IPB University Report “Indonesia Vegetable Intake Study”

Executive Summary （日本語版）

野菜摂取は栄養状態を改善し、健康な生活の為に重要である。しかしながら、インドネシアにおける野菜摂取の状況を最近の国レベルの代表的データを用いて解析した研究は少ない。そのような状況下、本研究の目的は以下の通りである。1）インドネシア人の野菜摂取量を定量的に把握する。2）野菜の種類ごとの消費量を解析する。3）地域ごとの野菜摂取量を把握する。4）年齢層ごとの野菜摂取量を把握する。5）インドネシアの 7 つの大都市での野菜消費量を把握する。6）インドネシア人の野菜摂取量が低いことの健康への影響を明らかにする。7）野菜摂取低下の要因を把握する。

本研究には主に以下のデータを使用した。Indonesia Basic Heath Research (RISKESDAS) 、Indonesia Food Consumption Survey (SKMI)、National Socio-Economic Survey (SUSENAS).

社会人口学的特性による野菜摂取量の違い、栄養不良の状態、非感染性疾患の発生率、低野菜摂取のインドネシア人の栄養状態、病気発生に影響をあたえる要因と深刻性を把握するために、文献調査および、データの二次解析を実施した。

全体としての野菜摂取量は過去 6 年間で低下傾向にあった。2020 年には野菜摂取量の平均は 143.2 g で推奨摂取量 （250 g）の 57%である。大多数のインドネシア人(66.5%)は一日にわずか 1-2 portion の野菜しか摂取しておらず（1 portion は 80 – 100g）推奨される一日当たり 5 portion 以上の摂取の 5%以下である。ケール沼キャベツ、ほうれん草、タマネギ、キャッサバの葉，ナス、トマト／チェリートマト、キュウリ、Long bean （ササゲ）Cayene pepper（赤唐辛子)、ニンニクがインドネシアにおける消費量上位 10 種の野菜である。2017 年―2020 年において、都市部の野菜摂取量は農村部の摂取量より低かった。大都市（ジャカルタ、ボゴール、デポック、タンゲラン、ベカシ、セマラン、スラバヤ）の野菜摂取量はインドネシア他地域より高く、市場へのアクセスが容易であること、e-commerce の普及が要因として考えられた。E-commerce を通しての野菜購入はは商品が家に直接届けられるので、（消費者にとって野菜購入が）より簡便となった。

野菜と果物の消費は年齢が上がると増加している。低野菜摂取は過体重、肥満、非感染性疾患のリスクを高めることと関係づけられる。さらに妊婦においては、貧血との関係がある。

野菜摂取が低いことの主な理由は、家庭に野菜が置かれていないことである。これは親が（積極的に）野菜摂取を考えていないこと、子供、思春期の若者に野菜嫌いが多いことによるものと考えられる。

野菜摂取を増加させるために、母親への栄養教育が必要である。学校においては、生徒たちに栄養教育を行い、健康な食習慣を身につけさせることも必要である。学校で生徒と学校の職員に栄養教育をおこなうことで、学校の食堂で健康な食事を提供できるようになる。寄宿舎学校では、栄養教育により、知識、態度を改善し、野菜をより好きになるようにすること

ができる。メニューの改善（調味料含む)、栄養教育により、生徒の野菜摂取量を向上させることができる。
職場においては様々な種類の野菜料理を提供し、より美味しい野菜料理を提供できることが重要である。長期的に野菜を摂取し、適切な栄養ある食事を提供するためには会社の経営層の支援が重要である。もっとも多く消費される 10 種の野菜は地域的な好みや、供給可能性が反映されている。インドネシアの食事ではニンニク、タマネギ、赤唐辛子、が広く使われるが、これらについて十分な供給がなされるようにするべきである。

EXECUTIVE SUMMARY

Vegetables are good for health since they enhance the overall nutritional profile. Despite this, there are just a few studies that use the most recent nationally representative data to provide a comprehensive overview of Indonesian vegetable consumption. The specific objectives of this research are to 1) quantify total vegetable consumption among Indonesian; 2) analyze vegetable consumption by commodities; 3) describe vegetable consumption by area; 4) describe vegetable consumption by age group; 5) describe vegetable consumption in 7 big cities in Indonesia; 6) investigate consequences of low vegetable consumption among Indonesian; and 7) explore determinants of low vegetable consumption.

Data from the Indonesia Basic Health Research (RISKESDAS), Indonesia Food Consumption Survey (SKMI), and National Socio-Economic Survey (SUSENAS) were mainly used in this study. A literature search and secondary data analysis were conducted to obtain information on vegetable consumption based on socio-demographic profiles; the prevalence of nutritional status; the prevalence of non-communicable disease; the determinant and impact of low vegetable consumption on nutritional status and disease among the Indonesian population.

The overall vegetable consumption of Indonesian tended to decline over the last six years. In 2020, the average vegetable consumption was 143.2 g or 57% of the recommended amount (250 g). The majority of Indonesian people (66.5%) only consumed 1-2 portions of vegetables per day (1 portion = 80-100 g), and only less than 5% consumed adequate amounts of vegetables (>5 portions per day). Kale/swamp cabbage, spinach, onion, cassava leaves, eggplant, tomato/cherry tomato, cucumber, long beans, cayenne pepper, and garlic are the top ten most consumed vegetables by Indonesians. Vegetable consumption in urban areas was lower than in rural areas in 2017-2020. DKI Jakarta, Bogor, Depok, Tangerang, Bekasi, Semarang, and Surabaya have greater average vegetable consumption than the rest of Indonesia due to high accessibility in markets and e-commerce. Purchasing vegetables through e-commerce offers simplicity since the goods are delivered directly to the home.

Consumption of fruits and vegetables increases with age. Low vegetable consumption relates to an increased risk of overweight, obesity, and non-communicable disease. Additionally, it has been linked to anemia in pregnant women. The primary reason for low vegetable consumption was a lack of vegetable availability at home. This is due to a lack of parental support and a lack of children and adolescents' preference for vegetables.

To increase vegetable consumption, mothers should be educated on nutrition. Schools can also promote healthy eating habits by educating students on nutrition. School canteen transition to healthier food can be improved with nutrition education for students and staff. Boarding school nutrition education enhances knowledge, attitude, and vegetable preference. Together with menu adjustment (including spice), nutrition education can successfully increase students' vegetable consumption.

Workplace vegetable dishes should be diversified, and the canteen cook should be able to prepare tasty vegetable meals. Higher management support is also required to ensure long-term availability and adequate intake of nutritious foods. The top ten most consumed vegetables reflect regional preferences and availability. Most Indonesian meals contain garlic, onion, and cayenne pepper. Consequently, the supply of these commodities should be maintained as production capacity grows steadily.

Vegetable consumption of Indonesian people

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INTRODUCTION

Background

Vegetables are good for health and also an important part of a healthy diet. Food components in the vegetables enhance the overall nutritional profile. Vegetables have a high water content, low energy content (and thus low energy density), and a high fiber content in addition to vitamins and polyphenols (Woodside, Young, and McKinley, 2013). According to the findings of a systematic review and meta-analysis, higher vegetable eating boosts micronutrient, carbohydrate, and fiber intakes while potentially lowering fat intake (Fulton et al., 2016).

It is advised that vegetables should be consumed in sufficient quantities on a daily basis. The World Health Organization recommends 400 grams of vegetables and fruits each day, which is divided into 250 grams of vegetables and 150 grams of fruits (FAO/WHO, 2003). The Indonesian Balanced Nutrition Guidelines advised three to four portions of vegetables per day, and two to three portions of fruits per day for adults (MOH, 2014).

Despite this, there are just a few studies that use the most recent nationally representative data to provide a comprehensive overview of Indonesian vegetable consumption. Previous studies using national surveys, namely National Socioeconomic Survey (SUSENAS) 1999-2005 and Individual Food Consumption Survey 2014, provided data on vegetable consumption of Indonesian people, but combined with fruits (Ariani, 2007; Hermina and Prihatini, 2016). The general objective of this study is to describe Indonesians' vegetable consumption by region and age group, as well as the drivers and consequences of poor vegetable consumption.

Specific Objectives

The specific objectives of this research are:

1. to quantify total vegetable consumption among Indonesian
2. to analyze vegetable consumption by commodities
3. to describe vegetable consumption by area
4. to describe vegetable consumption by age group
5. to describe vegetable consumption in 7 big cities in Indonesia
6. to investigate consequences of low vegetable consumption among Indonesian
7. to explore determinants of low vegetable consumption.

METHODS

Study Design

Data from the Indonesia Basic Health Research (RISKESDAS), Indonesia Food Consumption Survey (SKMI), and National Socio-Economic Survey (SUSENAS) were used in this study. SUSENAS is a series of large-scale multi-purpose socioeconomic surveys, including food consumption, which covers a nationally representative sample of households in Indonesia. The survey was typically conducted every March and September every year (Statistics Indonesia, 2021). RISKESDAS is periodic community-based research conducted to collect basic data and health indicators depicting the health condition at nationwide, province, and district/municipality levels. RISKESDAS was conducted every five years.

Indonesia Basic Health Research reported vegetable intake of household members aged >5 years old. Vegetable intake was assessed together with fruit intake. The intake was assessed based on frequency and portion of consumption by calculating the number of days of consumption in a week and average of portions per day using the STEPwise instrument from the World Health Organization (WHO). People were categorized as having an adequate intake of vegetables and fruit if they consume vegetables and/or fruit (combination of vegetable and fruit) at least 5 portions per day for 7 days a week. On the other hand, low intake was defined as consuming vegetables and fruit less than 5 portions per day for 7 days a week (MOH, 2019). One portion of vegetable is equal to 80-100 g. The details on variables, indicators, method, and source of data that will be used in this study are listed in Table 1.

Table 1. List of variables

Variable	Indicator	Method	Source of Data
Vegetable intake	1. Type of vegetable consumed 2. Intake of vegetable based on socio-demographic profile (age group and geographical area)	Literature review, Secondary data analysis	SUSENAS 2013, 2018, 2019-2021; SKMI 2014, RISKESDAS 2013, 2018, Scientific publication from peer reviewed journal

Variable	Indicator	Method	Source of Data
Nutritional and health status	1. Prevalence of overweight and obesity 2. Prevalence of non-communicable diseases 3. Impact of vegetable intake on nutritional status and health	Literature review	RISKESDAS 2013, 2018; Scientific publication from peer reviewed journal
Factors affecting low vegetable intake		Literature review	Scientific publication from peer reviewed journal

Data analysis

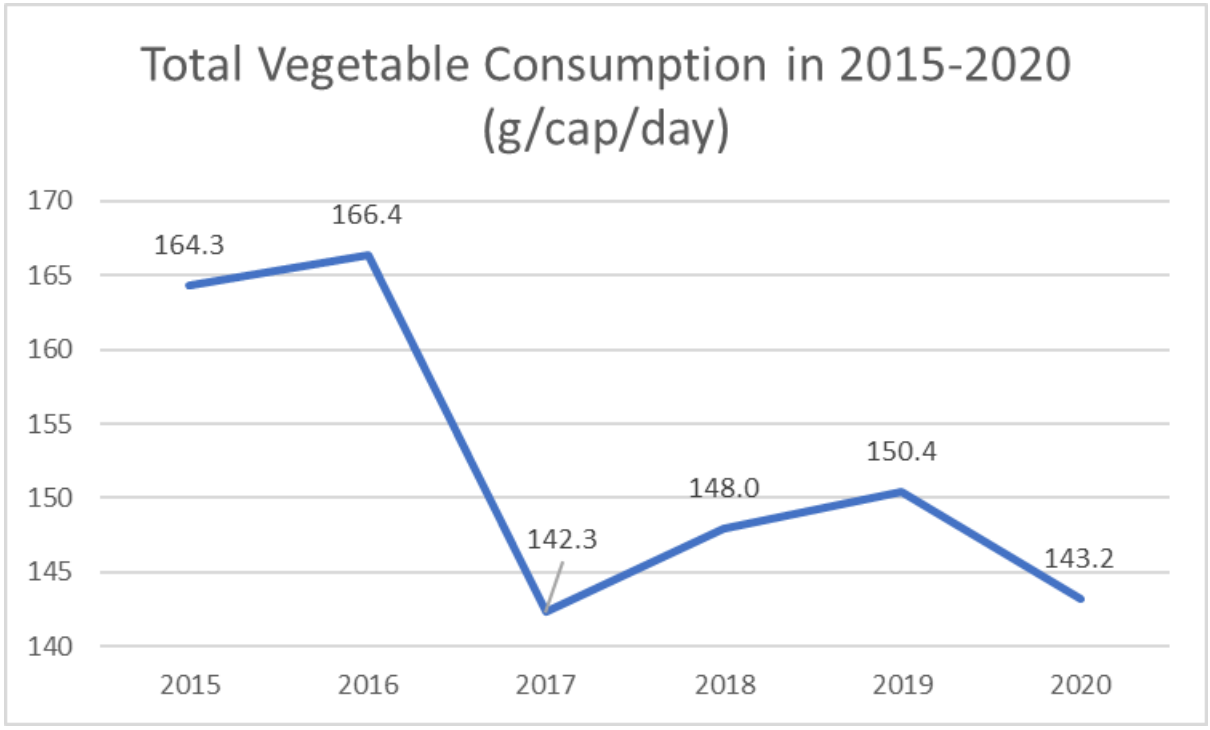
A literature search and secondary data collection were conducted to obtain information on vegetable consumption based on socio-demographic profiles; the prevalence of nutritional status; the prevalence of non-communicable disease; and the impact of low vegetable consumption on nutritional status and disease among the Indonesian population.

Specific keywords were searched on a scientific publication database (Google Scholar). The information was sorted based on relevancy and the date of publications (at least ten years ago). Information was extracted and coded in Microsoft Excel template form and analyzed systematically.

RESULT AND DISCUSSION

Total Vegetable Consumption

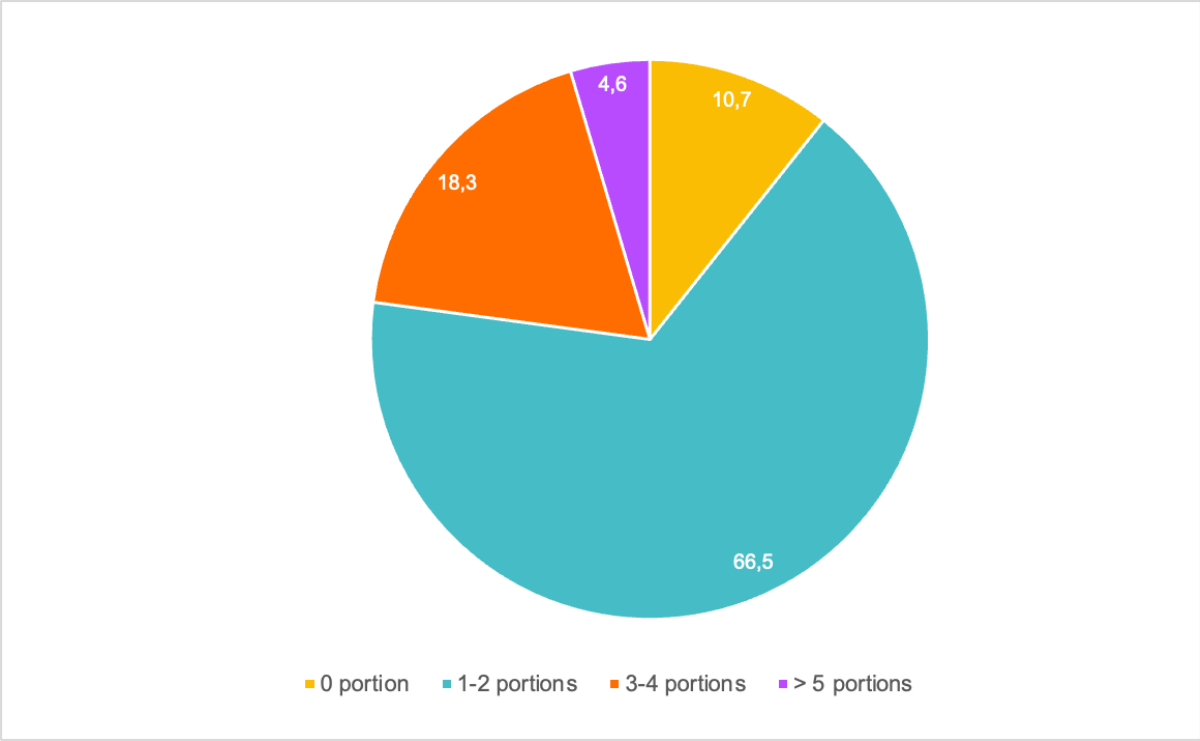
In Figure 1, total vegetable consumption during the last six years is depicted. Overall, Indonesians' vegetable consumption has decreased and stayed low. According to the most recent data from the Food Security Agency, Ministry of Agriculture (MoA) in 2020, overall intake was 143.2 g, or 57% of the recommended amount (250 g).



Source: Food Security Agency, (MoA, 2021)

Figure 1 Total vegetable consumption of Indonesians (g/cap/day)

Based on the data from Indonesia Basic Health Research 2018 (Figure 2), the majority of Indonesian people only consumed 1-2 portions of vegetables per day. Only less than 5% of Indonesian people consumed adequate amounts of vegetables (>5 portions per day).



Source: Indonesia Basic Health Research 2018 (MOH, 2019)

Figure 2. Proportion of daily fruit and vegetable consumption among Indonesian population

Vegetable Consumption by Commodities

Kale/swamp cabbage, spinach, onion, cassava leaves, eggplant, tomato/cherry tomato, cucumber, long beans, cayenne pepper, and garlic are the top ten vegetables consumed by Indonesians (Table 2). Kale, spinach, and cassava leaves are included as green leafy vegetables. In Indonesian food, the main spices consumed are onion, cayenne pepper, and garlic.

Table 2. Vegetable consumption in 2018-2021 by commodities (g/cap/day)

No	Vegetables	2018	2019	2020	2021
1	Kale/swamp cabbage	10.9	10.4	10.4	11.0
2	Spinach	9.0	9.3	9.1	9.1
3	Onion	7.6	7.7	7.4	8.0
4	Cassava leaves	7.6	7.4	7.7	8.0
5	Eggplant	7.3	7.7	7.7	7.1
6	Tomato, cherry tomato	6.7	6.4	6.4	6.9
7	Cucumber	5.4	5.6	6.0	6.3
8	Long beans	6.4	6.3	6.3	6.1
9	Cayenne pepper	5.0	5.4	4.9	5.3
10	Garlic	4.7	4.9	4.6	5.1
11	Red chillies	4.9	5.4	4.6	5.0
12	Pumpkin, squash	4.9	5.0	4.9	5.0
13	Mustard greens	4.0	3.7	3.9	4.4

No	Vegetables	2018	2019	2020	2021
14	Cabbage	4.0	4.1	3.7	4.1
15	Carrots	3.6	3.6	3.6	3.7
16	Petsai cabbage	2.9	2.7	2.9	3.4
17	Green papaya	3.0	2.9	2.7	3.4
18	Green beans	2.6	2.4	2.4	2.7
19	Bean sprout	2.4	2.4	2.4	2.6
20	Dog fruit	1.1	1.4	1.9	2.3
21	Young jackfruit	1.6	1.4	1.3	1.6
22	Green chillies	1.0	1.0	1.0	1.1

Source: SUSENAS 2018-2021 (Statistics Indonesia, 2018, 2019, 2020, 2021)

The top ten vegetables consumed by urban Indonesians are kale/swamp cabbage, spinach, onion, tomato/cherry tomato, eggplant, cucumber, red chillies, garlic, long beans, and cayenne pepper (Table 3).

Table 3. Vegetable consumption in 2018-2021 in urban by commodities (g/cap/day)

No	Vegetables	2018	2019	2020	2021
1	Kale/swamp cabbage	10.7	10.3	10.3	10.9
2	Spinach	9.3	9.4	9.0	9.3
3	Onion	7.4	7.4	7.2	7.9
4	Tomato, cherry tomato	6.9	6.6	6.6	7.0
5	Eggplant	5.7	6.0	5.9	5.7
6	Cucumber	5.1	5.1	5.6	5.7
7	Red chillies	5.4	5.9	4.9	5.3
8	Garlic	4.8	5.0	4.7	5.2
9	Long beans	5.4	5.1	5.1	5.1
10	Cayenne pepper	4.6	5.0	4.3	4.9
11	Mustard greens	4.4	4.1	4.3	4.7
12	Cassava leaves	4.1	4.1	4.1	4.6
13	Carrots	4.4	4.1	4.1	4.4
14	Pumpkin, squash	4.1	4.1	4.3	4.1
15	Petsai cabbage	3.4	3.3	3.4	4.0
16	Cabbage	3.3	3.3	3.1	3.4
17	Bean sprout	2.9	2.9	3.0	3.1
18	Green beans	2.6	2.4	2.4	2.6
19	Green papaya	1.7	1.6	1.4	2.0
20	Dog fruit	1.1	1.4	1.7	2.0
21	Young jackfruit	1.0	1.0	0.9	1.1
22	Green chillies	1.0	1.1	1.0	1.1

Source: SUSENAS 2018 – 2021 (Statistics Indonesia, 2018, 2019, 2020, 2021)

Cassava leaves, kale/swamp cabbage, spinach, eggplant, onion, long beans, cucumber, tomato/cherry tomato, cayenne pepper, and pumpkin/squash are the top ten vegetables consumed by rural Indonesians (Table 4). Cassava leaves are most plentiful in rural areas, which is why they were primarily consumed there.

Table 4. Vegetable consumption in 2018-2021 in rural by commodities (g/cap/day)

No	Vegetables	2018	2019	2020	2021
1	Cassava leaves	11.9	11.6	12.1	12.4
2	Kale/swamp cabbage	11.0	10.6	10.4	11.0
3	Spinach	8.6	9.0	9.4	9.0
4	Eggplant	9.1	9.9	9.9	9.0
5	Onion	7.8	8.0	7.6	8.2
6	Long beans	7.7	7.7	7.6	7.4
7	Cucumber	5.7	6.1	6.6	7.0
8	Tomato, cherry tomato	6.4	6.3	6.3	6.7
9	Cayenne pepper	5.6	6.1	5.6	6.1
10	Pumpkin, squash	5.7	6.0	5.7	6.0
11	Green papaya	4.6	4.4	4.1	5.1
12	Garlic	4.6	4.9	4.4	5.0
13	Cabbage	4.7	5.1	4.6	5.0
14	Red chillies	4.1	4.9	4.1	4.6
15	Mustard greens	3.3	3.1	3.4	3.9
16	Carrots	2.6	2.6	2.7	2.7
17	Petsai cabbage	2.3	2.1	2.3	2.7
18	Green beans	2.4	2.4	2.4	2.7
19	Dogfruit	1.1	1.4	2.0	2.6
20	Young jackfruit	2.0	1.9	1.7	2.1
21	Bean sprout	1.9	2.0	1.9	2.0
22	Green chillies	0.9	1.0	0.9	1.1

Source: SUSENAS 2018-2021 (Statistics Indonesia, 2018, 2019, 2020, 2021)

Vegetable Consumption by Area

As can be observed in Figure 3, vegetable consumption was higher in urban areas than in rural areas during 2015 and 2016. However, between 2017 and 2020, vegetable consumption in urban areas decreased to 138.2 g/cap/day, a level lower than that in rural areas.

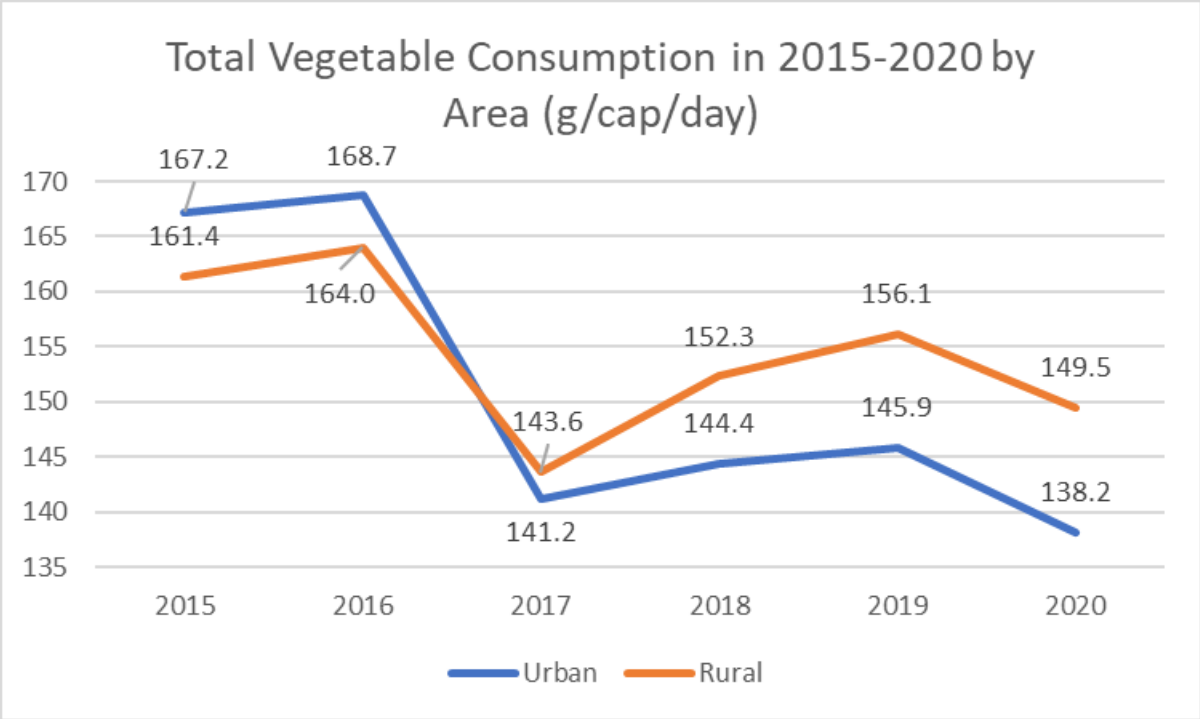
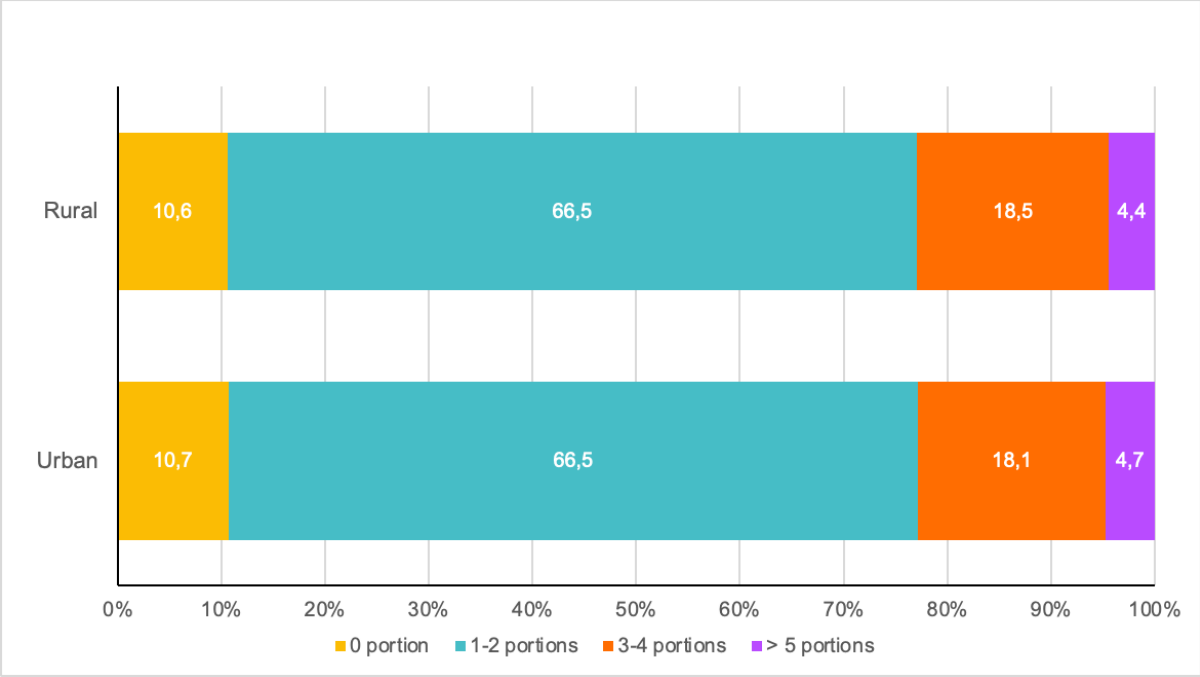


Figure 3 Total Vegetable Consumption in 2015-2020 by Area

Based on data presented in Figure 4, around two-thirds of people in urban and rural regions consume fewer than two portions of vegetables and fruit each day. Fewer than 5% of persons in urban and rural regions consume vegetables and fruits in the recommended amount (>5 portions per day), with the proportion being greater in urban than rural areas.

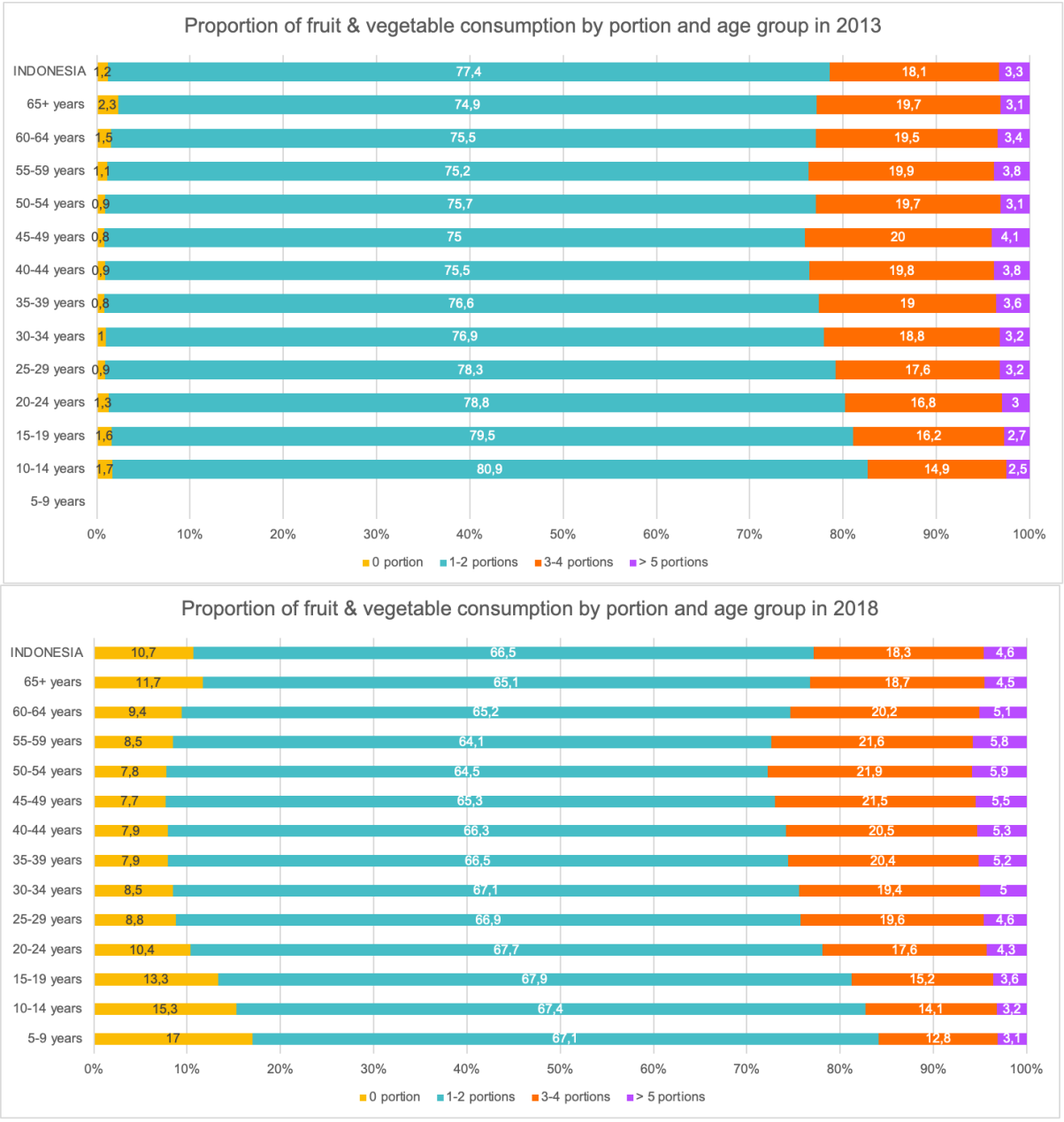


Source: Indonesia Basic Health Research 2018

Figure 4. Proportion of daily fruit and vegetable consumption based on geographic area

Vegetable Consumption by Age Group

According to the Indonesian Guidelines for Balanced Nutrition, Indonesians should take at least five portions of fruits and vegetables every day (MOH, 2014). According to data taken from RISKESDAS 2013 (MOH, 2013) and RISKESDAS 2018 (MOH, 2019), the majority of Indonesians ingested 1-2 portions of fruit and vegetables in 2013 (77.4 %) and 2018 (66.5 %), respectively. The percentage of persons who eat an acceptable amount of fruits and vegetables (5 portions) was low, despite a minor increase from 3.3 percent to 4.6 percent during the last five years.



Source: RISKESDAS 2013, RISKESDAS 2018

Figure 5. Proportion of fruits and vegetable intake of Indonesian people per day in a week based on age group in 2013 and 2018

Additionally, Figure 5 indicates an increase in the proportion of persons who do not consume fruits and vegetables, from 1.2 percent in 2013 to 10.7 percent in 2018. This could be explained by the fact that the proportion of persons who previously consumed 1-2 portions of fruit and vegetables decreased considerably from 77.4 percent in 2013 to 66.5 percent in 2018.

Consumption of fruits and vegetables increases with age, as illustrated in Figure 5. This finding held true for both the 2013 and 2018 data sets. The proportion of adults who consumed more fruits and vegetables climbed steadily from elementary school to adolescence, peaked in adulthood, and then decreased among the elderly.

Table 5. Average vegetable consumption based on age group

Age group	Vegetable consumption (g)	Recommended value (g)*
0-59 months	27.98	200
5-12 years	40.43	200
13-18 years	49.84	250
19-55 years	72.48	250
>55 years	90.09	250
Indonesia	64.95	250

Source: Analyzed from SUSENAS March 2021 data
*Based on Indonesian Guidelines for Balanced Nutrition (MOH, 2014)

On average, Indonesians only consumed 65 g of vegetables daily (Table 5). This amount only accounted for less than 40% of the recommended value as suggested by the Indonesian Guidelines for Balanced Nutrition. There is an increasing trend of vegetable consumption, with children aged 0-59 months consuming the smallest amount (<30 g) while the elderly had the highest consumption (90 g).

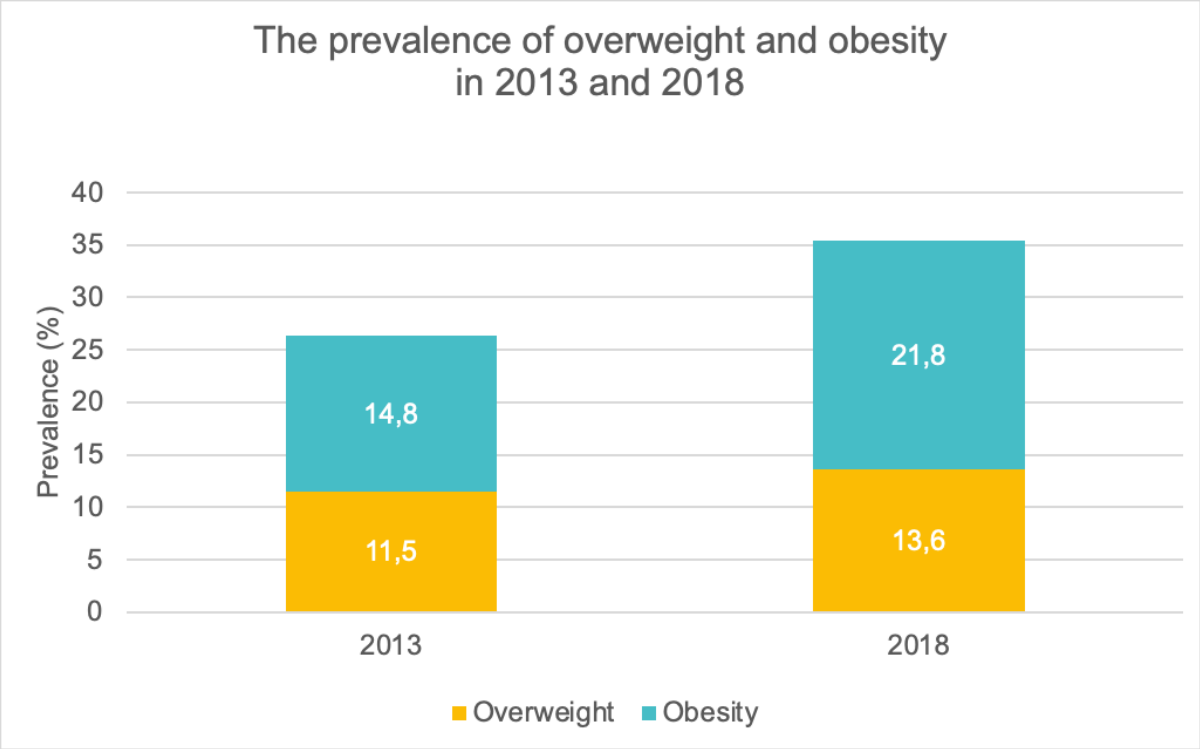
Vegetable consumption in 7 big cities in Indonesia

DKI Jakarta, Bogor, Depok, Tangerang, Bekasi, Semarang, and Surabaya have greater average vegetable consumption than the rest of Indonesia. These may be attributed to the abundance of vegetables in cities. It is easy to obtain vegetables in such cities, owing to e-commerce sites like Sayurbox, Tanihub, HappyFresh and Papa Pangan, as well as local markets. Purchasing vegetables online is convenient because the goods are delivered directly to the buyer's home. Various vegetables, including ready-to-eat mixed vegetable packages and mixed juice, can be selected using smartphone applications. Even the e-commerce provides vegetables dependent on harvest day. This might help purchasers eat a wide range of vegetables

at little cost. The ten most popular vegetables were practically same in all seven cities (see Annexes).

Consequences of Low Vegetable Consumption

The reference of overweight and obesity is extracted from two RISKESDAS publications in 2013 and 2018 (MOH, 2013 & 2019). The overweight is body mass index (BMI) of 25.0-26.9 kg/m^2, while obesity is BMI of equal to and more than 27.0 kg/m^2. The prevalence of overweight and obesity in 2013 and 2018 was presented in Figure 6. It showed an escalation of obesity prevalence during the span of five years, while the overweight prevalence were only slightly increased.



Source: RISKESDAS 2013 and RISKESDAS 2018

Figure 6. Prevalence of overweight and obesity among Indonesian adults

In the five-year period from 2013 to 2018, the prevalence of non-communicable diseases has increased. Diabetes mellitus has increased by more than 50%, whereas hypertension has increased by approximately 30%. The prevalence of cancer has also grown.

Table 7 presents the consequences of low vegetable consumption among the Indonesian population. There are 14 studies which analyzed the impact of low vegetable consumption among children, adolescents, adults, elderly, and pregnant women. Low vegetables consumption was associated with hypertension in 4 studies among adult and elderly population (Anwar, 2014; Mahwati, 2014; Suryani, Noviana and Libri, 2020; Susanti, Siregar and Falefi,

2020). There are two studies reported corelation of low vegetable consumption with obesity (Suhaema and Masthalina, 2015; Wati, Pamungkasari and Dharmawan, 2017, while another study suggested that it was associated with weight gain (Pratiwi and Mardiyati, 2018). In other study, low vegetables consumption was associated with both underweight and overweight or obesity (Arza and Sari, 2021).

Table 6. Prevalence of Non-Communicable Diseases in 2013 and 2018

Non-Communicable Diseases	Prevalence	
	2013	2018
Diabetes mellitus[1] (%)	6.9	10.9
Hypertension[2] (%)	25.8	34.11
Cancer[3] (‰)	1.4	1.79

[1]Prevalence among population aged ≥15 years, based on fasting blood glucose
[2]Prevalence among population aged ≥18 years, based on blood pressure measurement
[3]Prevalence among all age, based on medical diagnosis

One study in adolescents and two studies in pregnant women reported that low vegetables consumption was associated with anemia (Patimah *et al.*, 2016; Handayani and Sugiarsih, 2020; Hermawan, Abidin and Yanti, 2020). Low vegetables consumption also reported to be associated with metabolic syndrome (Suhaema and Masthalina, 2015; Rosha, Kumalaputri and Suryaputri, 2019), multimorbidity among elderly (Mahwati, 2014), poor sleep quality (Pengpid and Peltzer, 2020), and delayed in fine motoric development (Fitriani Umar and Muhammad Nurmaallah, 2018).

Table 7 Consequences of low vegetable consumption among Indonesian people

No	Source	Subject	Age group	Results
1	(Arza and Sari, 2021)	67 students of Pesisir Selatan Regency Junior High School, West Sumatra	Adolescents	Non normal nutritional status (underweight, overweight, and obese)
2	(Anwar, 2014)	156 patients at S. Parman Public Health Center, Banjarmasin City, South Kalimantan aged 20-75 years	Adults and elderly	Hypertension
3	(Pratiwi and Mardiyati, 2018)	62 university students aged 19-21 years	Adults	Weight gain
4	(Hermawan, Abidin and Yanti, 2020)	60 pregnant women in Bukit Kemuning Public Health Center, North Lampung	Pregnant women	Anemia

No	Source	Subject	Age group	Results
5	(Handayani and Sugiarsih, 2020)	59 pregnant women in Karawang Regency, West Java	Pregnant women	Anemia
6	(Suhaema and Masthalina, 2015)	31.998 people from RISKESDAS 2013 sample aged ≥ 18 years	Adults	Metabolic syndrome: 1. Central obesity 2. High blood pressure 3. High fasting blood glucose 4. High triglyceride level 5. Low HDL level
7	(Fitriani Umar and Muhammad Nurmaallah, 2018)	50 preschool children in Parepare City, South Sulawesi aged 3-6 years	Children	Fine motoric delay
8	(Suryani, Noviana and Libri, 2020)	63 patients aged 30-70 years in Idaman Banjarbaru City Hospital	Adults and elderly	Hypertension
9	(Susanti, Siregar and Falefi, 2020)	90 adults in Deli Serdang, North Sumatra	Adults	Hypertension
10	(Rosha, Kumalaputri and Suryaputri, 2019)	38.149 people from RISKESDAS 2013 aged >15 years old	Adolescents and adults	1. impaired glucose tolerance 2. overweight
11	(Wati, Pamungkasari and Dharmawan, 2017)	140 junior high school students grade 1 & 2 aged 10-18 years	Adolescents	Obesity
12	(Pengpid and Peltzer, 2020)	21,027 college or university students with median age of 20 years (IQR = 3 years) from 28 countries (Asia: Bangladesh, China, India, Indonesia, Kyrgyzstan, Laos, Malaysia, Myanmar, Pakistan, Philippines, Russia, Singapore, Thailand, Turkey, and Vietnam; Africa: Cameroon, Egypt, Ivory Coast, Madagascar, Mauritius, Namibia, Nigeria, South Africa and Tunisia; Americas:	Adults	Short sleep, poor sleep quality and restless sleep

No	Source	Subject	Age group	Results
		Barbados, Columbia, Grenada, Jamaica and Venezuela)		
13	(Patimah *et al.*, 2016)	200 adolescents girl in grade 10th from 5 high schools in Maros district, South Sulawesi	Adolescents	Microcytic-hypochromic anemia
14	(Mahwati, 2014)	2.960 elderly (≥ 60 years old) from Indonesian Family Life Surveys 2007 (IFLS4)	Elderly	Multimorbidity = having two or more chronic NCDs such as hypertension, diabetes, asthma, chronic lung disease, heart disease, stroke, arthritis, gout.

Determinants of Low Vegetable Consumption

There were 11 research that looked into the factors that contribute to Indonesians' low vegetable consumption. Almost all of them (10 studies) dealt with kids and teenagers. The lack of vegetable availability at home was the primary cause of low vegetable eating. This is attributable to a lack of parental support as well as a lack of preference for vegetables among children and adolescents. Due to a lack of education and a consequent lack of income, parents may have difficulties giving vegetables. The mother's role as a vegetable educator was also missing, and they lacked nutritional knowledge as well. Vegetables were generally disliked by youngsters due to a lack of expertise in preparing them, as well as a lack of self-efficacy and attitude on the part of the children and adolescents. Poor peer support and lack of exposure to vegetable-promoting media, among other external variables, exacerbate the problem of low vegetable eating.

Table 8 Determinants of low vegetable consumption

Source	Subject	Age Group	Results
(Febriana and Sulaeman, 2014)	102 students of Preschool Early Childhood Education PAUD in Beji, Depok	Preschool children	1. Lack of mother's support 2. Low per capita income 3. Poor preference on vegetable 4. Low illness frequency
(Hidayati, Aruben and Pradigdo, 2017)	86 students in Elementary School SDN Sendangmulyo	School children	1. Low level of family welfare 2. Lack of vegetable availability at home

Source	Subject	Age Group	Results
	03, Semarang City grade 5		3. Lack of parental support
(Afif and Sumarmi, 2017)	41 students of Elementary School SDN Kandang Tepus 01 and 02 Lumajang grade 4 and 5	School children	1. Lack of role of mother as educator 2. Lack of vegetable availability at home
(Asih Anggraeni and Sudiarti, 2018)	208 students of Junior High School SMPN 98 Jakarta grade 7 and 8	Adolescents	1. Low mother's education level 2. Lack of media exposure related to vegetable
(Amelia and Fayasari, 2020)	107 students of Junior High School SMPN 238 Jakarta grade 7, 8 amd 9	Adolescents	1. Low self-efficacy related to vegetable 2. Lack of vegetable availability at home 3. Poor parent influence
(Rachman, Mustika and Kusumawati, 2017)	85 students of Junior High School SMPK 1 Harapan, Denpasar grade 8	Adolescents	1. Poor attitude toward vegetable 2. Poor knowledge on nutrition 3. Lack of vegetable availability at home 4. Lack of media exposure related to vegetable 5. Low parent's income
(Ramadhani and Hidayati, 2017)	83 students in Junior High School SMPN 3 Surakarta grade 7 and 8	Adolescents	1. Poor preference on vegetable
(Muna and Mardiana, 2019)	97 students in Junior High School SMPN 24 Semarang grade 8	Adolescents	1. Male 2. Poor knowledge on nutrition 3. Poor skill in preparing vegetable 4. Lack of food availability at home 5. Poor parent's support 6. Poor peer's support
(Gustiara, 2012)	96 students of Senior High School SMA 1 Pekanbaru, Riau aged 15-18 years	Adolescents	1. Lack of vegetable availability at home 2. Frequent buying of lack of vegetable-snacks at school 3. Negative peer influence
(Oktavia, Syafiq and Setiarini, 2019)	186 teenagers in Yogyakarta	Adolescents	1. Low father's education level 2. Overweight body image 3. Poor knowledge on vegetable

Source	Subject	Age Group	Results
(Hanani, Suyatno and P, 2016)	7,664 pregnant mothers aged 15 years and above in Riskesdas 2013	Pregnant mothers	1. Poor 2. Low education level 3. Unemployed

CONCLUSIONS

Overall consumption of vegetables has tended to decline over the last six years and remains far below recommendation. The top ten vegetables consumed by Indonesians are kale/swamp cabbage, spinach, onion, cassava leaves, eggplant, tomato/cherry tomato, cucumber, long beans, cayenne pepper, and garlic. In 2015 and 2016, urban areas consumed more vegetables than rural areas. Between 2017 and 2020, however, vegetable consumption in urban regions tended to decline and eventually fall below that in rural ones. Vegetable consumption increases with age. The cities of DKI Jakarta, Bogor, Depok, Tangerang, Bekasi, Semarang, and Surabaya consume more vegetables on average than the rest of Indonesia. Low vegetable consumption relates to an increased risk of overweight, obesity, and non-communicable disease. Additionally, it has been linked to anemia in pregnant women. The primary reason for low vegetable consumption was a lack of vegetable availability at home. This is due to a lack of parental support and a lack of children and adolescents' preference for vegetables.

RECOMMENDATION AND ACTION PLAN

As a guideline, vegetable consumption should be raised by nutrition education targeted at mothers to ensure vegetables are readily available. Mothers should be assisted in increasing their children's enjoyment of vegetables by enhancing their ability to prepare the dish. The school canteen and the school feeding program may also serve healthier food if students are educated about nutrition. School canteen transition to healthier food can be improved with nutrition education for students and staff. Boarding school nutrition education enhances knowledge, attitude, and vegetable preference. Together with menu adjustment (including spice), nutrition education can successfully increase students' vegetable consumption.

Adults should be provided vegetables regularly at home and work. Workplace vegetable dishes should be diversified, and the canteen cook should be able to prepare pleasant vegetable meals. Workers accept vegetables when offered, but long-term food provision is required. Higher management support is essential to guarantee long-term availability and adequate intake of nutritious foods.

The top ten most consumed vegetables reflect regional preferences and availability. Most Indonesian meals contain garlic, onion, and cayenne pepper. Consequently, the supply of these commodities should be maintained as production capacity grows steadily.

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ANNEXES

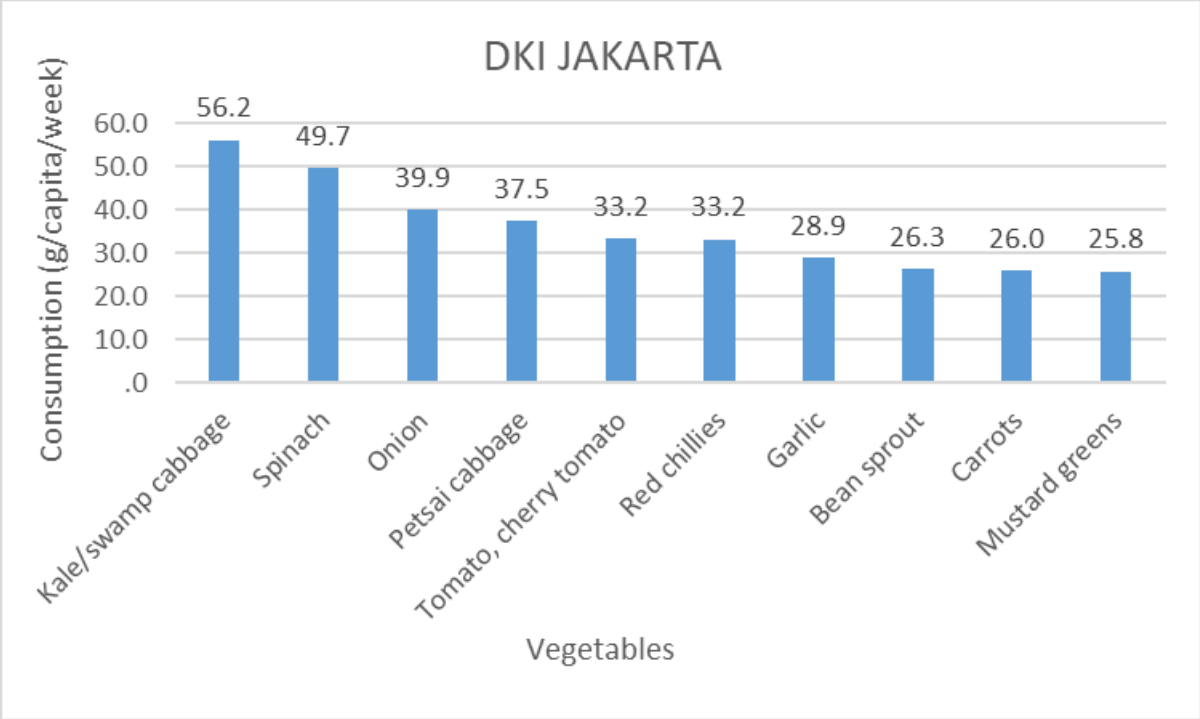
Annex 1 Vegetable Consumption by Commodities and Age Group in Indonesia (g)

	COMODITIES	0-59 months	5-12 years	13-18 years	19-55 years	>55 years	All age group
1	Spinach	2.17	2.80	3.19	4.83	5.77	4.32
2	Kale/swamp cabbage	1.99	3.00	3.75	5.26	5.84	4.63
3	Cabbage	0.73	1.08	1.34	1.86	1.93	1.62
4	Petsai cabbage	0.62	0.90	1.11	1.63	1.87	1.43
5	Mustard greens	0.88	1.27	1.62	2.38	2.72	2.09
6	Green beans	0.66	0.94	1.16	1.68	2.00	1.50
7	Long beans	1.35	2.03	2.55	3.65	4.53	3.27
8	Tomato, cherry tomato	1.72	2.48	3.01	4.43	5.26	3.93
9	Carrots	1.23	1.46	1.65	2.57	2.74	2.25
10	Cucumber	0.79	1.28	1.62	2.34	3.15	2.12
11	Cassava leaves	1.02	1.58	1.99	2.71	4.05	2.55
12	Eggplant	1.07	1.64	2.12	3.02	4.23	2.77
13	Bean sprout	0.88	1.28	1.56	2.31	2.58	2.02
14	Pumpkin, squash	0.69	0.98	1.25	1.84	2.81	1.72
15	Vegetable, cap cay soup ingredients (packages)	1.66	2.24	2.68	4.03	4.82	3.58
16	Tamarind/coconut curry vegetable soup ingredients (package)	0.80	1.23	1.57	2.28	2.68	2.01
17	Young jackfruit	0.17	0.29	0.38	0.51	0.66	0.46
18	Green papaya	0.13	0.20	0.26	0.34	0.51	0.32
19	Dog fruit/Jengkol	0.12	0.19	0.24	0.31	0.25	0.26
20	Onion	3.55	5.17	6.40	9.38	12.58	8.52
21	Garlic	3.46	5.04	6.24	9.14	12.15	8.29
22	Red chillies	2.16	3.14	3.89	5.62	6.51	4.97
23	Green chillies	0.05	0.08	0.10	0.14	0.16	0.12
24	Cayenne pepper	0.07	0.11	0.14	0.19	0.26	0.17
	TOTAL	27.98	40.43	49.84	72.48	90.09	64.95

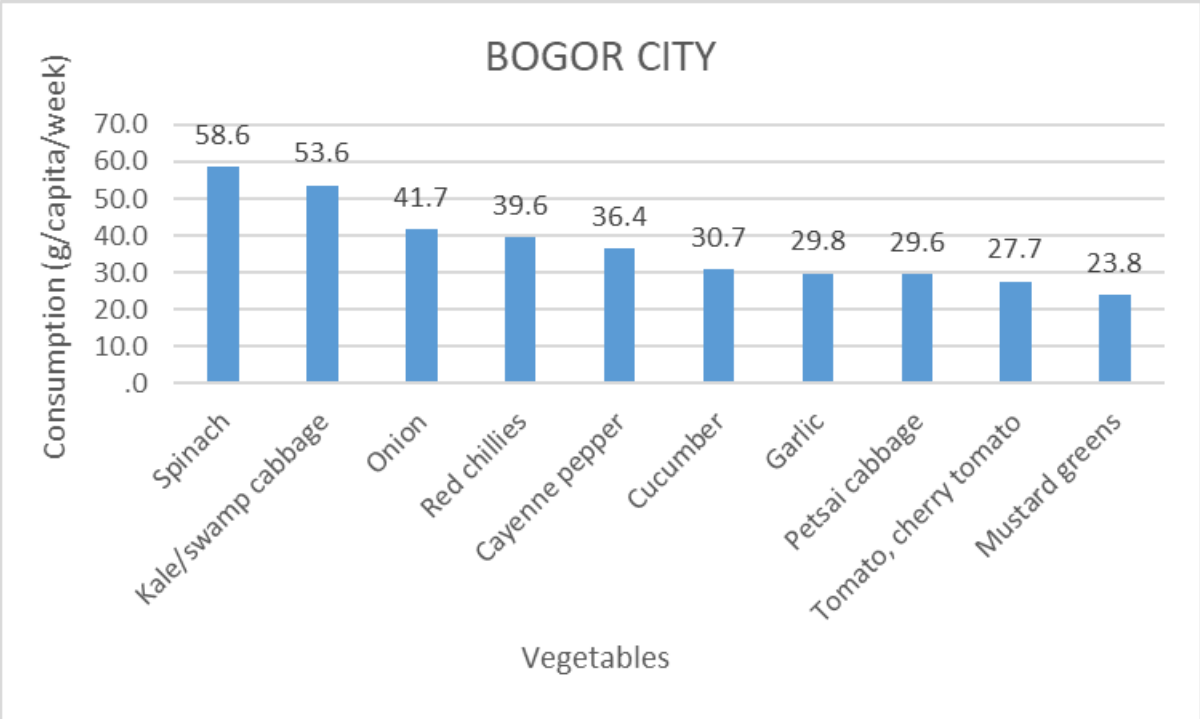
Annex 2 Vegetable Consumption by Commodities in Seven Big Cities in Indonesia (kg)

NO	COMODITIES	DKI JAKARTA	BOGOR CITY	BEKASI CITY	DEPOK CITY	SEMARANG CITY	SURABAYA CITY	TANGERANG CITY
1	Spinach	.050	.059	.062	.057	.088	.066	.128
2	Kale/swamp cabbage	.056	.054	.064	.056	.058	.112	.109
3	Cabbage	.011	.012	.011	.008	.022	.022	.006
4	Petsai cabbage	.038	.030	.046	.036	.036	.024	.038
5	Mustard greens	.026	.024	.023	.025	.041	.032	.026
6	Green beans	.015	.012	.015	.016	.021	.017	.015
7	Long beans	.020	.015	.020	.020	.039	.025	.030
8	Tomato, cherry tomato	.033	.028	.036	.033	.021	.049	.034
9	Carrots	.026	.022	.026	.022	.037	.027	.020
10	Cucumber	.022	.031	.037	.028	.011	.018	.041
11	Cassava leaves	.011	.005	.010	.017	.021	.011	.015
12	Eggplant	.016	.009	.017	.016	.033	.040	.021
13	Bean sprout	.026	.021	.024	.028	.011	.019	.028
14	Pumpkin, squash	.023	.017	.024	.016	.011	.022	.026
15	Young jackfruit	.004	.004	.006	.004	.005	.009	.007
16	Green papaya	.001	.002	.003	.005	.005	.005	.003
17	Dog fruit/Jengkol	.011	.018	.017	.011	.003	.001	.028
18	Onion	.040	.042	.046	.051	.045	.052	.058
19	Garlic	.029	.030	.035	.033	.044	.037	.029
20	Red chillies	.033	.040	.036	.040	.026	.016	.056
21	Green chillies	.007	.004	.005	.004	.006	.003	.009
22	Cayenne pepper	.025	.036	.022	.015	.015	.037	.027

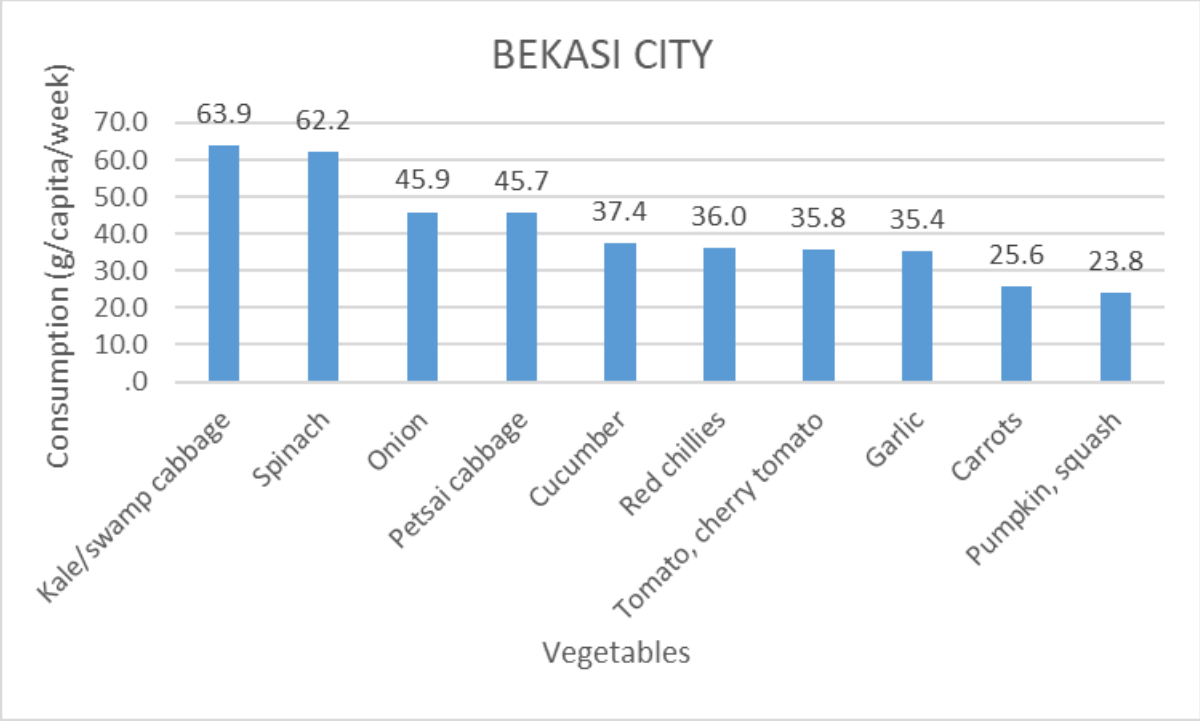
Annex 3 Ten Vegetables Mostly Consumed in DKI Jakarta



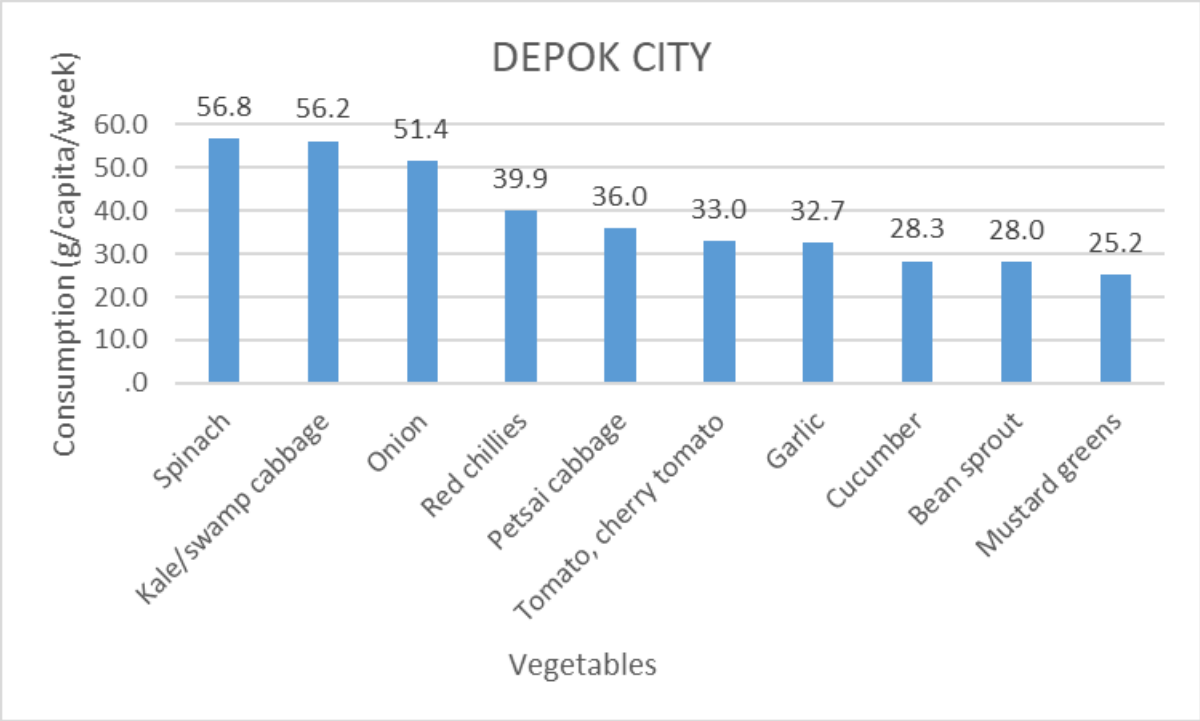
Annex 4 Ten Vegetables Mostly Consumed in Bogor City



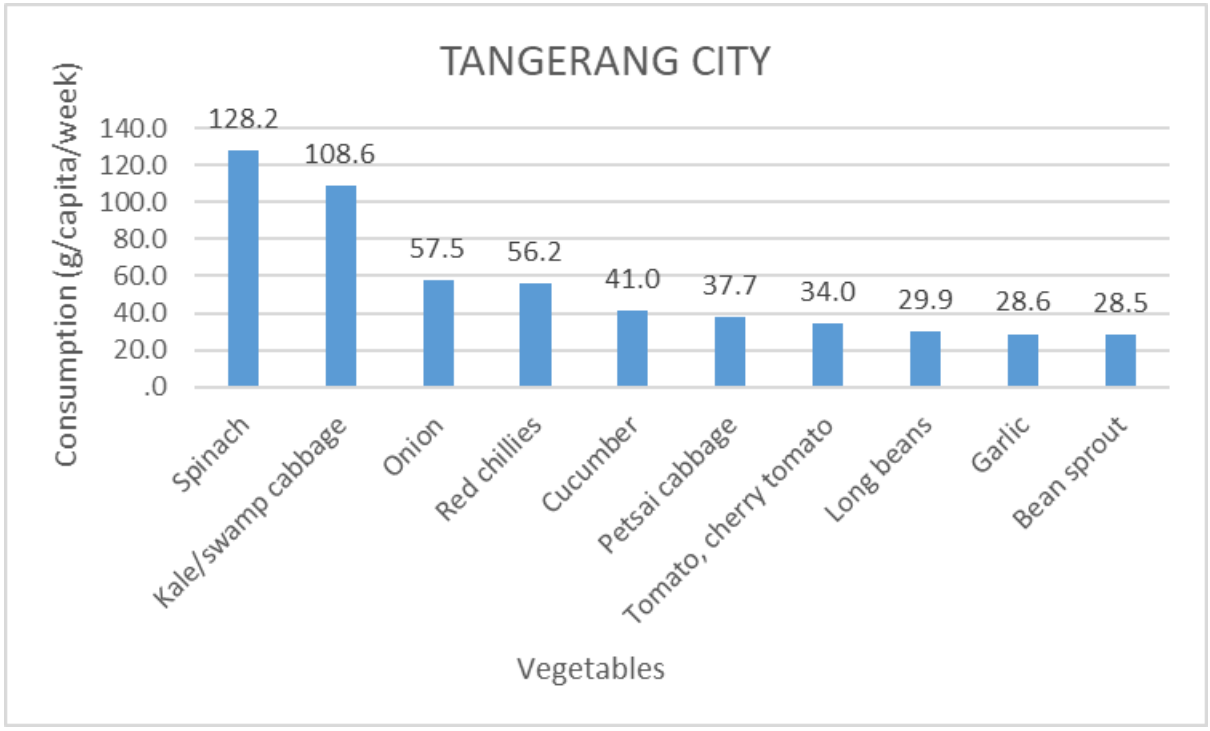
Annex 5 Ten Vegetables Mostly Consumed in Bekasi City



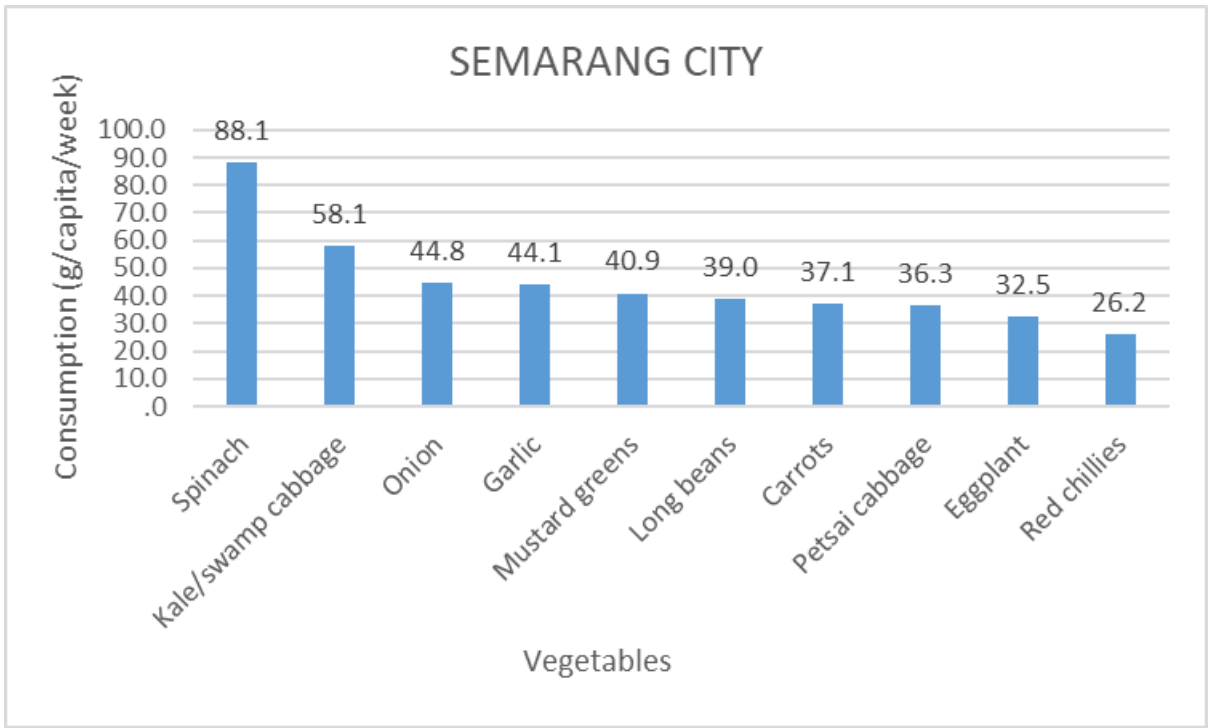
Annex 6 Ten Vegetables Mostly Consumed in Depok City



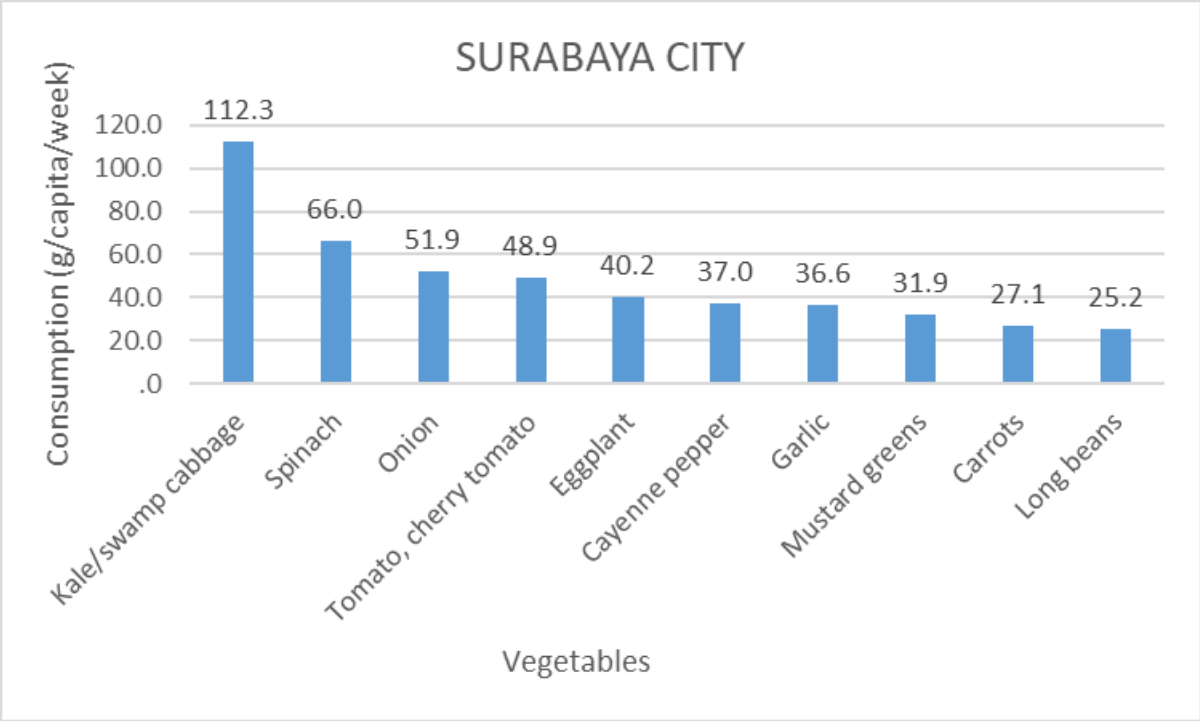
Annex 7 Ten Vegetables Mostly Consumed in Tangerang City



Annex 8 Ten Vegetables Mostly Consumed in Semarang City



Annex 9 Ten Vegetables Mostly Consumed in Surabaya City



Annex 10 Vegetable Consumption by Commodities and Age Group in DKI Jakarta

Commodities	**0-59 months**	**5-12 years**	**13-18 years**	**19-55 years**	**>55 years**
Spinach	3.57	4.02	4.09	7.26	11.14
Kale/swamp cabbage	2.25	3.09	4.06	6.50	7.71
Cabbage	0.39	0.64	0.85	1.15	1.73
Petsai cabbage	1.63	2.17	2.51	4.38	7.27
Mustard greens	1.43	1.93	2.55	4.22	5.95
Green beans	1.07	1.40	1.65	2.93	4.71
Long beans	1.52	2.09	2.47	4.04	6.13
Tomato, cherry tomato	2.34	2.92	3.30	5.83	8.42
Carrots	2.19	2.36	2.43	4.45	7.26
Cucumber	0.88	1.25	1.80	3.03	6.49
Cassava leaves	0.34	0.46	0.68	1.06	1.25
Eggplant	0.68	1.01	1.30	2.21	3.61
Bean sprout	1.57	2.33	2.70	4.53	6.74
Pumpkin, squash	0.98	1.28	1.63	2.84	6.52
Young jackfruit	0.13	0.20	0.21	0.30	0.39
Green papaya	0.02	0.02	0.02	0.04	0.04
Dog fruit/Jengkol	0.10	0.16	0.21	0.27	0.35
Onion	4.41	5.75	6.65	11.90	19.28
Garlic	4.40	5.74	6.59	11.91	19.29
Red chillies	4.15	5.45	6.28	11.12	17.30
Green chillies	0.02	0.02	0.03	0.05	0.07
Cayenne pepper	0.05	0.08	0.10	0.16	0.19
TOTAL	**40.45**	**52.64**	**61.38**	**105.95**	**165.25**

Annex 11 Vegetable Consumption by Commodities and Age Group in Bogor City

Commodities	**0-59 months**	**5-12 years**	**13-18 years**	**19-55 years**	**>55 years**
Spinach	3.86	3.80	3.17	6.90	9.56
Kale/swamp cabbage	2.40	3.66	4.16	6.85	8.06
Cabbage	0.23	0.53	1.27	1.29	2.29
Petsai cabbage	1.61	1.83	1.91	3.72	6.22
Mustard greens	1.21	1.95	2.68	3.34	4.24
Green beans	0.91	1.40	2.03	2.45	5.42
Long beans	0.73	1.60	2.12	2.61	4.34
Tomato, cherry tomato	2.67	3.45	4.32	6.14	8.77
Carrots	1.71	2.10	2.43	3.30	6.78
Cucumber	1.28	2.04	2.91	3.91	6.38
Cassava leaves	0.14	0.41	0.42	0.60	1.04
Eggplant	0.28	0.66	0.91	1.32	2.49
Bean sprout	1.36	1.90	2.76	4.18	6.18
Pumpkin, squash	0.73	1.40	1.47	2.38	6.20
Young jackfruit	0.05	0.24	0.15	0.32	0.65
Green papaya	0.01	0.03	0.01	0.04	0.13
Dog fruit/Jengkol	0.18	0.26	0.28	0.46	0.44
Onion	5.04	6.07	7.22	12.31	19.26
Garlic	5.03	6.04	6.78	12.15	19.27
Red chillies	4.82	5.86	6.82	11.64	17.09
Green chillies	0.01	0.02	0.02	0.02	0.03
Cayenne pepper	0.07	0.12	0.15	0.20	0.24
TOTAL	**41.29**	**53.99**	**63.35**	**101.92**	**157.59**

Annex 12 Vegetable Consumption by Commodities and Age Group in Depok City

Commodities	**0-59 months**	**5-12 years**	**13-18 years**	**19-55 years**	**>55 years**
Spinach	3.77	3.87	4.30	7.14	10.75
Kale/swamp cabbage	2.34	3.71	4.16	7.16	7.22
Cabbage	0.57	0.51	1.04	1.28	1.02
Petsai cabbage	1.94	2.48	2.84	4.90	7.22
Mustard greens	1.76	1.84	3.01	4.08	3.94
Green beans	1.40	1.59	1.28	2.58	4.10
Long beans	1.34	2.00	1.88	3.97	5.11
Tomato, cherry tomato	2.39	3.14	3.72	6.46	8.79
Carrots	2.29	1.93	2.37	3.95	4.01
Cucumber	0.96	1.61	1.79	3.26	6.19
Cassava leaves	0.49	0.66	0.86	1.27	2.50
Eggplant	0.60	0.93	1.23	2.08	2.12
Bean sprout	1.70	2.54	2.82	5.08	6.56
Pumpkin, squash	1.13	1.17	1.39	2.26	5.51
Young jackfruit	0.05	0.10	0.14	0.19	0.33
Green papaya	0.02	0.04	0.10	0.12	0.17
Dog fruit/Jengkol	0.11	0.18	0.18	0.30	0.28
Onion	5.20	6.06	7.34	12.62	18.24
Garlic	5.13	6.04	7.24	12.60	18.68
Red chillies	4.64	5.85	6.94	12.18	17.90
Green chillies	0.01	0.01	0.01	0.02	0.02
Cayenne pepper	0.03	0.05	0.06	0.10	0.09
TOTAL	**44.69**	**54.51**	**64.19**	**109.24**	**155.65**

Annex 13 Vegetable Consumption by Commodities and Age Group in Tangerang City

Commodities	**0-59 months**	**5-12 years**	**13-18 years**	**19-55 years**	**>55 years**
Spinach	4.28	4.18	3.87	7.33	10.23
Kale/swamp cabbage	2.43	3.54	4.45	7.34	7.43
Cabbage	0.33	0.63	0.49	0.77	0.56
Petsai cabbage	1.65	2.23	2.43	3.85	4.69
Mustard greens	1.40	1.87	2.24	3.38	3.68
Green beans	1.00	1.00	1.03	1.78	1.80
Long beans	1.50	2.30	2.67	3.85	7.04
Tomato, cherry tomato	2.53	3.37	3.29	6.05	8.38
Carrots	2.18	1.79	2.12	3.36	4.65
Cucumber	1.31	1.56	1.99	3.32	5.69
Cassava leaves	0.28	0.44	0.55	0.73	0.74
Eggplant	0.85	0.99	0.99	2.05	3.16
Bean sprout	1.77	2.53	2.43	4.11	5.30
Pumpkin, squash	0.61	1.31	1.05	2.06	5.31
Young jackfruit	0.11	0.25	0.17	0.31	0.91
Green papaya	0.02	0.04	0.03	0.08	0.06
Dog fruit/Jengkol	0.28	0.28	0.37	0.64	1.02
Onion	5.01	6.05	6.46	11.94	17.55
Garlic	4.91	6.00	6.46	11.79	17.19
Red chillies	4.65	5.73	6.19	11.37	15.74
Green chillies	0.02	0.03	0.04	0.06	0.08
Cayenne pepper	0.07	0.09	0.08	0.16	0.22
TOTAL	**44.93**	**55.90**	**59.51**	**104.16**	**147.10**

Annex 14 Vegetable Consumption by Commodities and Age Group in Bekasi City

Commodities	**0-59 months**	**5-12 years**	**13-18 years**	**19-55 years**	**>55 years**
Spinach	3.95	4.29	4.03	6.98	8.62
Kale/swamp cabbage	2.54	3.60	4.44	6.72	6.67
Cabbage	0.43	0.76	1.09	1.55	1.20
Petsai cabbage	1.76	2.52	3.15	4.91	7.88
Mustard greens	1.56	2.13	2.80	4.19	5.10
Green beans	1.53	1.83	2.07	3.35	5.31
Long beans	1.34	2.11	2.85	4.16	6.87
Tomato, cherry tomato	2.90	3.42	4.45	6.88	8.44
Carrots	2.57	3.11	2.93	5.06	7.92
Cucumber	0.92	1.78	2.50	3.67	6.38
Cassava leaves	0.16	0.53	0.87	0.89	1.19
Eggplant	0.60	1.06	1.45	2.63	3.77
Bean sprout	1.75	2.65	3.02	4.89	5.29
Pumpkin, squash	1.08	1.20	1.86	2.60	5.40
Young jackfruit	0.05	0.18	0.55	0.48	0.84
Green papaya	0.01	0.03	0.04	0.07	0.16
Dog fruit/Jengkol	0.09	0.19	0.22	0.33	0.39
Onion	4.69	6.14	7.30	12.36	17.52
Garlic	4.75	6.04	7.34	12.08	17.24
Red chillies	4.16	5.57	6.94	11.24	15.44
Green chillies	0.01	0.02	0.02	0.03	0.04
Cayenne pepper	0.05	0.07	0.09	0.14	0.15
TOTAL	**43.12**	**57.37**	**70.38**	**110.90**	**152.08**

Annex 15 Vegetable Consumption by Commodities and Age Group in Semarang City

Commodities	**0-59 months**	**5-12 years**	**13-18 years**	**19-55 years**	**>55 years**
Spinach	3.40	4.49	4.91	7.97	10.04
Kale/swamp cabbage	1.94	2.94	3.11	5.60	6.93
Cabbage	0.86	1.21	1.28	2.57	4.01
Petsai cabbage	1.28	1.68	2.01	3.24	4.79
Mustard greens	1.21	1.62	1.89	3.87	4.39
Green beans	0.87	1.40	2.01	2.63	3.87
Long beans	1.68	2.42	2.62	4.73	7.30
Tomato, cherry tomato	1.17	1.60	2.16	3.39	4.71
Carrots	1.99	2.36	2.61	4.96	5.85
Cucumber	0.22	0.56	0.73	1.13	1.21
Cassava leaves	0.51	0.51	0.75	1.33	3.14
Eggplant	0.88	1.39	1.43	3.01	5.01
Bean sprout	0.69	1.07	1.46	2.76	5.19
Pumpkin, squash	0.55	0.46	0.66	1.37	3.04
Young jackfruit	0.08	0.18	0.24	0.38	0.63
Green papaya	0.01	0.03	0.07	0.08	0.60
Dog fruit/Jengkol	0.00	0.04	0.04	0.05	0.04
Onion	4.43	5.93	6.82	12.26	22.16
Garlic	4.35	5.84	6.80	12.18	22.18
Red chillies	3.61	5.24	5.95	10.76	18.03
Green chillies	0.01	0.02	0.02	0.04	0.04
Cayenne pepper	0.02	0.04	0.05	0.08	0.10
TOTAL	**35.91**	**49.22**	**57.39**	**100.91**	**162.38**

Annex 16 Vegetable Consumption by Commodities and Age Group in Surabaya City

Commodities	0-59 months	5-12 years	13-18 years	19-55 years	>55 years
Spinach	3.19	4.08	4.58	7.52	8.22
Kale/swamp cabbage	2.61	3.89	5.60	7.69	10.59
Cabbage	1.35	1.27	1.55	2.72	3.40
Petsai cabbage	0.97	1.32	1.50	2.89	4.76
Mustard greens	1.80	2.26	2.59	4.76	7.68
Green beans	1.25	1.46	1.63	2.73	3.14
Long beans	1.71	2.56	3.08	5.30	6.10
Tomato, cherry tomato	2.64	3.85	4.85	7.36	9.91
Carrots	2.11	2.59	2.61	4.63	7.48
Cucumber	0.69	1.02	1.27	2.38	4.00
Cassava leaves	0.30	0.62	0.57	1.25	2.50
Eggplant	1.21	1.94	2.54	4.32	7.53
Bean sprout	1.36	1.35	1.74	3.12	5.55
Pumpkin, squash	0.80	0.79	1.32	1.93	4.66
Young jackfruit	0.29	0.42	0.58	1.08	1.31
Green papaya	0.02	0.02	0.02	0.05	0.11
Dog fruit/Jengkol	0.00	0.00	0.01	0.02	0.02
Onion	4.39	6.26	7.43	12.50	19.13
Garlic	4.41	6.30	7.43	12.51	18.81
Red chillies	3.09	4.62	5.30	8.55	13.00
Green chillies	0.01	0.01	0.01	0.02	0.03
Cayenne pepper	0.07	0.10	0.12	0.21	0.25
TOTAL	**40.44**	**56.31**	**67.48**	**110.96**	**161.49**