Available online (in Bahasa): https://journal.ipb.ac.id/index.php/jgizidietetik *J. Gizi Dietetik, Juni, 2024, 3(2):91-99*
E-ISSN 2830-0890 *DOI: doi.org/10.25182/jigd.2024.3.2.91-99*

Contribution of Wheat Flour to Fe, Zn, and Vitamin B9 Based on 2014 Indonesian Food Consumption Survey (SKMI) Data

Drajat Martianto[1,2], Atmarita[2], Nina Sardjunani[2], Roza Kartika[2]*, Elmira Fairuz Khilda Machfud[2]

[1]Department of Community Nutrition, Faculty of Human Ecology, IPB University, Bogor 16680, Indonesia

[2]Indonesian Nutrition Foundation for Food Fortification, Jakarta Selatan 12510, Indonesia

ABSTRACT

The mandatory wheat flour fortification program in Indonesia aims to reduce the prevalence of iron deficiency anemia (IDA). However, the effectiveness of this program is rarely evaluated. This study analyses the contribution of consumption of wheat flour and processed food to intake of Fe, Zn, and vitamin B9 (folate) using data from the 2014 Indonesian Food Consumption Survey (SKMI). The study used a cross-sectional research design and included a large sample of 145,360 individuals. The results clearly show that the average wheat flour consumption of the Indonesian population is below the recommended consumption level of 75 g/cap/day for a successful food fortification program, with an average of only 43.17±72.78 g/cap/day. In particular, only- a small portion of the Indonesian population, ranging from 10-30%, consumes wheat flour above the recommended level. Consumption of wheat flour of 75 g or more per capita per day contributes to the Recommended Daily Allowance (RDA) for iron, zinc, and folate intake, providing 20.35±11.96% of the RDA for iron, 57.52±32.73% of the RDA for zinc, and 12.01±6.45% of the RDA for folate. Regular monitoring of wheat flour consumption is needed to assess the impact of flour fortification in reducing micronutrient deficiencies in Indonesia. The Indonesian Food Consumption Survey (SKMI) needs to be conducted now and periodically in the future to continue to monitor the developments in wheat flour consumption and its contribution in overcoming the IDA problem, as a basis for improving policies to address the problem of Iron Deficiency Anemia (IDA) in Indonesia.

Keywords: anemia, fortification, micronutrient, wheat flour

INTRODUCTION

Micronutrient deficiency, also known as hidden hunger, is still a health problem in Indonesia. Hidden hunger is a condition of micronutrient deficiency that does not show signs of hunger but has an impact on the quality of human resources (Khomsan *et al.*, 2023). Hidden hunger problems in Indonesia include iron deficiency anemia (IDA), zinc deficiency, and folic acid deficiency. Even Riskesdas (2018) revealed that the prevalence of IDA is still relatively high. The prevalence of IDA in Indonesia is 23.7%, even higher in adolescents at 32%, and pregnant women at 48.9% (MoH 2019).

Micronutrients are very important for increasing work productivity, intelligence, and immunity. Micronutrient deficiencies can affect the quality of human resources. In the short term, IDA can cause delays in physical growth and reproductive maturity. Meanwhile, in the long term, iron deficiency can increase risks for mothers and babies during pregnancy, such as low birth weight (LBW), miscarriage, bleeding during childbirth, and even death of mother and baby (MoH 2014). Indonesia has experienced losses of more than 50 trillion rupiah due to reduced labor productivity caused by IDA, not including health service costs due to severe micronutrient deficiencies (Martianto 2022). In addition, zinc and

folic acid deficiencies are significantly associated with impaired child growth and development (Mrimi *et al.*, 2022). Thus, in the long run, micronutrient deficiencies can hinder the achievement of a *Indonesia Emas* (Golden Indonesia) 2045, which is characterized by superior human resources.

Food fortification is one strategy that can be used to overcome micronutrient problems. A review by Olson et al. (2021) found that food fortification was proven to be effective and was the most cost-effective method, at a cost of USD 66 per disability-adjusted life years (DALYs). The health benefit-cost ratio of food fortification is estimated at USD 17 for every USD 1 invested (Spohrer et al. 2013). The Indonesian government has implemented mandatory fortification of wheat flour as an alternative solution to overcome micronutrient problems in Indonesia, particularly to overcome the problem of iron deficiency anemia (IDA) and several other micronutrients such as zinc and several B vitamins.

Mandatory wheat flour fortification in Indonesia has existed for two decades since 1998. In addition, to increase the effectiveness of wheat flour fortification, the government has several times adjusted the standards for adding micronutrients. In SNI number 3751:2018, the government changes the type of iron fortification from iron to ferrous sulfate, ferrous fumarate, or sodium ferri-EDTA to increase effectiveness (BSN 2018).

Mandatory fortification of wheat flour has been in place for almost two decades, and fortification standards have been adjusted accordingly. However, research regarding the effectiveness of mandatory fortification of wheat flour at the national level, based on economic strata (income quintiles), age groups, and rural-urban areas is still needed. SKMI 2014 data is complete and up-to-date food consumption data to answer these questions. Therefore, this study analyzes the contribution of consumption of wheat flour and processed food to intake of Fe, Zn, and vitamin B9 using SKMI 2014 data.

METHODS

Design, place, and time

This study is a non-experimental study with a cross-sectional research design. The data collection was conducted by the Ministry of Health of the Republic of Indonesia (Kemenkes RI) in 2014 in 33 provinces in Indonesia, which received ethical approval from the Ethics Committee of the National Institute of Health (Balitbangkes) number LB.02.015/5.2/KE.006/2013. The data analysis for this paper was conducted in Jakarta in January 2024.

Type and Method of Data Collection

The data used in this study is secondary, namely data from the 2014 Indonesian Food Consumption Survey (SKMI) from the Indonesian Ministry of Health. Data collection was carried out by trained nutritionists throughout Indonesia using the 1x24-hour recall method with a sample coverage

of 145,360 subjects. The analysis process is weighted to see the representation of the actual population conditions. The distribution of subjects by age group and gender is shown below (Table 1).

Table 1. Number of subjects by group

Group	Number of subjects according to SKMI 2014			Proportion of subjects after weighting (%)		
	Male	Female	Total	Male	Female	Total
Toddlers (0-5 years old)	4989	4558	9547	5,2	4,8	5,0
Children (6-12 years old)	9756	8818	18574	9,6	9,2	9,4
Adolescents (13-18 years old)	9164	9004	18168	12,1	11,6	11,9
Adults (19-49 years old)	30885	36103	66988	50,8	51,9	51,3
Adults (50-60 years old)	9265	9471	18736	14,7	13,6	14,1
Elderly (>60 years old)	6438	6909	13347	7,7	8,9	8,3
Pregnant women*	0	521	521	0	0,4	0,4
Total	70497	74863	145360	100,0	100,0	100,0

Notes: *The pregnant women group is part of the adolescent and adult age groups who were pregnant at the time of data collection.

Data Processing and Analysis

Prevalence of micronutrient deficiency. EAR (Estimated Average Requirement) cut-off points were used to estimate the prevalence of micronutrient deficiencies in the population.

Wheat flour consumption. The individual food consumption analyzed in this study is the consumption of wheat flour and its processed products. . Wheat flour consumption is calculated by multiplying the total consumption of wheat flour and processed flour by a conversion factor. The data is then analyzed based on age group, income quintile, and area of residence. The conversion factor used in this study refers to the wheat flour conversion factor used in Hardinsyah and Amalia's (2007) research, as seen in Table 2. This conversion factor was carried by considering the composition of wheat flour against the composition of processed wheat food.

Table 2. Wheat flour conversion factor

Processed Food	Conversion factor
Wheat Flour	1,00
Wet Noodles	0,33
Instant Noodles	0,92
Macaroni	0,92
Unsalted Bread	0,68
Sweet Bread	0,68
Biscuit	1,00
Wet Cookies	0,47
Fried Food	0,25
Meatball Noodles	0,33
Kids snacks	0,92

Source: Hardinsyah and Amalia (2007)

Micronutrient intake. The micronutrient intake analyzed in this study consisted of the micronutrients listed in the SNI of wheat flour and those listed in the Indonesian Table of Food Composition (TKPI), which consisted of Fe, Zn, and folate intake. Micronutrient intake was obtained

by comparing the TKPI nutrient content per 100 g with the raw weight of the food consumed. The TKPI used is the 2017 TKPI (Ministry of Health 2018), which was enriched with various sources from the Malaysian Food Composition Database (MyFCD), Australian Food Composition Database, and folic acid content tables from SEAMEO RECFON.

RESULTS AND DISCUSSION

Proportion of dietary inadequacy. Analysis of micronutrient insufficieny using the EAR cut-off points shows that the proportion of inadequate intakes of Fe, Zn, and folic acid is still relatively high. The proportions of insufficient intake of Fe, Zn, and folic acid was 41.6%, 64.3%, and 98.2%, respectively. The highest proportion of Fe deficiency was found in pregnant women (89.3%), , followed by adolescents (56.6%) and adults aged 19-49 years (50.4%). Meanwhile, the highest proportion of Zn deficiency was found in the elderly group (77.8%), followed by the pregnant women (72.8%), and the proportion of folate deficiency was above 95% in all subject groups. This shows the need to evaluate and improve the effectiveness of micronutrient deficiency prevention programs in Indonesia.

Table 3. The proportion of inadequate intake of Fe, Zn, and folic acid using EAR cut-points

Group	Proportion of inadequate nutrition (%)		
	Fe	Zn	Vitamin B9
Toddlers (0-5 years old)	42,0	28,6	95,9
Children (6-12 years old)	28,7	46,9	98,3
Adolescents (13-18 years old)	56,6	70,5	99,0
Adults (19-49 years old)	50,4	67,8	98,2
Adults (50-60 years old)	19,1	71,8	98,1
Elderly (>60 years old)	26,5	77,8	98,6
Pregnant women	89,3	72,8	99,6
Total	41,6	64,3	98,2

Wheat four consumption. Wheat flour consumption in Indonesia is around 43.17±72.78 g/cap/day. This figure is still far from the minimum limit for wheat consumption which can provide an optimal fortification effect of 75 g/cap/day (WHO 2016).

Table 4. Average wheat flour consumption

Group	Average wheat flour consumption (g/day)
Toddlers (0-5 years old)	43,22±60,91
Children (6-12 years old)	64,72±84,20
Adolescents (13-18 years old)	61,65±90,69
Adults (19-49 years old)	40,78±71,81
Adults (50-60 years old)	27,53±54,13
Elderly (>60 years old)	21,89±45,29
Pregnant women	49,35±70,96
Total	43,17±72,78

According to the age group, the highest consumption of wheat flour was in the children's age group (6-12 years), namely 64.72±84.20 g/cap/day, followed by the adolescents' age group (13-18 years), was 61.65±90.69 g/cap/day. The average consumption of wheat flour for pregnant women was 49.35±70.96 g/cap/day. However, this consumption still did not reach the minimum limit for wheat flour consumption recommended by the WHO (75 g/cap/day). Meanwhile, the lowest consumption of wheat consumption flour was found in the older age group (>60 years), with an average consumption of 21.89±45.29 g/cap/day.

Table 4 also shows that the average data on wheat flour consumption is not normally distributed, with a standard deviation of 72.78. This is because not all subjects consumed wheat flour. Descriptive analysis showed that the median consumption of wheat flour for all subjects was 9.2 g/day. However, in some age groups (adults 19-49 years, adults 50-60 years, and the elderly), the median consumption of wheat flour was 0 g/day. This is because only 52.8% of the subjects consumed wheat flour, while the remaining 47.2% did not. In addition, the distribution of subjects who consumed wheat flour among adults aged 19-49 years, adults aged 50-60 years, and the elderly was 49.9%, 43.5%, and 40.5%, respectively.

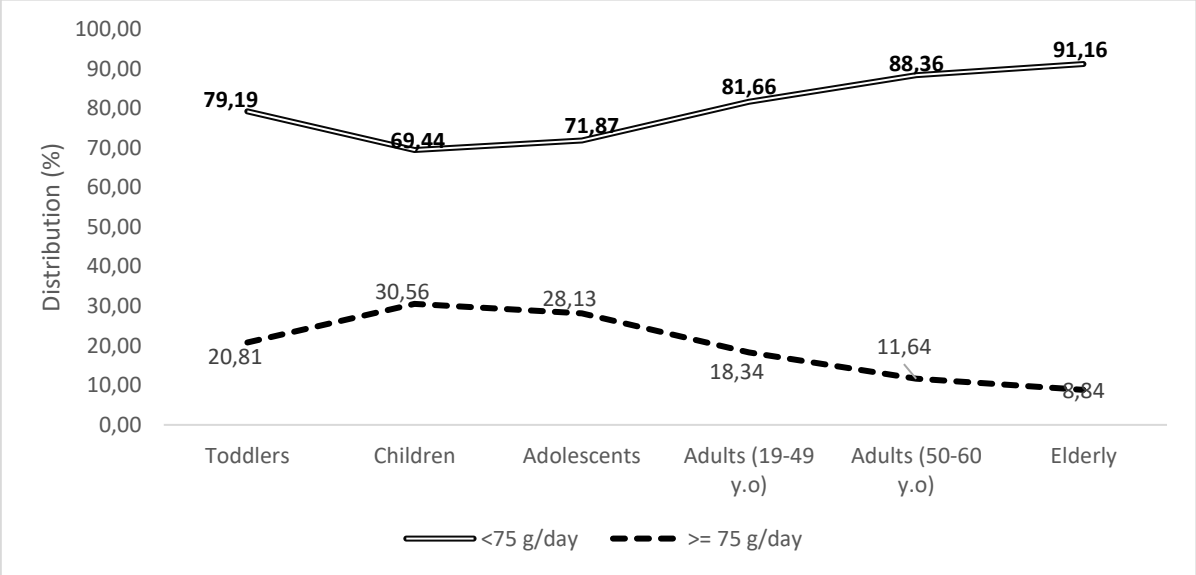

Figure 1. Distribution of wheat flour consumption by age group

The majority of Indonesian people still consume less than 75 g/cap/day (70-90%) of wheat flour, and only 10-30% consume more than 75 g/cap/day. Based on age group, 91.16% of the elderly (>60 years) consumed less than 75 g/cap/day of wheat flour. Meanwhile, the children's age group (6-12 years) has the highest proportion of wheat flour consumption, namely more than 75 g/cap/day (30.56%).

Based on income quintiles, average consumption of wheat flour increases with increasing income class. The highest average wheat flour consumption was in income quintile 5 (52.43±77.86 g/cap/day), and the lowest average wheat flour consumption was in income quintile 1 (26.51±60.27 g/cap/day).

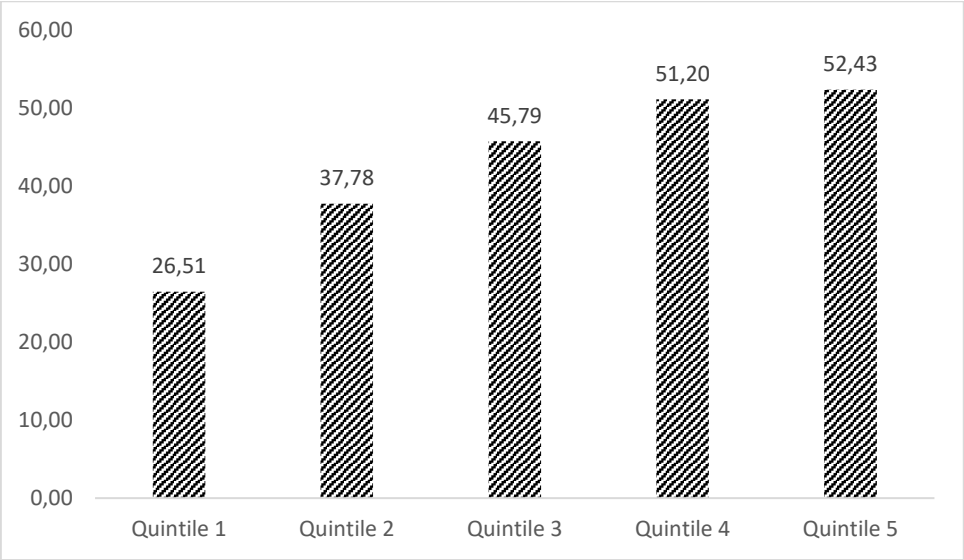

Figure 2. Average wheat flour consumption (g/cap/day) by income quintile

The distribution of wheat flour consumption of less than 75 g/cap/day is also still high across all income classes. Analysis of the distribution of wheat flour consumption also shows that the percentage of wheat flour consumption of less than 75 g/cap/day also increases with increasing income class, with percentages ranging from 76.13 to 88.38%.

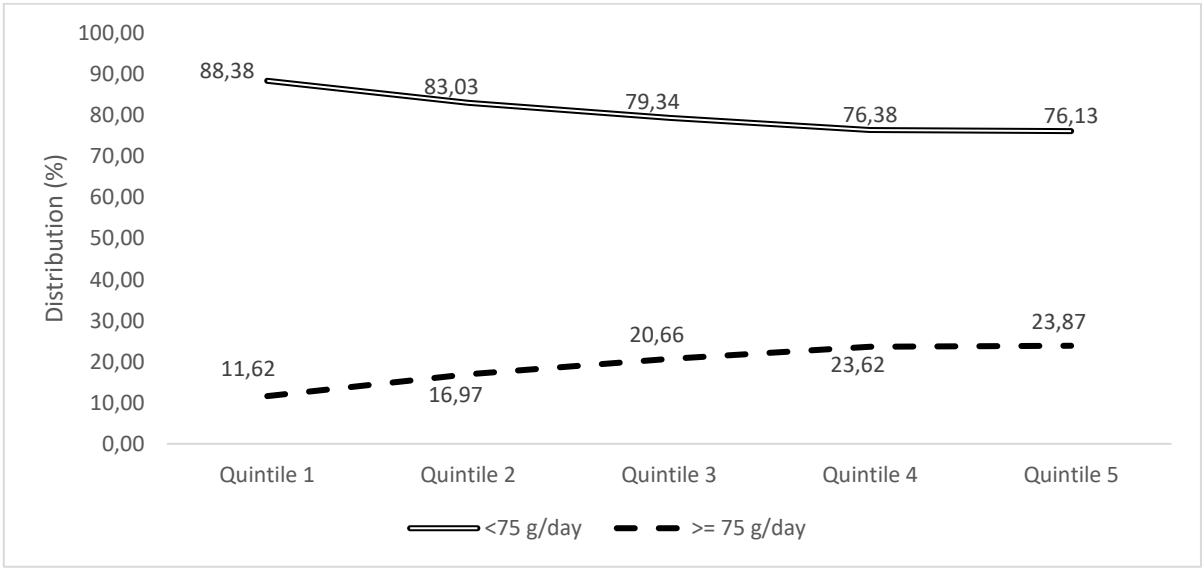

Figure 3. Distribution of wheat flour consumption by income quintile

Based on place of residence, the average consumption of wheat flour is higher in urban areas (52.20±77.60 g/cap/day) than in rural areas (35.73±67.66 g/cap/day). The distribution of wheat flour consumption of less than 75 g/cap/day is still high in urban (76.10%) and rural areas (84.03%).

Table 5. Average wheat flour consumption by place of residence

Place of residence	Average wheat flour consumption (g/day)
Urban	52,20±77,60
Rural	35,73±67,66
Urban+Rural	43,17±72,78

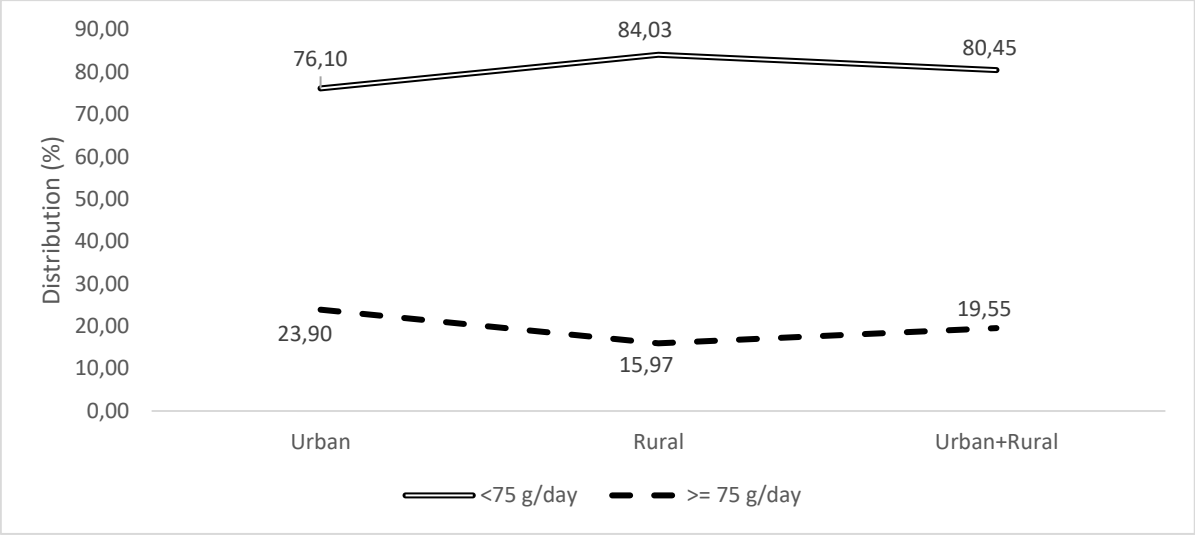

Figure 4. Distribution of flour consumption by areas

Although the analysis shows that wheat flour consumption remains low in all age groups, pregnant women, income groups, or place of residence, the potential effectiveness of wheat flour fortification is expected to be higher in the future. This is supported by the position of wheat flour, which is currently the second staple food after rice in the Indonesian people's diet.. Furthermore, the results of data analysis from the 2016-2021 National Socio-Economic Survey (SUSENAS) also show an increase in wheat flour consumption from 37.81 g/cap/day in 2016 to 46.30 g/cap/day in 2021. In addition, there has been an increase in the ratio of wheat to rice consumption from 13.9% in 2016 to 17.9% in 2021 (Martianto 2022). This has the potential to increase the effectiveness of wheat flour fortification in the future. In addition, food fortification efforts for other potential carriers can also be considered to overcome this gap in low wheat flour consumption (WHO 2021).

Iron intake from wheat flour consumption. The mean Fe intake from wheat flour consumption in subjects who consumed less than 75 g/day ranged from 0.17 ± 0.26 mg/cap/day. Meanwhile, the mean Fe intake from consuming wheat flour in subjects who consumed ≥75 g/day of wheat flour ranged from 2.16±1.06 mg/cap/day. This Fe intake contributed 1.66±3.03% to the RDA in subjects

consumed <75 g/day of wheat flour and 20.35±11.96% to the RDA in subjects who consumed ≥75 g/day wheat flour.

Table 6. Average Fe intake from wheat flour consumption and contribution to the RDA

Group	Average Fe intake (mg/day)		Contribution to RDA (%)	
	Wheat flour consumption <75g/day	Wheat flour consumption ≥75g/day	Wheat flour consumption <75g/day	Wheat flour consumption ≥75g/day
Toddlers (0-5 years old)	0,22±0,28	1,85±0,79	2,81±6,61	20,34±11,82
Children (6-12 years old)	0,25±0,29	2,19±1,05	2,83±3,34	24,74±12,41
Adolescents (13-18 years old)	0,19±0,27	2,35±1,18	1,51±2,18	18,74±10,33
Adults (19-49 years old)	0,16±0,26	2,18±1,06	1,26±2,20	18,41±12,14
Adults (50-60 years old)	0,14±0,24	1,98±0,92	1,72±2,89	23,17±10,71
Elderly (>60 years old)	0,14±0,24	1,81±0,88	1,61±2,80	21,27±10,06
Pregnant women	0,23±0,29	2,00±0,97	0,84±1,10	7,47±3,67
Total	0,17±0,26	2,16±1,06	1,66±3,03	20,35±11,96

Based on age group, consumption of wheat flour ≥75 g/cap/day can contribute 20.34 ± 11.82% of the RDA in the under-five age group (0-5 years) and 24.74 ± 12.41% of the RDA in the child age group (6-12 years). In the adolescent, adult, and elderly age groups, consumption of wheat flour ≥75 g/cap/day contributes 18-24% to the RDA. Meanwhile, consumption of wheat flour ≥75 g/cap/day contributed 7.47±3.67% to the RDA in the group of pregnant women. Consumption of wheat flour <75 g/cap/day only contributes 1-3% of the RDA to Fe intake. Meanwhile, compared to total Fe intake, wheat flour consumption <75 g/cap/day contributed 1.2-2.5% of total daily Fe intake. In addition, consumption of wheat flour ≥75 g/cap/day contributes 14-20% of the total daily Fe intake .

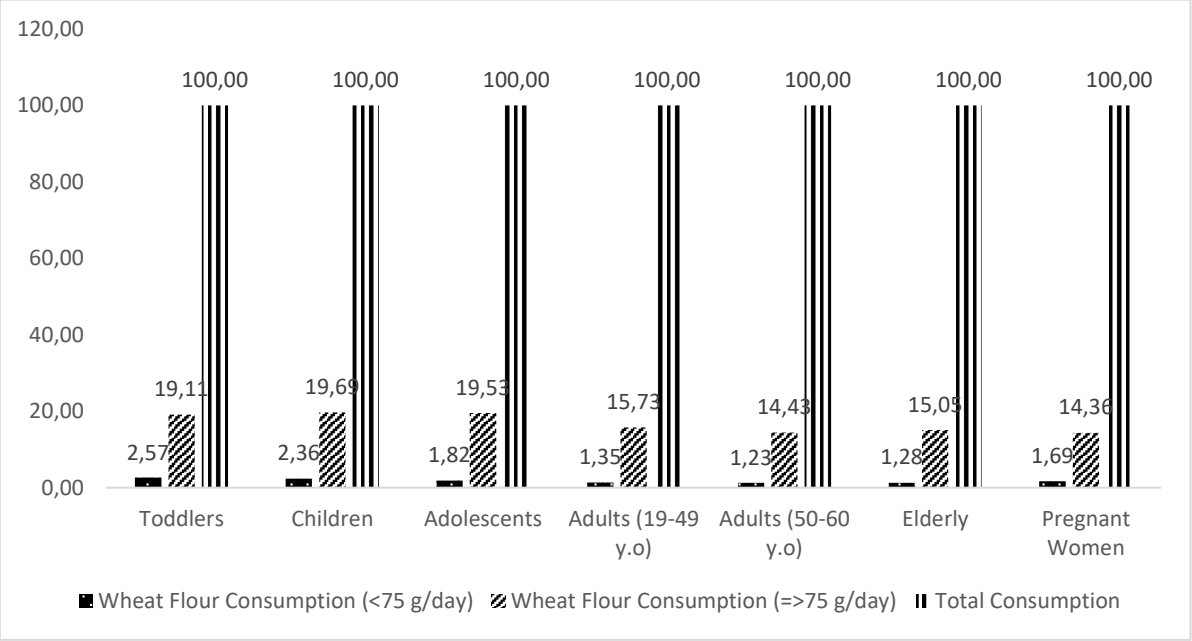

Figure 4. Contribution of Fe intake from wheat flour to total Fe intake (%)

Zn intake from wheat flour consumption. The mean Zn intake from wheat flour consumption in subjects consuming <75 g/day ranged from 0.37 ± 0.57 mg/cap/day. Meanwhile, the mean Zn intake from wheat flour consumption in subjects who consumed wheat flour ≥75 g/day ranged from 4.65±2.28 mg/cap/day. This Zn intake contributed 4.78±8.02% of the RDA in subjects who consumed less than 75 g/day of wheat flour and 57.52±32.73% of the RDA in subjects who consumed more than 75 g/day of wheat flour.

Table 7. Average Zn intake from wheat flour consumption and contribution to the RDA

Group	Average Zn intake (mg/day)		Contribution to RDA (%)	
	Wheat consumption <75g/day	Wheat consumption ≥75g/day	Wheat consumption <75g/day	Wheat consumption ≥75g/day
Toddlers (0-5 years old)	0,48±0,61	3,98±1,71	12,25±16,04	91,01±39,59
Children (6-12 years old)	0,53±0,62	4,72±2,26	8,3±10,23	76,22±40,38
Adolescents (13-18 years old)	0,42±0,59	5,07±2,54	4,25±6,06	50,80±25,37
Adults (19-49 years old)	0,35±0,55	4,69±2,30	3,81±6,18	50,02±24,76
Adults (50-60 years old)	0,31±0,52	4,26±1,98	3,41±5,82	45,14±21,62
Elderly (>60 years old)	0,29±0,51	3,92±1,89	3,20±5,63	41,23±19,69
Pregnant women	0,35±0,55	4,83±2,40	4,04±5,27	35,73±17,18
Total	0,37±0,57	4,65±2,28	4,78±8,02	57,52±32,73

Based on By group, consumption of wheat flour ≥75 g/cap/day can contribute to Zn intake of 91.01±39.59% of the RDA in the under-five age group (0-5 years) and 76.22±40.38% of the RDA in the child's age group (6-12 years). In the adolescent, adult, and elderly age groups, consumption of wheat flour ≥75 g/cap/day contributes to Zn intake of 40-60% of the RDA and in pregnant women the Zn intake of 35.73±17.18% of the RDA. Wheat flour consumption <75 g/cap/day only contributes 3-5% of the RDA of Zn intake. Meanwhile, when compared with the total Zn intake in a day, consumption of wheat flour <75 g/cap/day contributes to 7-13% of the total Zn intake in a day. In addition, consumption of wheat flour ≥75 g/cap/day contributes 50-61% of the total daily Zn intake.

J. Gizi Dietetik, Juni, 2024, 3(2):91-99
DOI: doi.org/10.25182/jigd.2024.3.2.91-99

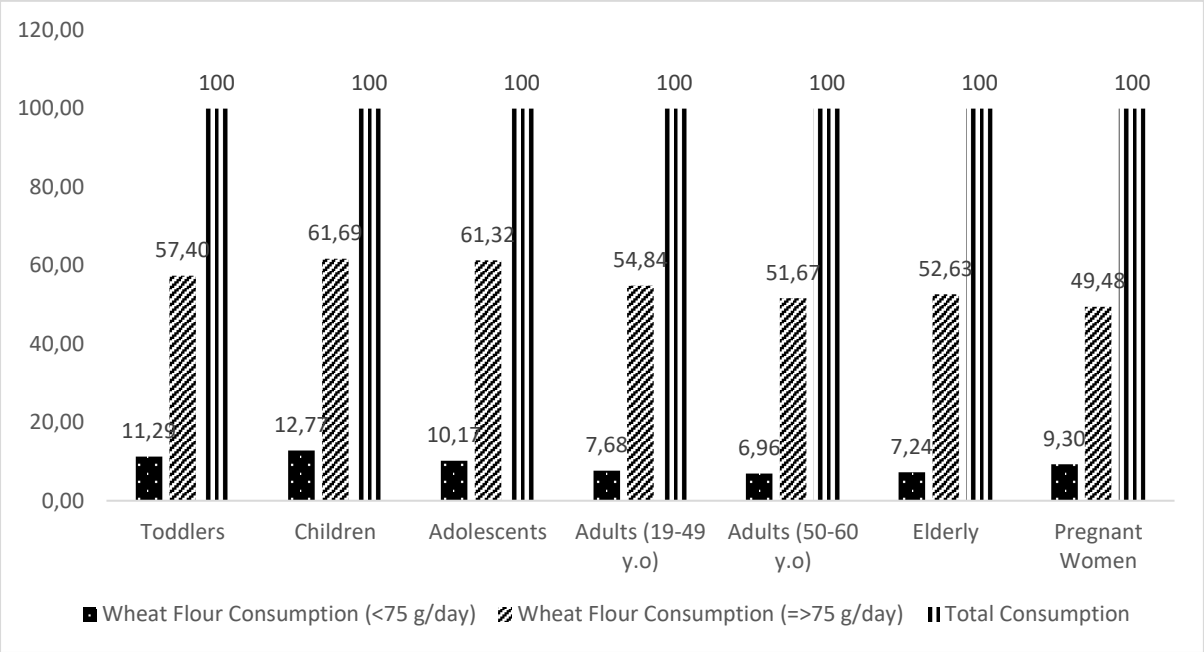

Figure 5. Contribution of Zn intake from wheat flour to total Zn intake (%)

Folic acid intake from wheat flour consumption. The mean folic acid intake from wheat flour consumption in subjects who consumed less than 75 g/day ranged from 3.71 ± 20.24 mcg/cap/day. Meanwhile, the mean intake of folic acid from wheat flour consumption in subjects who consumed ≥75 g/day was about 43.16±21.23 mcg/cap/day. This folic acid intake contributed 0.98±1.63% to the RDA in subjects who consumed less than 75 g/day of wheat flour and 12.01±6.45% in subjects who consumed ≥75 g/day of wheat flour.

Table 8. Average folic acid intake from wheat flour consumption and contribution to the RDA

Group	Average folic acid intake (mcg/day)		Contribution to RDA (%)	
	Wheat consumption <75g/day	Wheat consumption ≥75g/day	Wheat consumption <75g/day	Wheat consumption ≥75g/day
Toddlers (0-5 years old)	4,49±5,63	36,92±15,84	2,58±3,29	19,50±8,08
Children (6-12 years old)	4,93±5,79	43,84±21,01	1,50±1,87	13,53±7,18
Adolescents (13-18 years old)	3,88±5,50	47,07±23,62	0,97±1,37	11,76±5,91
Adults (19-49 years old)	3,21±5,13	43,52±21,38	0,80±1,27	10,85±5,35
Adults (50-60 years old)	2,90±4,87	39,52±18,36	0,72±1,22	9,88±4,59
Elderly (>60 years old)	2,72±4,71	36,37±17,55	0,68±1,18	9,09±4,39
Pregnant women	4,51±5,89	40,03±19,34	0,75±0,98	6,67±3,22
Total	3,71±20,24	43,16±21,23	0,98±1,63	12,01±6,45

Based on age group, consumption of wheat flour ≥75 g/cap/day can contribute to folic acid intake of 2.58 ± 3.29% of the RDA in the infant age group (0-5 years) and 1.50 ± 1.87% of the RDA in the child age group (6-12 years). In the adolescent, adult, and elderly age groups, consumption of wheat

flour ≥75 g/cap/day contributes to folic acid intakes ranging from 9-14% of the RDA. Wheat flour consumption <75 g/cap/day only contributes 0.5-3% to the RDA. Meanwhile, when compared with the total intake of folic acid in a day, consumption of wheat flour <75 g/cap/day only contributes to 3.5-10% of the total intake of folic acid in a day. On the other hand, consumption of wheat flour ≥75 g/cap/day contributes 30-50% of the total daily folic acid intake.

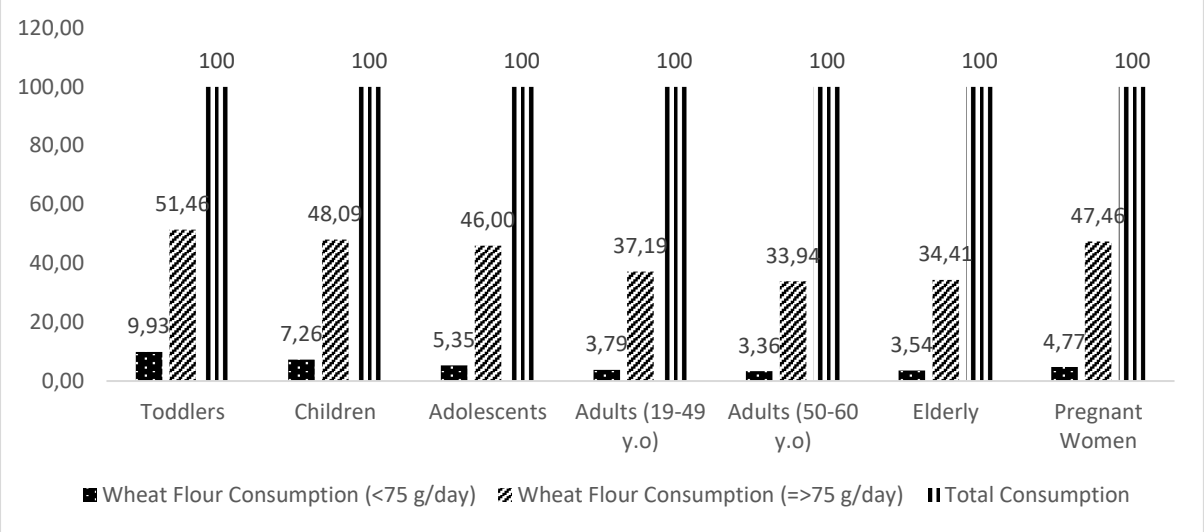

Figure 6. Contribution of folic acid intake from wheat flour to total folic acid intake (%)

The intake analysis above shows that the intake of Fe, Zn, and folate from wheat flour is still low. Based on the WHO wheat flour fortification guidelines (2021), routine monitoring of wheat flour consumption at the household or individual level is necessary to increase the effectiveness of fortification in the future. This is to ensure the coverage and health benefits of fortified wheat flour as well as the nutritional intake from fortified wheat flour is as expected. Indicators that need to be considered when monitoring fortified wheat flour consumption include coverage of fortified wheat flour, micronutrient content of fortified wheat flour, and micronutrient intake from fortified wheat flour (WHO 2021). This Wheat Flour Fortification Program Monitoring Guide can be a reference for the government in developing and implementing routine consumption monitoring for the fortification program and improving mandatory food fortification policies.

CONCLUSIONS

Wheat flour fortification will be optimal if the WHO-recommended cut-off for wheat flour consumption (75 g/cap/day) is reached. Although Indonesia has implemented mandatory wheat flour fortification, wheat flour consumption in Indonesia in 2014 was still low across all age groups, pregnant women, income quintiles, and areas of residence. In addition, intake of Fe, Zn, and folate from wheat

flour is still low in all age groups, and pregnant women are vulnerable to micronutrient deficiencies. Therefore, regular monitoring of consumption of fortified wheat flour is necessary to assess the impact of wheat flour fortification in reducing micronutrient deficiencies in Indonesia. The Indonesian Food Consumption Survey (SKMI) needs to be conducted now and periodically at least every 5 years to continue monitoring developments in wheat flour consumption and its contribution to preventing IDA as well as improving mandatory food fortification policies.

ACKNOWLEDGMENTS

Thanks to the Research and Development Agency of the Indonesian Ministry of Health for permission to use the 2014 SKMI data, and to the Bill and Melinda Gates Foundation for supporting this study of micronutrient intake from fortified foods in Indonesia from multiple data sources.

CONFLICT OF INTEREST

The authors had no conflicts of interest in the preparation of this article.

REFERENCE

[BSN] Badan Standardisasi Nasional. 2018. Standar Nasional Indonesia 3751:2018 Tepung Terigu sebagai Bahan Makanan.

Hardinsyah, Amalia L. 2007. Perkembangan konsumsi terigu dan pangan olahannya di Indonesia 1993-2005. Jurnal Gizi dan Pangan. 2(1):8-15. https://doi.org/10.25182/jgp.2007.2.1.8-15

Khomsan A, Briawan D, Oklita D, Khuzaimah U. 2023. Hidden Hunger: Kekurangan Gizi Mikro. Bogor (ID): IPB Press.

Martianto D. 2022. Fortifikasi Pangan untuk Pencegahan Kelaparan Tersembunyi dan Peningkatan Kualitas SDM Indonesia. Bogor (ID): IPB Press.

[MoH] Ministry of Health. 2014. Peraturan Menteri Kesehatan Republik Indonesia Nomor 41 Tahun 2014 tentang Pedoman Gizi Seimbang. Jakarta: Kementerian Kesehatan Republik Indonesia.

[MoH] Ministry of Health. 2019. Laporan Akhir Risest Kesehatan Dasar 2018. Jakarta: Kemenkes RI.

[MoH] Ministry of Health. 2018. Tabel Komposisi Pangan Indonesia 2017. Jakarta: Direktorat Jenderal Kesehatan Masyarakat, Direktorat Gizi Masyarakat.Mrimi EC, Palmeirim MS, Minja EG, Long KZ, Keiser J. 2022. Malnutrition, anaemia, micronutrient deficiency and parasitic infections among schoolchildren in rural Tanzania. PLoS Negl Trop Dis. 16(3): e0010261. https://doi.org/10.1371/journal.pntd.0010261

Olson R, Gavin-Smith B, Ferraboschi C, Kraemer K. 2021. Food fortification: The advantages, disadvantages and lessons from sight and life programs. Nutrients. Volume 13. https://doi.org/10.3390/nu13041118

Spohrer R. Larson M, Maurin C, Laillou A, Capanzana M, Garrett GS. 2013. The growing importance of staple foods and condiments used as ingredients in the food industry and implications for large-scale food fortification programs in Southeast Asia. Food and Nutrition Bulletin. 34(2): 50-59. https://doi.org/10.1177/15648265130342S107

[WHO] World Health Organization. 2016. Guidelines on Food Fortification with micronutrients. France: WHO.

[WHO] World Health Organization. 2021. Monitoring Flour Fortification to Maximize Health Benefits: A Manual For Miller, Regulators, and Programme Managers. Geneva: WHO. License: CC BY-NC-SA 3.0 IGO.