set at 26 mg/day for young women and 19 mg/day for young men.

Research conducted in 2015 at the Elementary School in Sukopuro Village, Jabung District, Malang Regency, shows the iron levels in the school's snacks (8). As many as 17 of the 20 snacks did not meet the recommended iron levels. Anemia in adolescents will impact decreased concentration in learning, decreased physical fitness, and growth disorders, so height and weight do not usually reach (9). This study aims to determine the contribution of Fe content in school snacks in high school canteens in Malang.

DOI: https://doi.org/10.21776/ub.ijhn.2022.009.02.4

RESEARCH METHOD

This research was conducted with a cross-sectional study design by performing quantitative Fe analysis techniques using the Atomic Absorption Spectrometry (AAS) method. The research sample consisted of five junior high schools and five senior high schools selected by purposive random sampling based on preliminary research (unpublished data) by Kusuma in 2018 regarding the availability of an adequate school canteen. In addition, the ten canteens must have the same type of snacks. This study selected three favourite snacks: fried chicken, fried tempeh, and noodles. Favourite snacks are determined based on students' ratio of most purchased snacks.

The samples were then analyzed for Fe content and calculated the fulfillment of the Nutrition Adequacy Ratio (RDA).

Iron analysis

The sample was weighed 5 g and then put in a crucible. It was ashed in a muffle furnace for 6 hours (600 ^{O}C) until ash was formed (complete ashing process). Add 25 ml of HCl in a crucible and heat for 30 minutes, then dilute with distilled water. Pipette 5 ml of the affixed solution, then put it into a 25 ml volumetric flask. Add bromophenol blue and sodium acetate to pH 3.5±1. Add 4 ml of 1.10 phenanthroline solution. Dilute with distilled water and shake until evenly distributed, then let stand for 1 hour. The color intensity of the test and standard samples was measured by UV-VIS spectrophotometry at a wavelength of 515 nm. The sample absorbance is plotted on the standard curve equation (10).

Data analysis

The data obtained were collected, tabulated, presented in a frequency distribution table, and analyzed descriptively. One-Way ANOVA test was conducted to calculate the contribution of the iron content (Fe) of food snacks with numbers of the adequacy of Iron (Fe) in students per day in the form of a per cent (%). Significant differences in each sample showed by p-value <0,05.

RESULTS

Sample Characteristics

The sample was weighed to determine the size and composition of the materials used. It can affect the iron content of each sample in each school. Characteristics of snack food samples from the research results showed that fried chicken, fried Tempe, and noodles had different material compositions from one school to another, depending on the snack-making process. The difference in the composition of this material causes differences in the iron content in the snack food samples. The composition of the ingredients and the portion size of the three types of snacks in each school's sample in Malang City can be seen in table 1.

DOI: https://doi.org/10.21776/ub.ijhn.2022.009.02.4

Table 1. The composition of the ingredients in the samples

Sample	Ingredients (g)	Schools									
		Junior High					**Senior High**				
		1	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
	Chicken	18	23	16	34	33	20	22	36	10	29
	Flour	23	12	60	10	10	34	25	41	26	37
Weight of a sample (g)		**41**	**35**	**76**	**44**	**43**	**54**	**47**	**77**	**36**	**66**
	Tempe	15	24	30	24	21	17	20	16	26	19
	Flour	10	10	10	34	7	21	19	26	26	20
Weight of a sample (g)		**25**	**34**	**40**	**58**	**28**	**38**	**39**	**42**	**52**	**39**
	Noodle	180	188	186	170	162	200	146	206	165	185
	Dumpling	0	17	17	44	8	17	-	16	17	15
	Chicken	6	15	10	7	0	11	15	10	23	10
	Vegetables	0	14	8	5	24	25	-	16	30	27
The total weight (g)		**186**	**234**	**221**	**226**	**194**	**253**	**161**	**248**	**235**	**237**

Iron Content and The Fulfillment in Junior High School snacks

All samples were normally distributed and homogeneous, so the analysis continued with one-way ANOVA and Post hoc Tukey. There is a significant difference in iron content (p-value <0.05) in each group of snacks, shown by the difference in letter notation in each sample shown in table 2. The highest average of iron content is in the noodle sample, followed by fried chicken and fried tempe.

The table also describes the iron fulfillment of each snack in different sex groups; the highest completion is the males' group by noodle sample.

Iron Content and The Fulfillment in Senior High School snacks

All samples were normally distributed and homogeneous, so the analysis continued with one-way ANOVA and Post hoc Tukey. There is a significant difference in Iron content (p-value <0.05) in each group of snacks, shown by the difference in letter notation in each sample shown in table 3. The highest average iron content is in the Fried tempe, followed by noodles and fried chicken.

The table also describes the iron fulfillment of each snack in different sex groups; the highest completion is the males' group by noodle sample.

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Table 2. The Iron Content and Iron Contribution in Junior High School samples

Sample	Junior High School	Fe content (mg/100g)	Serving size (g)	Fe content per serving size	% RDA	
				(mg/serving size)	Males	Females
	1	0.014[a]	41	0.006	0.128	0.074
	2	0.035[c]	35	0.012	0.272	0.157
	3	0.119[e]	76	0.090	2.010	1.159
	4	0.031[b]	44	0.014	0.303	0.175
	5	0.055[d]	43	0.024	0.526	0.303
	1	0.037[a]	25	0.009	0.308	0.178
	2	0.039[a]	34	0.013	0.442	0.255
	3	0.114[c]	40	0.058	1.920	1.108
	4	0.061[b]	58	0.035	1.179	0.680
	5	0.039[a]	28	0.011	0.364	0.210
	1	0.027[a]	186	0.050	1.116	0.644
	2	0.047[b]	234	0.110	2.444	1.410
	3	0.047[b]	221	0.104	2.308	1.332
	4	0.183[d]	226	0.414	9.191	5.302
	5	0.065[c]	194	0.126	2.802	1.617

The %RDA was calculated as iron requirements from snacks (20-30% of daily needs).
* 20% RDA. ** 30% RDA (RDA for males: 15 mg/day, females: 26mg/day)
The statistical analysis using Post Hock Tukey. The different letters showed the difference in the Fe content in each group of snack sample

Table 3. The Iron Content and Iron Contribution in Senior High School samples

Sample	Senior High School	Fe content (mg/100g)	Serving size (g)	Fe content per serving size	% RDA	
				(mg/serving size)	Males	Females
	1	0.115[b]	54	0.062	1.380	0.796
	2	0.232[d]	47	0.109	2.423	1.398
	3	0.083[a]	77	0.064	1.420	0.819
	4	0.171[c]	36	0.062	1.368	0.789
	5	0.304[e]	66	0.201	4.459	2.572
	1	0.136[a]	38	0.052	1.723	0.994
	2	0.189[c]	39	0.074	2.457	1.418
	3	0.156[b]	42	0.066	2.184	1.260
	4	0.269[d]	52	0.140	4.663	2.690
	5	0.332[e]	39	0.129	4.316	2.490
	1	0.158[b]	253	0.400	8.883	5.125
	2	0.115[a]	161	0.185	4.114	2.374
	3	0.147[b]	248	0.365	8.101	4.674
	4	0.192[c]	235	0.451	10.027	5.785
	5	0.339[d]	237	0.803	17.854	10.300

DOI: https://doi.org/10.21776/ub.ijhn.2022.009.02.4

The %RDA was calculated as iron requirements from snacks (20-30% of daily needs).
* 20% RDA. ** 30% RDA (RDA for males: 15 mg/day. females: 26mg/day)
The statistical analysis using Post Hock Tukey. The different letters showed the difference in the Fe content in each group of snack sample

DISCUSSION

Some current definitions of "snack" in the literature are based on the time of day of an eating occasion, the type of food consumed, the amount, the location, or a combination of several factors. Furthermore, some studies relied on study participants to label their eating occasions, sometimes without providing them with a list of examples or controlled, defined labels (11). School snacks are food and beverages prepared and sold by street vendors on the streets and in other crowded public places, eaten or consumed directly without further processing or preparation.

Snack culture is part of the daily life of almost all age groups and social classes, including school-age children and teenagers. The nutritional content of snack foods varies depending on the type. There are main meals, snacks, and drinks. The consumption of snacks will contribute to a person's nutritional status (12)(13).

According to Aprilia (2011), snack food is defined as ready-to-eat food or snack food that is not produced at the household level and is prepared for direct consumption at sales locations located on the roadside or in public places sold by walking around. Snack foods cannot replace the main meal, so they should not consume during the main mealtime. Consumption of snacks can maintain the child's energy sufficiency before the main meal arrives. However. excessive consumption of snacks can also cause weight gain if the choice of snacks is in the form of foods high in calories, fat, sugar, and low in nutrients needed by children.

Food samples were taken based on initial observations made in ten schools based on the consideration that these samples were available in the school canteen. The sample is a favourite food sold in the school canteen.

Children in school need carbohydrates, fats, proteins, and iron; this is the problem of iron nutritional anemia (8). The incidence of anemia in Indonesia is relatively high. Based on Basic Indonesia Health Research 2018 (4) data, the prevalence of anemia in adolescents is 32%, meaning 3-4 out of 10 adolescents suffer from anemia. This phenomenon is influenced by the habit of nutritional intake that is not optimal and lacks physical activity. Another research mention that school children often skip breakfast, thus requiring energy and nutrients that can meet the recommended adequacy in a day, with school students' snacks sold around the school environment (14). Snacks in student's social life are a part of socializing with their friends. Students tend to consume less nutritious food. An observation study about the behavior of choosing snacks in the school canteen in youth (10-19 years old) shows that 52.8% of respondents often consume fast food and junk food (15).

Iron is a micromineral that is abundant in the human body. Iron in the body can be obtained from recycling damaged red blood cells and food. There are three groups to categorize various food groups according to their composition of iron, foods with low, medium, and high iron supplies. The first group consists of seeds, roots, and tubers. Foods with moderate iron supplies consist of whole grains, seeds, and tubers, including foods from animal sources and foods containing vitamin C. Foods with high iron supplies, include meat, poultry, fish, or food rich in vitamin C. The categorization can generate human diet intake, informing human dietary patterns. It also helps to

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enhance people's iron bioavailability and improves micronutrient outcomes (16).

Iron differs from other minerals because iron balance in the human body is regulated by absorption only because there is no physiologic mechanism for excretion. Based on intake data and isotope studies, iron bioavailability has been estimated to be 14-18% for mixed diets and 5-12% for vegetarian diets in subjects with no iron stores. Hence, these values have been used to generate dietary reference values for all population groups (17)(18).

Several dietary factors can influence the absorption of iron. Absorption-enhancing factors are ascorbic acid and meat, fish, and poultry. On the other hand, ingesting large amounts of normal food or beverages that impair iron absorption may be an overlooked cause of iron deficiency, such as tea and coffee (e.g. polyphenols, phytates), and calcium (19). Tea interferes with iron absorption and can lead to iron deficiency anemia when consumed in large quantities (20).

Types of drinks widely available in the school canteen include tea (both packaged tea and tea brewed directly), milk and tea-based drinks, which are very popular these days. Consuming beverages with high polyphenol content, such as tea and product made from milk that contains high calcium, is also the cause of low iron absorption by the body (21).

Differences in iron content in each sample in various schools

There was a significant difference between the iron content in the three sample groups in each school, with a one-way ANOVA p-value of 0.000 ($p<0.05$). This difference occurs due to differences in size, portion, and composition of the constituent materials in each sample. The chicken composition in all schools is chicken and flour, although it is unknown what type of flour and the part of chicken are used in each school canteen. The different iron content in each sample at other schools can be affected by the position of chicken meat used. The iron content for whole broiler chickens is 1 mg/100g, and different parts have different iron content. Breast meat contains 0.9 mg/100g iron, wings are 1 mg/100g ingredients, and thighs are below 1.1 mg/100g of material (22).

The same thing was also seen in fried tempe and noodles samples. The iron content in noodles was the highest among fried chicken and fried tempeh. This phenomenon happens due to variations in the ingredients in the noodles. Some schools have varied noodle products by adding crackers, dumplings, or vegetables. This variation then contributes to the iron content of the sample.

Tempe samples also showed significant differences (p-value <0.05) in iron content in each different school. This difference is caused by the composition of tempe and flour used in each sample. According to Astawan's research, tempe produced from Grobogan soybeans has the same water, protein, fat, and mineral content as tempe from imported soybeans, which means tempe with soybean base ingredients with different varieties has the same nutritional content (23). Moreover, other factors affecting iron deterioration in tempe include heat, air, light, and humidity. Iron stability depends on several factors, including the carrier material's nature, particle size, and exposure to heat, humidity, and air (24).

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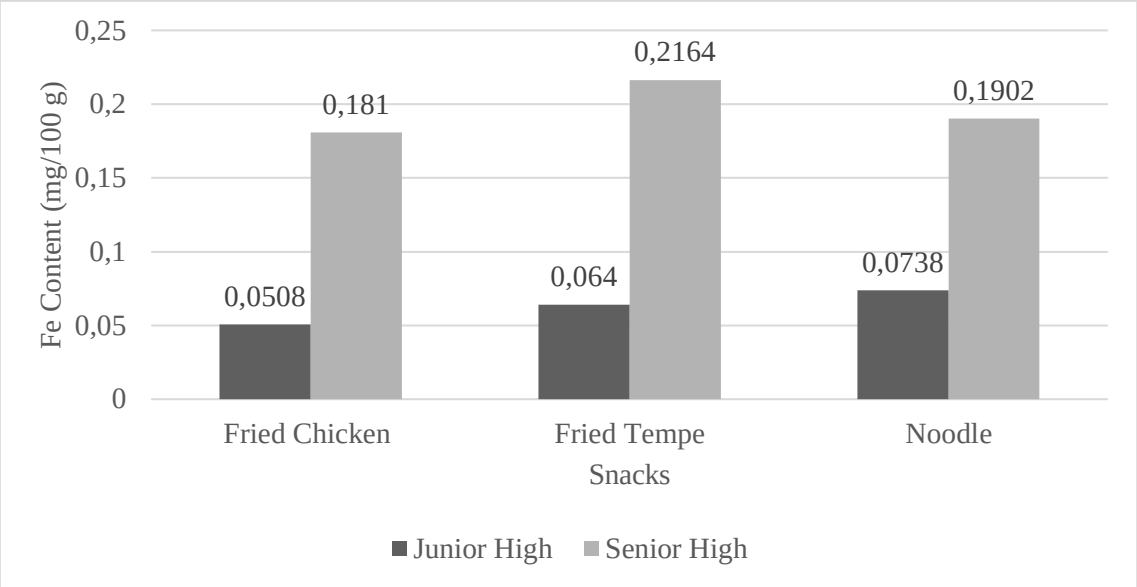
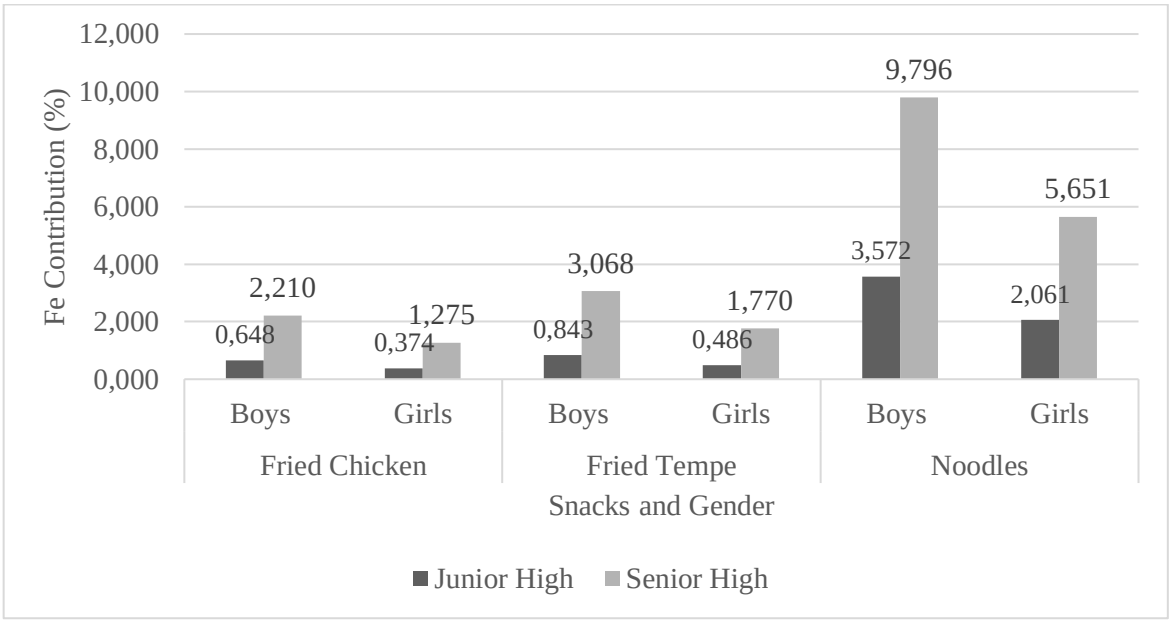


Figure 1. The Comparison of the average Iron Content in Samples Between Junior High School and Senior High School Groups



The standard Nutritional Adequacy Rate (RDA) is 15 mg/day for males and 26 mg/day for females

Figure 2. The Percentage of Iron Contribution Based on Gender Among Samples

Comparisons of Iron content in a snack between two groups of school

Figure 1 shows that the iron content in the food group in senior high school is higher than that in the junior high school group because of the influence of the length of time and the level of pocket money. Senior high school students have more pocket money, so the canteen also has the flexibility to provide more varied

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snacks, more significant portions, and better-quality nutrition.

The school canteen significantly impacts school-age children and adolescents' dietary intake and nutritional status. Many canteens had inadequate infrastructure and were managed informally, with limited rules, monitoring, and supervision. Although healthy options, including vegetables and fruits, were available in most canteens, unhealthy foods and beverages were abundant and cheap. Lack of awareness of the importance of nutrition for school-age children and adolescents was pervasive among all stakeholders. Personal preference and availability were the main drivers of the students' food choices (25). However, students with more pocket money frequently consume (by 25–89%) sugary beverages, snacks, fast food, or street food stalls, a risk factor for unhealthy eating (26).

The Iron Contribution by school snack based on gender

The standard Nutrition adequacy of iron for high school students is about 26 mg/ day for females and 15 mg/day for males. The additional iron requirements for adolescent females include the other calculation for the amount of iron lost in menses beyond the growth requirements. Figure 2 showed that the noodles in the Senior high school's snack have the highest average completion, around 9,78% in the male group. However, the contribution of iron by school snacks is still far from the standard, which is 15 mg/day for males and 26 mg/day for females.

The noodle sample has various components compared to fried chicken and fried tempe, which contribute to the iron content in the noodle sample.

CONCLUSION

The school level may contribute to the snack portions and snack types in the school canteen because it relates to pocket money and the length of school time. However, the percentage of iron contribution from school snacks provided by the school's canteen to the Nutritional Adequacy Rate is still far from standard, with 1.127% for fried chicken, 1.542% for fried tempe, and 5.270% for noodles. The highest completion of iron was by noodles in Senior High school for a male student group, which the highest contribution is reaching 17.854%.

REFERENCES

1. WHO. Anaemia Policy Brief. 2012;(6):1–7. Available from: http://www.who.int//iris/bitstream/10665/148556/1/WHO_NMH_NHD_14.4_eng.pdf
2. Seyoum Y, Humblot C, Nicolas G, Thomas M, Baye K. Iron deficiency and anemia in adolescent girls consuming predominantly plant-based diets in rural Ethiopia. Sci Rep. 2019 Dec 1;9(1).
3. WHO. Country Prevalence of anemia in children aged 6 – 59 months (%). 2018;80.
4. Kementerian Kesehatan Republik Indonesia. Laporan Nasional Riset Kesehatan Dasar. Kementeri Kesehat RI. 2018;1–582.
5. Cia A, Nur Annisa S, F. Lion H. Asupan Zat Besi dan Prevalensi Anemia pada Remaja Usia 16-18 Tahun. J Kesehat. 2021;04(02):144–50.
6. Aztriani Y. Kontribusi Bekal Makanan Terhadap Kecukupan Gizi dan Dihubungkan dengan Status Gizi Anak di SD Negeri No. 060890 Kecamatan Medan Polonia. 2020;(060890).
7. Emilia E, Juliarti, Akmal N. Analisis Konsumsi Makanan Jajanan Terhadap Pemenuhan Gizi Remaja (Analysis of Snacks consumption against the teenager fulfillment of Nutritional). J Nutr

Culin. 2020;1(1).
8. Wiraningrum EA, Pudjirahaju A, Setyobudi SI. Pangan Jajanan Anak Sekolah (PJAS), Kecukupan Energi Dan Zat Gizi Anak Sekolah Dasar. J. Inform. Kes. Ind. 2012. p. 25–33.
9. Masthalina H. Pola konsumsi (faktor inhibitor dan enhancer fe) terhadap status anemia remaja putri. J Kesehat Masy. 2015;11(1):80.
10. Krismaputri ME, Hontono A, Pramono YB. Kadar vitamin a, zat besi (fe) dan tingkat kesukaan nugget ayam yang disubstitusi dengan hati ayam broiler. Animal Agri J.. 2013;2(024):7474750.
11. Hess JM, Jonnalagadda SS, Slavin JL. What is a snack, why do we snack, and how can we choose better snacks? A review of the definitions of snacking, motivations to snack, contributions to dietary intake, and recommendations for improvement. Adv Nutr. 2016;7(3):466–75.
12. Skoczek-Rubińska A, Bajerska J. The consumption of energy-dense snacks and some contextual factors of snacking may contribute to higher energy intake and body weight in adults. Nutr Res. 2021;96:20–36.
13. de Graaf C. Effects of snacks on energy intake: An evolutionary perspective. Appetite. 2006;47(1):18–23.
14. Abalkhail B, Shawky S. Prevalence of daily breakfast intake, iron deficiency anemia and awareness of being anemic among Saudi school students. International Journal of Food Sciences and Nutrition. 2002(53). p. 519–28.
15. Permatasari P, Priliantini A, Anjani SR. The study analyzes iron deficiency anemia for female students of state senior high schools. Malaysian Journal of Public Health Medicine. 2021(21).
16. Nyakundi P. Categorization of Food Groups According to Their Composition of Iron, Ascorbate and Calcium: Analysis of the Kenya Food Composition Tables 2018. Int J Res Sci Innov | [Internet]. 2020;VII(July). Available from: www.rsisinternational.org
17. Hurrell R, Egli I. Iron bioavailability and dietary reference values. Am J Clin Nutr [Internet]. 2010 May 1 [cited 2022 Oct 23];91(5). Available from: https://pubmed.ncbi.nlm.nih.gov/20200263/
18. Dainty JR, Berry R, Lynch SR, Harvey LJ, Fairweather-Tait SJ. Estimation of dietary iron bioavailability from food iron intake and iron status. PLoS One [Internet]. 2014 Oct 30 [cited 2022 Oct 23];9(10):e111824. Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0111824
19. Zijp IM, Korver O, Tijburg LBM. Effect of tea and other dietary factors on iron absorption. Crit Rev Food Sci Nutr [Internet]. 2000 [cited 2022 Oct 23];40(5):371–98. Available from: https://pubmed.ncbi.nlm.nih.gov/11029010/
20. Fan FS. Iron deficiency anemia due to excessive green tea drinking. Clin Case Reports [Internet]. 2016 Nov [cited 2022 Oct 23];4(11):1053. Available from: /pmc/articles/PMC5093162/
21. DeLoughery TG. Iron Deficiency Anemia. Med Clin North Am. 2017 Mar 1;101(2):319–32.
22. Lombardi-Boccia G, Martinez-Dominguez B, Aguzzi A. Total

heme and non-heme iron in raw and cooked meats. J Food Sci. 2002;67(5):1738–41.
23. Astawan M, Wresdiyati T, Widowati S, Bintar siti harnina, Ichsani N. Karakteristik fisikokimia dan sifat fungsional tempe yang dihasilkan dari berbagai varietas kedelai. J Pangan. 2013;22(3):241–52.
24. Ahnan-Winarno AD, Cordeiro L, Winarno FG, Gibbons J, Xiao H. Tempeh: A semicentennial review on its health benefits, fermentation, safety, processing, sustainability, and affordability. Compr Rev Food Sci Food Saf. 2021;20(2):1717–67.
25. Rachmadewi A, Soekarjo D, Maehara M, Alwi B, Mulati E, Rah JH. School Canteens in Selected Areas in Indonesia: A Situation Analysis. Food Nutr Bull. 2021;42(2):225–46.
26. Li M, Xue H, Jia P, Zhao Y, Wang Z, Xu F, et al. Pocket money, eating behaviors, and weight status among Chinese children: The Childhood Obesity Study in China mega-cities. Prev Med (Baltim) [Internet]. 2017;100(April):208–15. Available from: http://dx.doi.org/10.1016/j.ypmed.2017.04.031

DOI: https://doi.org/10.21776/ub.ijhn.2022.009.02.4