



UNIVERSITAS INDONESIA

**ASSOCIATION OF EATING BEHAVIOR AND DIET
QUALITY AMONG ADULTS LIVING IN URBAN AND
RURAL AREA OF EAST JAVA**

THESIS

ARINDAH NUR SARTIKA

1606839952

FACULTY OF MEDICINE

NUTRITIONAL SCIENCES STUDY PROGRAM

JAKARTA

2018



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Submitted in partial fulfillment of the requirements for the degree of
Master of Science in Community Nutrition

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MAJORING IN COMMUNITY NUTRITION

JAKARTA

JUNE 2018

AUTHOR'S DECLARATION OF ORIGINALITY PAGE

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ACKNOWLEDGEMENT

My foremost gratefulness would be dedicated to My Lord Allah SWT, for giving me all blessing and grace to finalize my study. I would like to give my appreciation to all supports and guidance that given to me. Here, my gratitude goes to:

(1) Dr. dr. Ari Fahrial Syam, SpPD-KGEH., MMB, FINASIM, FACP, as Dean of Faculty of Medicine, Universitas Indonesia;

(2) Dr. dr. Fiastuti Witjaksono, MKM, MS, SpGK(K), as Head of Nutrition Department; Dr. dr. Inge Permadhi, MS, SpGK(K), as Head of Nutritional Sciences Study Program, and academic staff in Nutrition Department, Dr. Cipto Mangunkusumo General Hospital, Faculty of Medicine, Universitas Indonesia and SEAMEO RECFON;

(3) Dr. dr. Fiastuti Witjaksono, MKM, MS, SpGK(K), as my advisor who guided me to write proposal and thesis;

(4) Ir. Helda Khusun, MSc, PhD, as my advisor who guide me to conduct a study well and explain the result clearly;

(5) SCRIPT study team (Indonesia, Malaysia, and Seattle team) and its collaborators who gave me a chance to join the study;

(6) Dr. Judhyastuti Febrihartanti, MSc, Roselynn Anggraini, M.Gizi, and others Indonesia team included staff and enumerators in SCRIPT study whom i cannot mention one by one, thank you for all supports and guidance during the study phase;

(7) My parents, Papa Ari Machkota, S.H., M.Hum, Mama Sri Elly Fajriati, B.Sc, and my big family, as fulltime supporters to finish my study;

(6) My beloved friends SEAMEO RECFON Batch 2016, my senior Batch 2015, my bestfriends, and other supporters, thank you for all kindness given to me.

Lastly, thank you for supporters that i could not mention one by one. I hope God will give his blessing for you all.

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ABSTRACT

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Since diet consists of complex food, assessment of diet using diet quality is preferable. Literatures found eating behavior was related to diet quality. This study aimed to see association of eating behavior and diet quality among adults living urban and rural area. A cross sectional study in East Java was conducted with 185 total subjects. This study used propotional proportion to size to select villages in selected urban and rural area. Structured questionnaire and 2 x 24-h food recall were used in the study. To assess diet quality, average intake was scored using diet quality index – international (DQI-I). The results showed significant association of eating behavior towards living area in term of meal frequency, eating place during lunch and dinner, also breakfast habit. People in urban mostly ate 1-2 meals, ate outside home, and skipped breakfast. Compared to urban population, rural population mostly ate 3 meals per day, and had lower percentage of eating out and breakfast skippers. The study also found significant difference of diet quality score (total score, score of adequacy, score of moderation, and score of overall balance) between urban and rural adults. Generally, people in urban had lower score of diet quality compared to people in rural. In addition, snacking frequency was found influencing diet quality in urban. People who had no snack was found having higher risk to have diet quality score below median compared to snack eaters. However, promotion on choosing healthy snack should be addressed since some of snack consumed by adults could trigger excessive intake of fats. Among various snacks available in the society, fruits is more prefarable to improve quality of diet.

Keywords: diet quality, eating behavior, adults, urban, rural

ABSTRAK

Nama : Arindah Nur Sartika
Program studi : Ilmu Gizi
Judul : Hubungan antara Perilaku Makan dan Kualitas Diet pada Orang Dewasa di Kawasan Perkotaan dan Pedesaan di Jawa Timur
Pembimbing : 1. Dr. dr. Fiastuti Witjaksono, MKM, MS, SpGK(K)
2. Ir. Helda Khusun, MSc, PhD

Diet merupakan perpaduan dari berbagai jenis makanan yang dikonsumsi bersama. Sehingga penilaian kualitas diet lebih direkomendasikan menggunakan indeks kualitas diet. Studi literatur menemukan bahkan perilaku makan memiliki asosiasi dengan kualitas diet. Oleh karena itu, studi ini memiliki tujuan untuk melihat perilaku makan, kualitas diet, dan asosiasi keduanya pada usia dewasa yang tinggal di kawasan perkotaan dan pedesaan. Sebuah studi potong lintang dilakukan di Jawa Timur dengan total subjek sebanyak 185 orang. Pemilihan sample pada studi ini dilakukan dengan menggunakan metode *proportional proportion to size* (PPS) di kawasan perkotaan dan pedesaan terpilih. Studi ini menggunakan kuesioner terstruktur dan 2 x food recall 24 jam. Kemudian, rata-rata asupan dinilai menggunakan *diet quality index – nternational* (DQI-I). Hasil studi menunjukkan hubungan bermakna antara perilaku makan dan kualitas diet terhadap jenis tempat tinggal. Mayoritas populasi perkotaan mengonsumsi 1-2 makan utama, mengonsumsi makan di luar rumah, dan melewatkan makan pagi. Sedangkan mayoritas populasi pedesaan makan 3 kali sehari, dan memiliki presentasi makan di luar dan tidak mengonsumsi makan pagi yang lebih rendah dibandingkan populasi di perkotaan. Selain itu, ditemukan perbedaan signifikan pada kualitas diet di kedua jenis tempat tinggal (untuk total skor, skor adekuasi, skor moderasi, dan skor keseimbangan total). Secara umum, orang dewasa di perkotaan menunjukkan skor kualitas diet yang lebih rendah dibanding orang dewasa di pedesaan. Hasil studi juga mendapatkan bahwa terdapat hubungan konsumsi *snack* dan kualitas diet pada subjek kawasan perkotaan. Orang yang tidak mengonsumsi *snack* dilaporkan memiliki resiko yang lebih besar untuk memiliki kualitas diet di bawah skor median. Promosi untuk mengonsumsi *snack* perlu digalakan, tetapi dengan memperhatikan jenis *snack* yang dikonsumsi. Beberapa *snack* yang dikonsumsi masyarakat, beberapa diantaranya dapat mempengaruhi konsumsi lemak yang berlebih. Di antara *snack* yang tersedia, buah adalah jenis *snack* yang paling direkomendasikan untuk mencapai diet yang berkualitas.

Kata kunci : kualitas diet, perilaku makan, usia dewasa, perkotaan, pedesaan

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LIST OF ABBREVIATIONS

24-H RECALL	24-hour recall
BMI	Body Mass Index
<i>Deff</i>	Design effect
DQI	Diet Quality Index
DQI-a	Diet Quality Index- Adapted
DQI-I	Diet Quality Index-International
DQI-R	Diet Quality Index-Revised
DQS	Dietary Quality Score
EAR	Estimated Average Requirement
FFQ	Food frequency questionnaire
HDI	Healthy Diet Indicator
HEI	Healthy Eating Index
MDS	Mediterranean Diet Score
MUFA	Mono unsaturated fatty acid
NCD	Non-communicable disease
ONQI	Overall Nutritional Quality Index
PMK	<i>Peraturan Menteri Kesehatan</i>
PPS	Proportional Proportion to Size
PUFA	Poly unsaturated fatty acid
RDA	Recommended Dietary Allowance
SES	Social-economy status
SFA	Saturated fatty acid
USDA	United States Department of Agriculture
WHO	World Health Organization

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CHAPTER 1

INTRODUCTION

1.1. Background

The number of overnutrition especially obesity has been increasing rapidly in Indonesia. Basic Health Survey showed that the percentage of obesity has increased from 2007-2013 almost in 34 provinces (total provinces in Indonesia).¹ This situation may have effect to human health and the country's economy condition.

Studie showed that obesity increased the risk of non-communicable diseases such as ischemic heart disease, diabetes, stroke, and hypertension.² The Lancet's study in 2017 reported that around 41% of deaths worldwide are related to elevated body mass index (BMI).³ In Indonesia, the increased number of obesity is gaining together with some non-communicable diseases like diabetes, ischemic heart disease, and cerebrovascular disease as top cause of death, and the prevalence also increases over years in many provinces.^{1,4} The review from 129 studies concluded that overweight and obesity or overnutrition related to health problems also can affect the economy and link to economic burden. Besides losing money to cure the disease, persons also lose their productivity due to their absenteeism on work or even they lose their occupation due to long or permanent disability. From those facts, to prevent the impacts it needs seriousness to control obesity in the community.⁵

To tackle the problem, it seems that understanding factors related to nutritional status including obesity is needed. Diet is one of the important variables that accounts for obesity⁶. The rapid trend of obesity is correlated to unbalanced energy intake and poor quality diet.⁷ Diet quality as a complex food intake which is consist of more than one nutrients/food groups was found related to nutritional status⁸. However, the fact about diet quality between urban and rural area is less consistant. Some references showed rural inhabitants have lower quality of diet, but some references showed they have better diet compared to urban inhabitants.⁹⁻¹² Other studies also proved that diet quality is associated with nutritional status altogether with other variables such as socio-economic and demographic^{9,10,13-16} and eating behavior, include meal frequency, breakfast habit, and eating out habit¹⁷⁻

²⁴. Therefore, a study about diet quality and its related factors is should be done to find strategy on reducing obesity in urban and rural area.

Most of studies found about diet quality are from outside Indonesia. It is known that studies regarding diet quality in Indonesia population is still lacking, especially looking for differences of diet quality in urban and rural setting. As pilot study, it can be conducted a study in a province that has certain criteria such as has high population density, has urban and rural area, has obesity prevalence above national prevalence, and is at the top province with non-communicable diseases.

East Java can be chosen as study population about diet quality in Indonesia considering the following characteristics: it is high dense province; it has megapolitan city as urban society and districts that very depend on agriculture as rural society; it has high number of non-communicable disease cases.¹ A published study about diet quality in East java is also not found yet. Thus, diet quality study is suggested to be conducted in East Java together with study about eating behavior that is still questionable. As an additional, the study supposed to give information the difference of diet quality of people living in urban and rural area, also how the association of eating behavior and diet quality.

In brief, diet is responsible for the occurence of obesity. Thus, conducting a study about diet quality and eating behavior is recommended to support obesity reduction in East Java, as part of Indonesia. Result of the study is expected to find the differences of dietary behavior between urban and rural area also give recommendation to improve dietary behavior that influence to health and nutritional status.

1.2. Problem Statement

The number of overnutrition especially obesity has been increased rapidly in Indonesia. Dietary behavior is one of keys that has responsibility to the nutritional status. There is a need to study about diet quality and eating behavior since literatures show its relationship, but not clearly show the differences between urban and rural society. East Java can be chosen as study site because it is top high dense province, also has megapolitan city as urban society and districts that very depend

on agriculture as rural society and has high number of non-communicable disease cases.

1.3. Research Question

- a. How is the diet quality of adults living in urban/rural area of East Java?
- b. Is there any significant difference of diet quality of adults living in urban and rural area of East Java?
- c. How is the association between diet quality and eating behavior among adults living in urban/rural area of East Java?

1.4. Hypothesis

- a. There is significant difference between diet quality of adults living in urban and rural area of East Java ($p < 0.05$)
- b. There is significant association between eating behaviors (breakfast habit, meal frequency, snacking habit, eating out habit) and diet quality of adults living in urban and rural area of East Java ($p < 0.05$)

1.5. Objective of the study

1.5.1 General objective

To assess eating behavior and diet quality and its association among adults living in urban and rural area of East Java

1.5.2 Specific objective

- a. To assess socio-economic and demographic characteristics and nutritional status of adults living in urban and rural area of East Java
- b. To assess diet quality between adults living in urban and rural area of East Java
- c. To assess eating behavior of adults living urban and rural area of East Java
- d. To assess association of eating behavior and diet quality among adults living in East Java.

1.6. Benefit of the study

The study will provide information about current diet quality and eating behavior among adults living in urban and rural site of East Java, also how the association of

diet quality and eating behavior. For academic, this study will give an example the use of specific index to measure diet quality in Indonesia. Stakeholders (government) also can read the details and see what should be improved or what is already good in result and recommendation part.

CHAPTER 2

LITERATURE REVIEW

2.1. Diet quality

Before discussing about the term used “diet quality”, we should understand the definition of diet. According to dictionary^{25,26}, “diet” has more than one meaning. Firstly, diet means “as foods or drinks that habitually consumed”. Another definition, diet is “special course of food or eating plan that restrict certain type of food to lose weight or due to medical reasons”. In community nutrition field, academics often use the first definition to observe what people eat routinely. Some researchers even were curious to study the relationship between diet and other issues such as its influencing factors or its outcomes. Eventually, the topic about diet quality has arisen since long time ago.²⁷

Defining diet quality is simply difficult to do because no single static definition exists. From numerous studies, the experts found that the terminology surrounding the diet quality is quite broad and confusing to clarify what precisely compose a high-quality diet. In general understanding, people believe that high-quality diet should meet the recommendation, such as in nutrition field, a good diet should prevent from malnutrition, especially overnutrition that has been trending nowadays. In fact, the use of specific term mostly depends on the objective of the study also the background of the researchers whether dietitians, public health decision makers, sociologists, economists, or food industry producers. Example of terminology used in diet study are healthy diet, balanced diet, nutritious food, optimal nutrition, functional foods, overall health promoting diet, nutrient-rich foods, and others.^{27,28}

2.2. Assessments of diet quality

To assess diet quality, most of researchers put certain nutrients that should be eaten or not eaten in daily life. They have their own consideration choosing method that is suitable for specific objective, also specific population. The first study about diet quality was held by Patterson *et al.*²⁹ in 1994. Since the development tool to measure diet quality, other researchers have been reviewing various tools or competing to build a valid method that can be used by community. However,

basically, measuring dietary pattern can be done by two kind of strategies: ‘a priori’ of theoretically defined indexes of diet quality and ‘a posteriori’ or empirically derived dietary patterns³⁰.

Theoretically defined indices of diet quality are composed of nutritional variables, general nutrients and foods or food groups that are believed as healthful or baneful. The index variables are counted to conclude an overall measure of diet quality. There were many researches using this method since two decades ago. A predefined index of diet quality, another name of this method can be useful to evaluate the diet and compare the diet quality among subgroups within the population. Normally the index would be a high potential to predict health outcome that contribute to ‘healthiness’³⁰.

Different with the first method, the second method uses statistical approaches (i.e. factor and cluster analysis) to generate patterns from collected food intake data. However, this method rises some comments. There are some studies where dietary patterns have been obtained by doing factor or cluster analyses showed positive and/or negative relationship with dietary patterns and specific outcome. This method looks like succeed to differ healthy and less healthy diet patterns, but if a dietary pattern obtained to be a risk factor for a certain disease, it is difficult to find detail explanation. Some previous studies could not find any relationship between factor or cluster with health outcome. The possible reason is the varied eating patterns or diets that found in study does not always represent the ideal one. The contribution either factor or cluster analysis to the construction of diet quality are questionable. Therefore, it is concluded that this method maybe not be very beneficial to evaluate diet quality rather than a predefined analysis method³⁰.

There are several a predefined analysis methods or predefined indices applied in previous studies. However, it needs more attention on the differences between those indices. To conduct a study, researcher should choose the most suitable index, considering study’s objective, setting, and resources. These are example of indices that might be suitable to this study.

2.2.1. International Diet quality index (DQI-I)

Before 20s century, quality of diet studies mostly conducted in specific population only. There was lack of validated tool for cross-national comparisons had restricted the ability to compare quality of the diet. Some researchers created a tool called the Diet Quality Index-International (DQI-I) for global assessment of diet quality across different nations. The main parts of index were variety, adequacy, moderation and overall balance. DQI-I has 100 as total score, but each component has different scoring range. Initially, this index conducted to cross-countries comparison between two settings, China and the United States of America.³¹ Review from Guerrero and Rodriguez³² in 2017 explained that DQI-I was developed to compare population with different eating habits and to assess their position in nutrition transition's stage.

Table 2.1 Components of DQI-I

Component	Score	Scoring criteria
Variety	0-20 points	
Overall food group variety (meat/poultry/fish/eggs; dairy/beans; grain; fruit; vegetable)	0-15 points	≥ 1 serving from each food group/d = 15 Any 1 food groups missing/d = 12 Any 2 food groups missing/d = 9 Any 3 food groups missing/d = 6 ≥ 4 food groups missing/d = 3 None from any food groups = 0
Within-group variety for protein source (meat, poultry, fish, dairy, beans, eggs)	0-5 points	≥ 3 different sources/d = 5 2 sources/d = 3 From 1 source/d = 1 None = 0
Adequacy	0-40 points	
Vegetable group ^{3,4}	0-5 points	≥ 3 -5 servings/d = 5, 0 servings/d = 0 $\geq 100\%$ < 100 -50% $< 50\%$
Fruit group ^{3,4}	0-5 points	≥ 2 -4 servings/d = 5, 0 servings/d = 0 $\geq 100\%$ < 100 -50% $< 50\%$
Grain group ^{3,4}	0-5 points	≥ 6 -11 servings/d = 5, 0 servings/d = 0 $\geq 100\%$ < 100 -50% $< 50\%$
Fiber	0-5 points	≥ 20 -30 g/d = 5, 0 g/d = 0 ≥ 100

Table 2.1 Components of DQI-I (Continued)

Component	Score	Scoring criteria
Protein ³	0-5 points	<100-50% <50 ≥10% of energy/d = 5, 0 g/d = 0 ≥100
Iron ^{3,5}	0-5 points	<100-50% <50% ≥100% RDA (AI)/d = 5, 0% RDA (AI)/d = 0 ≥100
Calcium ³	0-5 points	<100-50% <50% ≥100% RDA (AI)/d = 5, 0% RDA (AI)/d = 0 ≥100
Vitamin C ^{3,6}	0-5 points	<100-50% <50% ≥100% RDA (AI)/d = 5, 0% RDA (AI)/d = 0 ≥100
Moderation	0-30 points	<100-50% <50%
Total fat	0-6 points	≤20% of total energy/d = 6 >20-30% of total energy/d = 3 >30% of total energy/d = 0
Saturated fat	0-6 points	≤7% of total energy/d = 6 >7-10% of total energy/d = 3 >10% of total energy/d = 0
Cholesterol	0-6 points	≤300 mg/d = 6 >300-400 mg/d = 3 >400 mg/d = 0
Sodium	0-6 points	≤2400 mg/d = 6 >2400-3400 mg/d = 3 >3400 mg/d = 0
Empty calories foods	0-6 points	≤3% of total energy/d = 6 >3-10% of total energy/d = 3 >10% of total energy/d = 0
Overall balance	0-10 points	
Macronutrient ratio ⁷ (carbohydrate:protein: fat)	0-6 points	55-65 : 10-15 : 15-25 = 6 52-68 : 9 – 16 : 13-27 = 4 50-70 : 8-17 : 12 -30 = 2 Otherwise = 0
Fatty acid ratio (PUFA:MUFA:SFA)	0-4 points	P/S = 1-1,5 and M/S = 1-1,5 = 4 Else if P/S = 0,8-1,7 and M/S = 0,8-1,7 =2 Otherwise = 0

Source: Kim et al³¹

1. Values are the percentages of the sample in subcategories; 2. Abbreviations: RDA, Recommended Dietary Allowance; AI, Adequate Intakes; RNI, Recommended Nutrient Intake; MUFA, monounsaturated fatty acids; SFA, saturated fatty acids; P/S, ratio of PUFA to SFA intake; M/S, ratio of MUFA to SFA intake; 3. Used as a continuous variable; 4. Based on 7118 kJ (1700 kcal)/9211 kJ (2200 kcal)/11304 kJ (2700 kcal) diet; 1 kcal 4.1868 kJ; .5 Scoring system based on the AI value for China and RDA value for the United States; 6. Scoring system based on the RNI value for China and RDA value for the United States; 7. Ratio of energy from carbohydrate to protein to fat.

2.2.2. Healthy diet indicator

Huijbregts *et al*³³ initiated a measure of dietary pattern using a recommendation from WHO for chronic diseases' prevention. They proved that healthy diet indicator was associated with all-cause mortality in the analyses and sensitive for all countries involved (Finland, Italy, and Netherland) during 20 years of follow up.³³ In the study, Huijbregts *et al*³³ mentioned portion serving to consume some nutrients and food groups, such as: saturated fatty acids, polyunsaturated fatty acids, protein, complex carbohydrates, dietary fiber, pulse-nuts-seeds, monosaccharides and disaccharides, and cholesterol. However, the latest study by Jankovic *et al*³⁴ corrected the healthy diet indicator introduced by Huijbregts *et al*³³ with the updated WHO guidelines on diet and nutrition to prevent chronic diseases. Jankovic *et al*³⁴ focused on the following 7 components in order to improve the comparability with the similar study³⁵. Those components were moderation components (saturated fatty acids, mono-and disaccharides, cholesterol, moderation range (polyunsaturated fatty acid, protein), and adequacy (total dietary fiber, fruits and vegetables).

Table 2.2 Healthy Diet Indicator Components Based on the World Health Organization's 2003 Dietary Guidelines and Operationalization as Applied in the Consortium on Health and Ageing in 1988–2011

Variable	Standard (Lower Limit) for Minimum HDI Score of 0 Points	Standard for Maximum HDI Score of 0 Points	Standard (Upper Limit) for Minimum HDI Score of 0 Points
Moderation components:			
Saturated fatty acids, energy %	NA	<10	>15
Mono-and disaccharides, energy %	NA	<10	>30
Cholesterol, mg/day	NA	<300	>400
Moderation range components:			
Polyunsaturated fatty acids, energy %	0	6-10	>10
Protein, energy %	0	10-15	>20
Adequacy:			
Total dietary fiber, energy %	0	>25	NA
Fruit and vegetables, g/day	0	>400	NA

Source: Jankovic *et al*³⁴

2.2.3. Variety of diet quality indices

The other diet quality assessment tools can be seen on table 2.3 and summary of indices can be seen in table 2.4.

Table 2.3 Some existing diet quality indices

Index	References
Diet Quality Index (DQI)	Patterson <i>et al.</i> (1994)
Adapted Diet Quality Index (DQI-a I)	Drewnowski <i>et al.</i> (1996)
Adapted Diet Quality Index (DQI-a II)	Drewnowski <i>et al.</i> (1997)
Revised Diet Quality Index (DQI-R)	Haines <i>et al.</i> (1999)
International Diet Quality Index (DQI-I)	Kim <i>et al.</i> (2003)
Healthy Eating Index (HEI)	Kennedy <i>et al.</i> (1995)
HEI-2005	Guenther <i>et al.</i> (2008)
HEI-2010	Guenther <i>et al.</i> (2013)
Mediterranean Diet Score (MDS)	Trichopoulou <i>et al.</i> (1995) Trichopoulou <i>et al.</i> (2003) Hu <i>et al.</i> (2002)
Mediterranean Dietary Pattern adherence index (MDP)	Sanchez-Villega <i>et al.</i> (2002) Martinez-Gonzalez <i>et al.</i> (2004)
Cardioprotective Mediterranean diet index (Cardio)	Gerber (2006)
Mediterranean-Dietary Quality Index (Med -DQI)	Rumawas <i>et al.</i> (2009)
Mediterranean Style Dietary Pattern Score (MSDPS)	
Overall Nutritional Quality Index (ONQI)	Katz <i>et al.</i> (2009)
Healthy Diet Indicator	Huijbregts <i>et al.</i> (1997) Huijbregts <i>et al.</i> (1998) Dubois <i>et al.</i> (2000) Haveman-Nies <i>et al.</i> (2001)
Dietary Variety Score	Fanelli and Stevenhagen, (1985) Fernandez <i>et al.</i> (1996) Drewnowski <i>et al.</i> (1996) Drewnowski <i>et al.</i> (1997) La Vecchia <i>et al.</i> (1997) Slattery <i>et al.</i> (1997) Fernandez <i>et al.</i> (2000) Bernstein <i>et al.</i> (2002)
Dietary Diversity Score	Kant <i>et al.</i> (1993) Drewnowski <i>et al.</i> (1996)

Sources: Waijer⁹, Carvalho³⁵

Table 2.4 Summary of diet quality indices

Index	Diet components/ difference between indice	Subjects of original study	Notes from former study
Diet quality index (Original DQI, DQI-a I, DQI-a II, DQI-R, DQI-I)	• DQI-a I excluded protein, sodium, calcium, fruit, vegetable, and starches, but added energy and alcohol in original DQI • DQI-a II added sodium into DQI-a I • DQI-R revised original DQI into some components: macronutrients, moderation, variety, proportionality • DQI was designed similar to DQI-R with some components: variety, adequacy, moderation, overall balance	DQI, DQI-a II, DQI-R → United States DQI-I → United States and China	• DQI: Lower index scores positively associated with vitamin and mineral intakes and negatively associated with fat intake (Patterson <i>et al</i>, 1994) • DQI-R: Moving from lowest to highest group of scores: significant improvement in all components of DQI-R (Haines <i>et al</i>, 1999) • DQI-I: Many nutrients showed strong relationships with index score (Kim <i>et al</i>, 2004)
HEI (Original HEI, HEI-2005, HEI-2010, HEI-2015)	• Differences of original HEI and HEI-2005: dietary assessment of HEI-2005 based density and introduces new components such as oils, beans, dark green and orange vegetables and legumes, also excluded some points such as variety, cholesterol, and total fat • Differences of HEI-2005 and HEI-2010: HEI-2010 added some items such as protein, refined grains, sodium, fatty	United States	• HEI positively correlated with intake of nutrients (Kennedy <i>et al</i>, 1995)

Table 2.4 Summary of diet quality indices (Continued)

	acids, empty calories, also deleted saturated fat and oils, and changed some food groups, i.e. meat and beans → beans group is separated with meat (to be total protein food also green and beans)		
	• Differences of HEI-2010 and HEI-2015: empty calories → changed with saturated fat and added sugar		
ONQI	• Focus on micronutrients (for food industry)	United States	• ONQI indicated favorable effects on purchase pattern and significantly correlated with diseases, includes diabetes, cardiovascular disease, and cancer (Katz <i>et al</i>, 2010)
HDI	• Focus on diet recommendation for preventing chronic disease by WHO	Europe	• Large variation in intake between three countries • Association of mortality only in men group (Huijbregts <i>et al</i>, 1997)
Mediterranean Dietary Index (MDS, Cardio, QDI)	• Difference of MDS and MDPS : scoring system of MDS follows guidelines, MDPS follows actual intake of population • MDP added some components of the diet as a relative percentage by using the	Europe , United States	• MDS: 17% reduction in mortality for 1 unit increase in the 8-point score (Trichopoulou <i>et al</i>, 1995)

Table 2.4 Summary of diet quality indices (*Continued*)

maximum and minimum Z-scores of the sample
• Cardio aimed to see the dose relationship between cardioprotective food items with myocadiac infarction • Med-DQI added original DQI components with oils

2.3. Diet Quality Index for Study in Indonesia

Comparing some tools might be beneficial before conducting study about diet quality in Indonesia. The tool used in the study should be linear with study's goal and be able to examine diet in specific areas that might have different characteristics. To compare the tools, it can be done by reviewing the previous studies.

Most of the studies developed diet quality tools in outside Asia. Started with DQI, DQI-a II, DQI-R, ONQI, and HEI, used American population as the subjects.^{29,36-38} Meanwhile, Mediterranean Diet, DQI-a I, and HDI were located in European countries. The only one study that tried to measure Asia population was DQI-I.

In term of possibility to use the specific tool for Asia population, especially Indonesia, DQI-I and HDI can be considered. Since DQI-I's used many Asian countries in the studies, the former objective of DQI-I study was to compare two different populations, and it showed the significant association between the index and many nutrients.³⁹ DQI-I also refers to international recommendation and specific recommendation (RDA) in each countries. Whereas, HDI was arranged from global recommendation of prevention for chronic diseases by WHO, so that hopefully can be applied in all countries. Both of DQI-I and HDI also have general components of scoring, and it is not really into specific diet, such as various Mediterranean Diet indices for Mediterranean diet style and HEI for American diet style.

Actually, some researchers refer to HEI when they conduct a study about diet quality. They tried to adapt or even use the original index by United States. However, if we see into the lists, some components are questionable for Indonesia society, for example, dairy consumption. As we know, dairy consumption was not available in Indonesia Dietary Recommendation⁴⁰, because it is not routinely consumed by Indonesian population. Therefore, even though it can still be used in Indonesia, but it might ruin the score for dairy consumption in diet quality scoring system.

In brief, it can be understood that not all indices are recommended to measure diet quality in Indonesia. Some consideration might be arisen, such as the

objective, components of the index, and results from former studies. From the review, two possible tools recommended for Indonesian study are DQI-I and HDI. However, table 2.6 shows how DQI-I seems more suitable to assess diet quality of Indonesia population.

Table 2.5 Comparison of DQI-I and HDI

DQI-I	HDI
Components: Variety -Overall food group variety (meat/poultry/fish/eggs; dairy/beans; grain; fruit; vegetable) -Within-group variety for protein source (meat, poultry, fish, dairy, beans, eggs) Adequacy -Vegetable group, Fruit group, Grain group, Protein, Iron, Calcium, Vitamin C Moderation -Total fat, Saturated fat, Cholesterol, Sodium, Empty calories foods Overall balance -Macronutrients ratio (carbohydrate: protein: fat) -Fatty acid ratio (PUFA: MUFA: SFA)	Components: Moderation components -Saturated fatty acids, energy % -Mono and disaccharides, energy % Cholesterol, mg/day Moderation range components -Polyunsaturated fatty acids, energy% -Protein, energy % Adequacy -Total dietary fiber, energy % -Fruit and vegetables, g/day
From the components can be seen it is more complex than HDI	From the components can be seen it is simpler than DQI-I
Separates fruit and vegetable	Combines fruit and vegetables
Includes micronutrients adequacy	Does not include micronutrients
Mostly used by Asia countries	Mostly used by European countries
Study by Kim <i>et al</i> offers the use of DQI-I to assess cross-national diet quality that have different culture and economic condition	Study Jankovic <i>et al</i> recommends to confirm HDI in non-Western population such as Asia, Africa, and South America that have different dietary pattern
Even though the founder of tool claims the use of DQI-I to assess chronic disease but the findings related diseases are still lacking/ not clear	Since the beginning, HDI mostly used to assess morbidity/mortality/biomarkers and some studies found the association, although it took more time since mostly as cohort studies
Scoring system also consider cut off from specific RDA	Scoring system use cut off that already set

DQI-I is preferred to use in the study among Indonesia community since it contains of wider components, not only for the adequacy but also variety, moderation, and overall balance. It is also already used to examine in Asian countries. The nutrients included in the index also consider recommended allowance from each country that might differ across countries.

2.4 Eating behavior

2.4.1 Eating behavior definition

There is no certain and clear definition of eating behavior. Every person has perception to define the meaning of eating behavior. In a book with the title *Encyclopedia of Behavioral Medicine*, Lara LaCaille puts statements that “Eating behavior is a broad term that encompasses food choice and motives, feeding practices, dieting, and eating-related problems such as obesity, eating disorders, and feeding disorders. Eating behavior is complex; humans make hundreds of food decisions each day that are influenced by a variety of personal, social, cultural, environmental, and economic factors”.⁴¹ In addition, Gahagan also states that the development of human eating behavior relies on combination of biological context of eating regulation and other factors such as parental influence and social context, that is built since infancy to further life stage.⁴²

After understanding how experts define the term of eating behavior, the remaining question is about the importance of eating behavior. From previous study we get some explanations. Human body needs nutrients from food to maintain their health. What they eat will show their quality of diet and directly affect their biological function or can be seen on a biological level. However, how good their diet will depend on how they behave regarding food or called as eating behavior, that informed vary among different population^{15,43}.

2.4.2 Association of eating behavior and diet quality

To dig more knowledge about eating behavior, some researchers have done some studies regarding its association with diet quality.

2.4.2.1 Meal frequency and diet quality

Recently, a paper in 2016 published a study about meal frequency diet quality. Using Dietary Guidelines Index (DGI) of Australian, Leech *et al* investigated the

difference of eating 1-2 times per day and ≥ 3 times per day, also its relationship with DGI and specific nutrients intakes. They also assessed eating occasion (EO) or total frequency of eating (snack and meal) with diet quality. Overall result showed that meal frequency was conversely associated with micronutrient intakes and overall diet quality. Also, a higher frequency of all EOs and meals was positively associated with food variety, fruits, and dairy foods in DGI-2013.¹⁸ In different setting, other study about meal frequency and diet quality had done by Murakani and Livingstone. This study was done in United States using Healthy Eating Index 2010 (HEI-2010). The more frequent meals eaten per day was higher modestly and positively associated with higher score of HEI-2010, not only in women but also in men.¹⁷

2.4.2.2 Skipping breakfast and diet quality

Breakfast is often talked as the most important meal in a day, even though there is unclear definition of breakfast. In systematic review, O'Neil *et al* found one common definition that breakfast is first meal of the day. Other studies mention time of eating should be during 6 am and 9 am, also it should not coffee or tea.⁴⁴ However, the definition of breakfast is very depend on the personal perspective. To avoid the confusion among researchers and participants, it might let participants define breakfast by their selves.

As mentioned before, breakfast is familiar as very important meal. The summary of breakfast studies found that eating breakfast has good impression on cognitive performance and feelings of wellbeing, and diet quality. Breakfast is also important in weight management and reduce risk of non-communicable diseases such as: cardiovascular disease, dyslipidemia, and type 2 diabetes mellitus.⁴⁴

Regarding diet quality, skipping breakfast was reported positively associated with poor diet quality. People who rarely eat breakfast consume more energy from fat compared to people who eat breakfast regularly.¹⁹ People also tend to consume low protein, vitamin, and mineral. Whereas, breakfast eaters are more likely to consume more fiber and consume lower fat and sugar.⁴⁵

2.4.2.3 Eating out and diet quality

In this century, the trend of eating outside home has been discussed by many expertise in many countries. An example of a global public relations and communications agency who was involved in research about eating out is Weber Shandwick. In 2015, Weber Shandwick Asia created *Asia Pacific Food Forward Trends Report* from an online survey through 4 leading countries: Australia, China, Korea, and Singapore. Except Australia, the three countries showed less than fifty-percent of people eat home-cooked meals in most days.⁴⁶ However, currently the terminology of eating out is not only about home-cooked meals, but also meals that should be eaten at home. Therefore, people who eat their meals outside house already classified as eating out, such as eating in car on the way to work, eating in a restaurant, and eating in the canteen.⁴⁷ In the third sector, Poulain explains that taking meals in office has increased due to some considerations and time management as the first reason.⁴⁸

To see the effects of eating out, some researchers have conducted studies with diet quality as the income. First example is study by Todd *et al*, on behalf of United States Department of Agriculture. From that study, eating out or commonly called as food away from home (FAFH) in United States is proved increasing daily calorie and reducing diet quality.²⁰ Other studies also had result that taking home-cooked meals at dinner time was associated with greater diet quality.^{21,22} Home-cooked meals are lower in carbohydrates, fat and sugar. It also leads people to consume fewer calories away from home, consume less fast food, frozen and ready-to-eat meals.²²

2.4.2.4 Snacking habit and diet quality

In the study about snacking habit, definition about snack may be questionable and lead question about differences with meal. A literature review by Hess *et al* mentioned some operational definitions in several publications. Some publications defined “snack” are according to the time, type of food, amount of food, location of food, or put some factor together.⁴⁹ However, let subjects differentiate snack or meal based on their own perception may be more useful to see the difference with meal.¹⁷

A study in UK, snack frequency was associated with high consumption of confectionery and alcohol, but lower in cereal, protein, fat, and dietary fiber consumption. It was also associated with lower healthy diet score.⁵⁰ Using different tool, Zizza *et al* investigated the association between snacking and diet quality using healthy eating index. From their study they found that snacking has modest association with overall diet quality score.²⁴

2.5 Urban and Rural Population

The term “urban” and “rural” commonly used to compare between two populations. However, the definition among some studies may have differences, include the way to classify. Some approaches used to classify urban and rural population are determine based on the number of populations per area, number of inhabitants per km² or called as population density, and the others use specific criteria based on the institution or country who made the study.^{51–53}

In Indonesia, the definition of urban and rural setting follows the government’s laws. The Law No. 32/2004 on Local Governance is referred by The National Development Planning Board (Bappenas) to determine three administrative categories of urban areas. These categories are: 1) urban areas as autonomous regions (city governments); 2) urban areas within district boundaries (district capital towns); and 3) urban areas spilling over into one or more adjacent administrative areas. Both city and district/regency have the same status as administrative government, but in district/regency predominantly has agriculture as main occupation. An area that has agriculture as main activities is considered as rural area.⁵⁴

Some literatures mention that urban and rural population have different characteristics. A systematic review from 17 Indonesian studies shows that urban population is strongly associated with overweight an obesity in all stages. In adults aged 19-55 years, chance of being overweight and obesity is higher in urban rather than in rural.⁵⁵ Other study mention that overnutrition in urban area are influenced by multifactors coming together such as age, marital status, food consumption and physical activity. Adults in urban population tend to have frequent consumption on high fat and high-densed energy food, also have low physical movement or high sedentary lifestyle.⁵⁶ Moreover, urban population tend to spend money for

convenience foods more than their rural counterparts. They have closer access to ready access to food retail outlets, street vendors (particularly in poorer areas) and marketing campaigns. So, they are more exposed to highly processed and non-traditional foods. Modernization seems play in trade liberalization, foreign direct investment and advances in technology. It made (ultra) processed food and sugar-sweetened beverages more widely exist in urban population⁵⁷

In term of diet quality, a study in outside Indonesia showed there were differences among adults living urban and rural.⁹ A study by Suliga also found similar results although they focused on women reproductive age only.¹⁰ However, other gender specific study showed no differences in the index between urban and rural women¹¹. Different findings from several studies can be understood because each study used different index to assess diet quality.

2.5 Previous diet quality studies in Indonesia

In publication, the studies use the term “diet quality” among adults in Indonesia are still lacking compared to studies in other countries especially for developed countries like United State, Canada, and Australia. From literature review with specific keyword “diet quality, adults, Indonesia”, there are some studies found, such as study by Muslihah et al⁵⁸, Salim⁵⁹, Dewi and Dieny⁶⁰. However, there are studies by Amrin *et al*⁶¹, Perdana *et al*⁶², and Ilmia⁶³ that also aim to study about diet quality although they used different terminology or tool.

In study by Muslihah et al⁵⁸, they conducted a cross-sectional study which aimed to assess the diet quality and its relation to nutrition knowledge, body mass index (BMI), and socio economic status (SES) among adults person in Malang, East Java. To get information about diet quality, the researchers collect data of two non-consecutive 24-h dietary recalls and semi quantitative FFQ and analyzed it using dietary diversity scores, micronutrient adequacy score, prevention non-communicable disease score (according to WHO recommendation), and overall score of diet quality by combining three scores. The results found that most subjects were middle SES, normal and overweight. The study also found no correlation between diet quality and all variables except nutrition knowledge score

The other studies of diet quality applying different method were conducted by Salim⁵⁹ and Dewi and Dieny⁶⁰. Both studies had adolescents as their subjects and chose Diet Quality Index-International (DQI-I) as the method. At the first study by Salim⁵⁹, she conducted a study which aimed to compare diet quality among overnutrition adolescent school girls with the normal nutritional status in Central Jakarta, DKI Jakarta. Whereas, Dewi and Dieny⁶⁰ had goal to analyze the relationship between diet quality and energy density with body mass index among adolescents in Semarang, Central Java. The first study obtained information that over nourished adolescent school girls had lower balance score, consume less energy, protein variety, fatty acid ratio and vegetables. Also, the study found the overall balance quality component was associated with overnutrition. The second study found significant association between diet quality with energy density also energy density with body mass index.

In 2017, Ilmia preferred to using healthy eating index in her study. She aimed to see the association between healthy eating index and nutritional status of women across two seasons in rural area of Central Sulawesi. During two harvest seasons, the study asked about 24-h recall and took blood assessment to see the anemia status besides using body-mass index. The study proved the significant association between nutritional status and healthy eating index during lean season and harvest season.⁶³

Different with study above, Amrin *et al*⁶¹ and Perdana *et al*⁶² tried to develop an specific index for Indonesian, but it was gender specific and could not be generalized for all adults population. Also, both studies did not associate its index with other specific outcomes such as diseases or health states. It seems the index still needs more development until it is useful for general population and to associate with other outcomes.

2.5 Factors associated with eating behavior and diet quality

Ferranti *et al*¹⁵ in their study made a framework (figure 2.1) that show how diet quality influenced by multi-factors. In short, it can be understood if internal and external factors shape an eating behavior, then it will determine the quality of human diet. Originally, the framework by Ferranti *et al* was adapted from study by

Story *et al.*⁶⁴ However, the previous framework did not mention about diet quality, but it put more factors that influence eating behavior.

In Contento's book, he said that, "Eating behaviors are acquired over a lifetime, and changing them requires alterations in these behaviors for long term-indeed permanently." Thus, understanding how people shape their dietary behaviors is important, especially when people intend to give nutrition education in individual or community, because it is the long-life experience that may have some considerations conflicting their behavior.⁶⁵

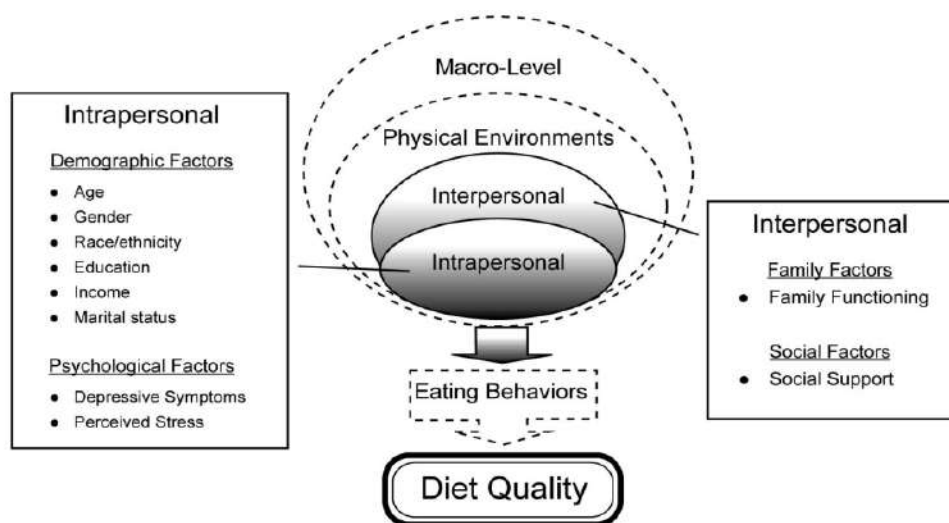


Figure 2.1 Framework of diet quality by Ferranti *et al*¹⁵

Besides understanding determinants of diet quality through framework above, some studies also mentioned variables that affect to diet quality. Even though it might use different methods and subjects, the findings showed some similarities. The details are showed in table 2.6.

Table 2.6 Variables that were found significantly associated with diet quality from several studies

No	Variables	Findings
1.	Gender	Women had better diet quality than men ^{13,66-68}
2.	Economic status	People living in socio-economically disadvantaged areas had poorer diet quality scores ¹³⁻¹⁵
3.	Education/knowledge	Greater education and better diet knowledge were positive independent determinants of a good quality diet ^{14,69-71}
4.	Nutritional status	People with healthy weight has better diet quality compared to underweight, overweight, obese people ¹³
5.	Smoking habit	Non-smoking person had higher diet quality ¹³
6.	Meal frequency	Eating three meals per day had positive impact to diet quality ^{69,72}
7.	Eating alone	Men and women eating alone consumed significantly more fat spreads ⁷³
8.	Breakfast habit	Rare breakfast eater group had consumed less rice, potatoes, vegetables, fish and shellfish, milk and dairy products, and sweets, daily energy, dietary fibre, calcium, and potassium. The percent energy from carbohydrates was lower and fat intake was higher in this group compared to regular and often breakfast eaters ¹⁹
9.	Age	The adolescents had the worst <i>diet quality</i> compared with adults and older age ⁷⁴ ; Young adults (18-24 years) had lower diet quality compared to the older age ¹³ ; Adult aged 60 years ate a better-quality diet than did the younger adults ⁷⁵
10.	Social support	Higher social support (assessed by Social Support Instrument) lead to have better diet quality ¹⁵ ; Lack of social support was the most common barrier for healthy eating ¹⁶
11.	Dwelling	There were no differences in the total Dietary Guidelines Index for urban and rural women in Australia ¹¹ ; Higher diet quality generally in urban compared to rural women ^{9,10} ; Percentage of households met WHO recommendation and had recommendation compliance index 0.95-1 was higher in rural area compared to urban area ¹²
12.	Food price	The cost to purchase healthy foods was included as a barrier to healthy eating ⁷⁶ ; Nutritional quality (energy density decreased, mean adequacy ratio (MAR) increased) improved after price was manipulated ⁷⁷

2.6 Theoretical Framework

Theoretical framework used in the study is adapted from several studies^{15,24,45,64,65,73}

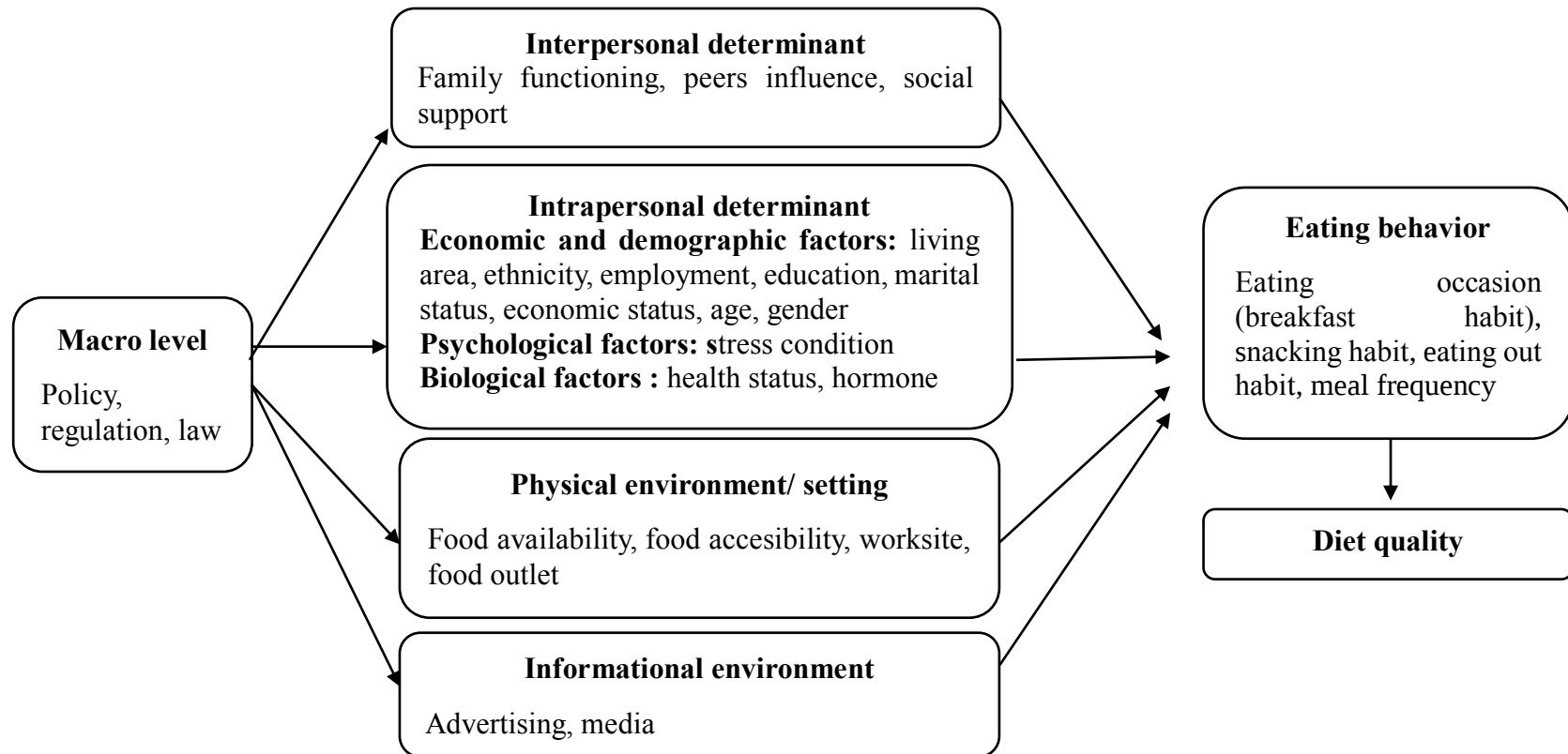


Figure 2.2. Theoretical framework

2.7 Conceptual framework

To make it more focused, the study only considers some variables that have role to diet quality.

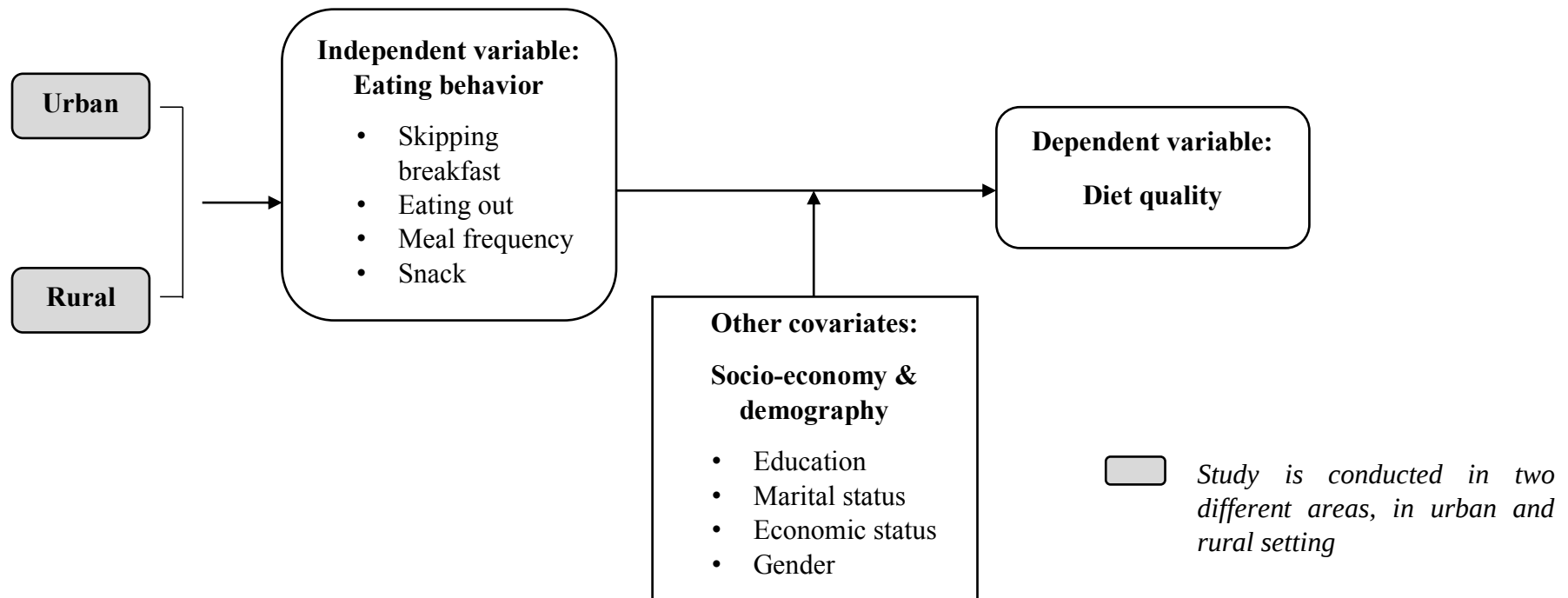


Figure 2.3. Conceptual framework

CHAPTER 3 METHOD

3.1. Study Design

The study was designed as observational study, a comparative cross-sectional study. All data needed in the study were collected at the same period. This study was part of big study about socio-cultural and economic drivers of protein transitions in South-East Asia (SCRIPT) conducted by SEAMEO RECFON and its collaborators.

3.2. Area and Time of the Study

Data collection had been conducted in East Java, Indonesia in February-March 2018. Two cities, *Kota Surabaya* and *Kabupaten Lumajang* were selected to represent urban and rural setting. Surabaya is a megapolitan city and capital city of East Java Province. Whereas, Lumajang is one of regencies in East Java that has agriculture activity as main occupation, around 150 kms or 4 until 5 hours to be reached from Surabaya.

3.3 Material of the Study

3.3.1 Population and subject

Population of the study was targeted for adults living in *Kota Surabaya* and *Kabupaten Lumajang*. The subjects were decided according to criteria mentioned below.

3.3.2 Criteria of Subject

To be involved in the study, person had to meet the inclusion criteria that were: 1) classified as adult aged 19 – 64 years, 2) not in pregnancy or lactating state, 3) not in diet restriction due to certain disease in the last one month, 4) not showing unusual diet such as consuming certain diet products (as meal substitute). In the SCRIPT study, gender was equally recruited, so it affected to percentage of women and men in the final analysis. Since the umbrella study included people aged >64 years also lactating and pregnant mothers, so some people were excluded from the study.

3.3.3 Sample size and sampling procedure

3.3.3.1 Sample size

The components of the formula used in the sample calculation were following findings from previous study which had similar variables. There were two formulas used in the sample calculation: 1) hypothesis testing between 2 means for comparing diet quality in urban and rural setting, 2) hypothesis testing between 2 proportions for assessing association of eating behavior and diet quality. Included in the calculation was design effect (D_{eff}) to increase heterogeneity of the subjects, which is 2. Some calculations were already conducted using data from available studies. The highest result of sample size calculation was mentioned in table 3.1. Since study about eating behavior was limited, calculation of sample size using other variables could not be determined. However, this study found power of the study for meal frequency and snacking frequency achieved 90%.

Formula of hypothesis testing between 2 proportions

$$n = \frac{\left(z_{1-\alpha/2} \sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right)^2}{(P_1 - P_2)^2}$$

P_1 = proportion of population 1
 P_2 = proportion of population 2
 α = level of significance (5%)
 β = power of the test (90%)

Formula of hypothesis testing between 2 means

$$\sigma^2 = \frac{[(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2]}{(n_1 - 1) + (n_2 - 1)}$$

$$n = \frac{2\sigma^2 [z_{1-\alpha/2} + z_{1-\beta}]^2}{(\mu_1 - \mu_2)^2}$$

n_1 = total subjects of population 1
 n_2 = total subjects of population 2
 s_1 = standard deviation of population 1
 s_2 = standard deviation of population 2
 μ_1 = mean of population 1
 μ_2 = mean of population
 α = level of significance (5%)
 β = power of the test (90%)

Table 3.1 Results of sample calculations

Variables	Source	N : 2 x n x D_{eff}
Diet quality in urban and rural	Ponce <i>et al</i> ⁷⁸	176
Diet quality and eating behavior (breakfast)	Smith <i>et al</i> ⁴⁵	70

N: total sample for two study sites after multiplied by design effect, n: total sample from formula, D_{eff} : design effect,

3.3.1.2 Sampling procedure

East Java was chosen purposively according to total population in all provinces in Indonesia. It is included at provinces that give high contribution for total Indonesia population. Whereas, to represent urban setting, the capital city or *Kota Surabaya* is selected as study site. Because there are more than one rural setting existing in East Java, so that the selection of urban setting was done using simple random sampling until it obtained *Kabupaten Lumajang* as rural site of the study. Whereas, to select the subjects involved in the study, the methodological approach was based on multi-stage random sampling.

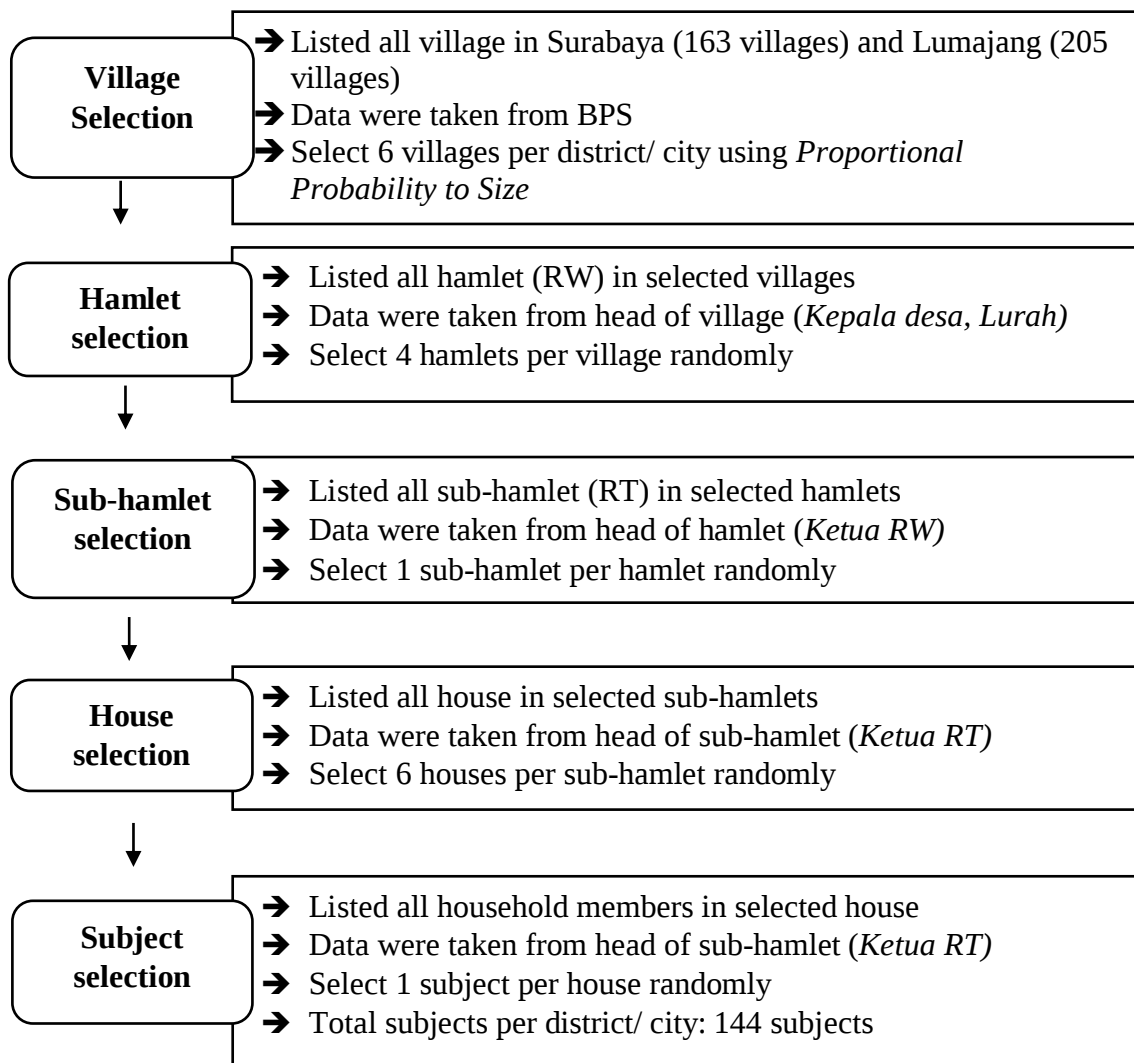


Figure 3.1. Sampling flowchart

Total subjects were collected in the SCRIPT study was 144 per study site or 288 subjects from two study sites. However, some subjects were excluded in the diet quality study since they were aged more than 64 years, in pregnancy/lactating state, or showing certain diet. In final analysis, misreporters were also excluded from the study.

3.4 Instrument of The Study

Data collection of this study consists of interview about socio-demography and economy characteristics, food intake (24-h recall) and eating behavior, also anthropometry assessment. To support data collection activity, there were some instruments used. The details of data collection tools can be seen on table 3.3.

Table 3.2 Instruments of data collection

No.	Instruments	Purpose
1.	Structured questionnaire	To obtain socio-demography and economy data
2.	24-h recall questionnaire	To assess food intake
3.	Diet Quality International Index questionnaire	To score diet quality of food consumed by respondents
4.	Food Photograph Book	To help estimating the amount of food consumed by respondents
5.	Eating behavior questionnaire	To obtain data about eating behavior
6.	Stationary (pen, paper, etc.)	To collect all data needed
7.	Weight scale and shorr board	To measure weight and height

After data collection, there were several tools used in the data entry and analysis. Raw-cooked conversion list, edible food weight list, and food oil absorption list were used in the study to determine food compositions. Others tools that used during dietary analysis were Indonesia Food Composition Table from PERSAGI, Fatty Acid Food Sources from PERGIZI Pangan, United States Department and Agriculture (USDA) Food Database, and Singapore Food Data

Base. Data entry and analysis were running by Nutrisurvey 2004 version and Microsoft Office (Microsoft Excel 2010 version), and SPSS 20 version.

3.5 Data Collection Procedure

There were some steps of the study:

1. Preparation

- a. Prepared ethical clearance and other permission
- b. Contacted key informants/PIC in the field
- c. Trained the enumerators
- d. Made schedule of interview and inform to PIC/subjects
- e. Prepared and distributed all logistics

2. Pretesting

Pretesting was conducted to practice the questionnaire and flow of data collection. Total samples involved in the pretesting was 30 respondents.

3. Anthropometry measurement

To find data about nutritional status, weight and height measurements were assessed using weight scale and shorr board. In weight measurement, subject took off stuffs that sticks on his/her body such as: jewelry, watch, shoes/sandals, wallet, handphone, belt, jacket, in order to get the actual body weight. After taking off some stuff, subject was asked to stand up on weight scale. Similar to weight measurement, in height measurement, subject must take stuffs that might disturb the measurement such as hat, shoes, or any stuff in between head and board. Height and height measurement was assessed two times.

4. First Interview

- a. Explained about the study and asked the participation to join the study
- b. Asked about socio-economy and demography using structured questionnaire
- c. Asked about food intake using 24-hour recall questionnaire and used food photograph to help in estimating the type of food and food portion
- d. Asked about eating behavior using structured questionnaire

4. Second interview

Asked about food intake using 24-hour recall questionnaire and used food photograph to help in estimating the type of food and food portion

3.6 Operational Definition

Details of variables and the indicators are explained in table 3.3

Table 3.3 Variable Indicators Matrix

No	Variables	Definition	Indicators	Methods	Instruments	References
1	Socio-economy and demography		Type of data: categorical	Interview	Structured questionnaire	IDHS ⁷⁹ , Petry ⁸⁰
	-Economic status	Economic status according to wealth status (determined by giving scoring of ownership of goods and housing condition)	Wealth status: tertile 1 (the poorest), tertile 2, tertile 3			
	-Educational level	Educational level according to history of last education	Lower education (never attend school or ever attend elementary school), secondary education (ever attend high school), higher education (ever attend diploma/university)			
	-Gender	Gender of subject according to personal confession or ID card	Gender: men, women			
	-Living area	Type of living area in the last 6 months	Current living area: urban, rural			
	-Marital status	Marital status according to personal confession	Marital status: yes, no			
	-Age	Age in years according to ID card or personal confession.	Age group :19-29 years, 30-49 years, 50-64 years			

4 Table 3.3 Operational Definition (*Continued*)

No	Variables	Definition	Indicators	Methods	Instruments	References
	-Occupation	Occupation according to personal confession.	Occupation classifications: -Professional/skilled workers, executives -Staff administration, operational staff -Sales/ service workers, traders -Farmers -Labours, drivers -Students -Housewives -Not working			
2.	Eating behavior		Type of data: categorical	Interview	Structured questionnaire	Azadbakht <i>et al</i> ⁴⁵ , Holmes and Roberts ⁸²
	-Meal frequency	Total meals consumed in one day (yesterday)	Meal frequency: ≤ 2 times, 3 times, >3 times			
	-Snacking frequency	Total snacking time in one day (yesterday). Called as snack whatever it is, it is according to subject's perception	Snacking frequency: No snack, 1-2 times, ≥ 3 times			
	-Eating place	Place of eating (breakfast, lunch, dinner)	Breakfast/lunch/dinner: at home, outside home			
	-Breakfast habit	Subject's habit whether she/he ate breakfast or not, in the last three days.	Never: always skip breakfast during 3 days, sometimes: skip 1-2 breakfast during 3 days; always: never skip breakfast during 3 days			

5 Table 3.3 Operational Definition (*Continued*)

No	Variables	Definition	Indicators	Methods	Instruments	References
3.	Diet quality	Assessment of diet using diet quality index – international (DQI-I)	Type of data: numerical Score per component: variety, adequacy, moderation, overall balance, and total score	Interview	24-h recall questionnaire, DQI-I questionnaire	Kim <i>et al</i> ³¹
4.	Nutritional status	Nutritional status according to body mass index (BMI)	Type of data: categorical Above median: total diet score > median Type of data: categorical Underweight = BMI <18.5 Normal = BMI 18.5-22.9 Overweight = 23.0-24.9 Obese 1 = $\geq 25.0 - 26.99$ Obese 2 = ≥ 27	Anthropometric measurement: height, weight	Shorr board, weight scale (SECA)	WHO for Asian population ⁸¹

5.3 Data Quality Assurance

Some strategies were conducted to ensure data quality of the study, starting from the preparation, during data collection activity, until data analysis phase. Questionnaire used in the study had been tested, nutritional status measurement tools also had been calibrated during preparation. In term of human resources, local enumerators were recruited to minimise information bias. There was also enumerator training before data collection, and daily briefing in every data collection. In addition, the completeness of data was monitored by field supervisor. After data gathered from the field, data entry was done by some people who already trained to input questionnaire into SPSS version 20 and nutrisurvey 2004 version.

3.8 Data Analysis and Data Presenting

Statistical analysis was done using SPSS 20 version. Before testing several hypotheses of the study, normality test had been done using Kolmogorov-Smirnov test. Data were considered as normally distributed if p-value >0.05.

3.8.1 Univariate analysis

This analysis was performed to obtain data about socio-economy and demography, nutritional status, eating behavior, and diet quality. Categorical data was presented through frequency distribution (n, %) and numerical data was presented using mean $\pm$ standard deviation (SD) or median (Nmin-Nmax) according to normality of the data.

3.8.1.1 Socio-economy and demography

To compare socio-economic and demographic characteristics, data were shown into different column: urban and rural. Goods ownership was assessed to capture economic status, using score “1” for yes and “0” for no. Type of fuels, floor, wall, and ceiling was also included in the measurement by giving score “1” for proper household conditions. And “0” for opposite conditions.

3.8.1.2 Eating behavior

Eating behavior was assigned using categorical data that shown in variable identification (table 3.4). Similar to data presenting about socio-economy and demography, eating behavior was informed across two areas.

3.8.1.3 Nutritional status

Average height and weight was used to calculate nutritional status. Nutritional status was classified from body mass index (BMI). Below is formula used to calculate BMI.

$$BMI = \frac{\text{weight (in kg)}}{\text{height (in m)} \times \text{height (in m)}}$$

3.8.1.4 Diet quality

Dietary assessment was analysed using average intake from 2x 24-h recall. There were four categories of DQI-I used in the study: variety, adequacy, moderation and overall balance. Below were steps of diet quality assessment:

1. Variety assessment

Variety assessment was done by seeing availability of food consumed in two intakes. In this component, type of food groups in general and type of protein source group were considered. Food exchange list in Ministry Health Regulation (Permenkes) No. 41 about balanced diet was used to help portion per serving. As an example, one serving of banana “*pisang ambon*” is 50 g. Food group could be assigned as “available” if served at least a half of serving size.⁵⁹ The availability of some food group had been scored as mentioned on table 3.5. Scoring for variety was conducted after counting an average intake of 2x 24-h recall. In data presenting, to make clearer, classification of scoring was combined into groups: 1-2 food group (s), 3-4 food groups, and 5 food groups.

2. Adequacy assessment

Adequacy scoring was conducted once by considering average ammount of vegetables, fruits, grain, fiber, protein, vitamin c, calcium, and iron consumed. To get score of adequacy, average intake was taken from 2 x 24-h recall intake. Cut off used in the study refered to PMK No. 41 about balanced diet, Indonesian Recommended Dietary Allowances (RDA), and Estimated Average Requirement (EAR). Fruits, vegetables, and grain cut off used in the study were following PMK No.41 recommendation. Whereas, cut off for fiber adequacy was in line with RDA. EAR was determined for assessing micronutrients such as iron, calcium, and vitamin c. According to Fahmida and Dylon⁸³, EAR is more preferable to assess individual inadequacy. This approach was also followed by previous study about

diet quality conducted by Salim.⁵⁹ RDA and EAR used in the assessment were gender and age specific. For fruits and grain scoring, weight and serving size also referred to food exchange list in PMK No.41. Each type of fruits and grain sources assessed in the study might be different according to food exchange list. As an example, one medium banana “*pisang ambon*” is 50 g and it is equal to 20 medium size of grapes (165 g). In data presenting, some groups of adequacy scoring were combined or deleted, for example no subject who did not achieve protein consumption below 50%, thus in data presenting only showed two groups: 50-99% and $\geq 100\%$.

3. Moderation scoring

Third scoring was moderation. To get score of moderation, average intake was taken from 2 x 24-h recall intake. In this present study, empty calories food was not included in the assessment since standardized list of empty calories foods in Indonesia was not available. Classification of foods that belong to empty calories foods was also still arguable. Cut off for fat, saturated fat, sodium, and cholesterol followed recommended cut off from original study. In data presenting, some groups of adequacy scoring were combined or deleted, for example no subject who did not consume sodium more than 3400 mg per day, thus in data presenting only showed two groups: ≤ 2400 mg/d and > 2400 mg/d.

4. Overall balance

Lastly, overall balance was conducted to score ratio of macronutrients and fatty acids based on ratio mentioned on table 3.5. To get score of overall balance, average intake was taken from 2 x 24-h recall intake. After that, each component was changed into percentage. Subjects got score if they should meet acceptable range for macronutrients ratio and fatty acids ratio. Otherwise, they were score by 0. In data presenting, classification of overall balance was also presented into groups: acceptable and not acceptable.

5. Total score

All components of scoring were combined into total score of diet quality. Subject was classified as good diet if had score $> 60\%$ of perfect score, but since not many subjects could reach this cut off, median score was chosen as cut off. Therefore, in the analysis there were two groups: above median group, below median group.

Table 3.4 Scoring of diet quality

Component	Score	Scoring criteria
Variety	0-20 points	
Overall food group variety (meat/poultry/fish/eggs; dairy/beans; grain; fruit; vegetable)	0-15 points	all food groups/d = 15 Any 1 food groups missing/d = 12 Any 2 food groups missing/d = 9 Any 3 food groups missing/d = 6 ≥4 food groups missing/d = 3
Within-group variety for protein source (meat, poultry, fish, dairy, beans, eggs)	0-5 points	3-5 sources/d = 5 2 sources/d = 3 1 source/d = 1
Adequacy	0-40 points	
Vegetable ^a	0-5 points	3 serving, no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Fruit ^a	0-5 points	2 serving, no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Grain/staple foods ^{a, b}	0-5 points	Follow government recommendation, no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Fiber ^c	0-5 points	RDA, no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Protein	0-5 points	≥10% of energy/d , no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Iron ^c	0-5 points	EAR, no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Calcium ^c	0-5 points	EAR, no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Vitamin C ^c	0-5 points	EAR, no consumption = 0 <50% = 1 50-99% = 3 ≥100% = 5
Moderation	0-24 points	
Total fat	0-6 points	≤20% of total energy/d = 6 >20-30% of total energy/d = 3 >30% of total energy/d = 0
Saturated fat	0-6 points	≤7% of total energy/d = 6 >7-10% of total energy/d = 3 >10% of total energy/d = 0

Table 3.4 Scoring of diet quality (Continued)

Component	Score	Scoring criteria
Cholesterol	0-6 points	≤ 300 mg/d = 6 > 300 -400 mg/d = 3 > 400 mg/d = 0
Sodium	0-6 points	≤ 2400 mg/d = 6 > 2400 -3400 mg/d = 3 > 3400 mg/d = 0
Overall balance	0-10 points	
Macronutrient ratio ⁷ (carbohydrate:protein:fat)	0-6 points	Acceptable range: 55-65 : 10-15 : 15-25 = 6 52-68 : 9 – 16 : 13-27 = 4 50-70 : 8-17 : 12 -30 = 2 Otherwise = 0
Fatty acid ratio (PUFA:MUFA:SFA)	0-4 points	Acceptable range: P/S = 1-1,5 and M/S = 1-1,5 = 4 Else if P/S = 0,8-1,7 and M/S = 0,8-1,7 = 2 Otherwise = 0

Abbreviation, PUFA = poly unsaturated fatty acid, MUFA = mono unsaturated fatty acid, SFA = saturated fatty acid, RDA = recommended dietary allowance, EAR = estimated average requirement

^aBased on PMK no.41

^bGrain recommendation were according to age and gender specific on PMK no.41, female: 19-29 years= 5 servings, 30-49 years= 4.5 servings, 50-64 years = 4.5 servings, male: 19-29 years= 8 servings, 30-49 years= 7.5 servings, 50-64 years = 6.5 servings

^cEAR (Estimated Average Requirement) were based on gender and sex specific on Indonesian RDA

3.8.1.5 Under and over reporting analysis

This study considered mis-reporting during dietary assessment since it could result of the study. Under and over reporting intake was based on predicted total energy expenditure (pTEE) by McCorry *et al.* Under reporters and over reporters were taken from calculation of EI_{rep} : pTEE. This present study used -2 SD or <40% as cut off for under reporting and +3SD or >190% as cut off for over reporting, after considering EI_{rep} of people in between range 40-190% were still acceptable for normal diet in those population, also considering total subjects in the study. Later, mis reporters were excluded from analysis of the study.

$$pTEE = 7.377 - (0.073 \times \text{age}) + (0.0806 \times \text{weight}) + (0.0135 \times \text{height}) - (1.363 \times \text{gender})$$

Note: Age (years); weight (kg); height(cm); gender (0 for males and 1 for females)

3.8.2 Bivariate analysis

Bivariate analysis had been ran to assess hypotheses of the study. Independent t-test/mann-whitney non-parametric test was done to compare means difference. Whereas, chi-square test/fisher's exact test was conducted to association using proportion such as association of eating behavior and diet quality. Significant association or differences were assigned if p -value was less than 0.05. Details of statistical analysis that had been done can be seen on table 3.6.

Table 3.5 Data analysis of the study

No	Independent variable	Type of data	Dependent variable	Type of data	Statistical analysis
1	Socio-economy and demography, nutritional status	----- Descriptive -----			
2	Diet quality: -total score -score of: variety, adequacy, moderation, overall ballance	Numeric	Living area	Categorical	Indepen dent t-test/ Mann-Whitney
3	Diet quality -diet quality (classification) -adequacy -moderation -overall balance	Categorical	Living area	Categorical	Chi-square/ Fisher's exact
4	Eating behaviour -meal frequency -snacking frequency -eating place: breakfast, lunch, dinner -breakfast habit	Categorical	Living area	Categorical	Chi-square/ Fisher's exact
5	Eating behaviour -meal frequency -snacking frequency -eating place: breakfast, lunch, dinner -breakfast habit	Categorical	Diet quality	Categorical	Chi-square/ Fisher's exact

3.8.3 Multivariate analysis

To see the magnitude of eating behavior related to diet quality, logistic regression was done by considering socio-economic and demographic characteristics. Variables that included in the multivariate analysis had $p < 0.25$.

5.5 Organization of the study

3.9.1. Organizational structures

The main organization in this study consists of three persons as below.

Main researcher	: Arindah Nur Sartika, S.Gz
Advisor 1	: Dr. dr. Fiastuti Witjaksono, MKM, MS, SpGK(K)
Advisor 2	: Ir. Helda Khusun, MSc, PhD

Table 3.6 Human Resources Allocation

Position	Person	Responsibilities
Main researcher	1	-Write proposal -Plan and prepare the administration and materials/instruments -Conduct training -Contact key informants -Conduct pretesting -Participate in data collection as one of field supervisor -Do data cleaning and analysis -Write report -Ensure and track progress of the study -Present study report and dissemination
Advisor	2	-Assist and advise the study process from preparation, data collection, data analysis, report writing, and dissemination
Field supervisor	2	-Supervise data collection in the field
Enumerator	8	-Attend training from researchers -As data collector in the field
Data entry personel	8	-Input data from questionnaire to computer

3.9.2. Ethical Consideration

This study already obtained permission from “FKUI Research Ethical Committee” and government from national level to local level. Moreover, this study also conducted by ensuring basic principal of bioethics, include asking voluntary participation from candidates of subjects, keeping confidentiality of study information, and avoiding harmful action to the participants.

CHAPTER 4

RESULTS

4.1. Subjects' Characteristics

Subjects of the study was taken from SCRIPT study (Socio-cultural and economic drivers of protein transitions in South-East Asia), focus on East Java, Indonesia. Of 288 respondents in the big study, 185 subjects were included in this study. Not all of subjects from SCRIPT study could be assessed since some criteria were not qualified for diet quality assessment, such as: elderly, lactating and pregnant women, subject without 2 x 24-h recall assessment, and mis-reporters intake. Procedure to select subjects from big study (SCRIPT study) can be seen as well in figure 4.1.

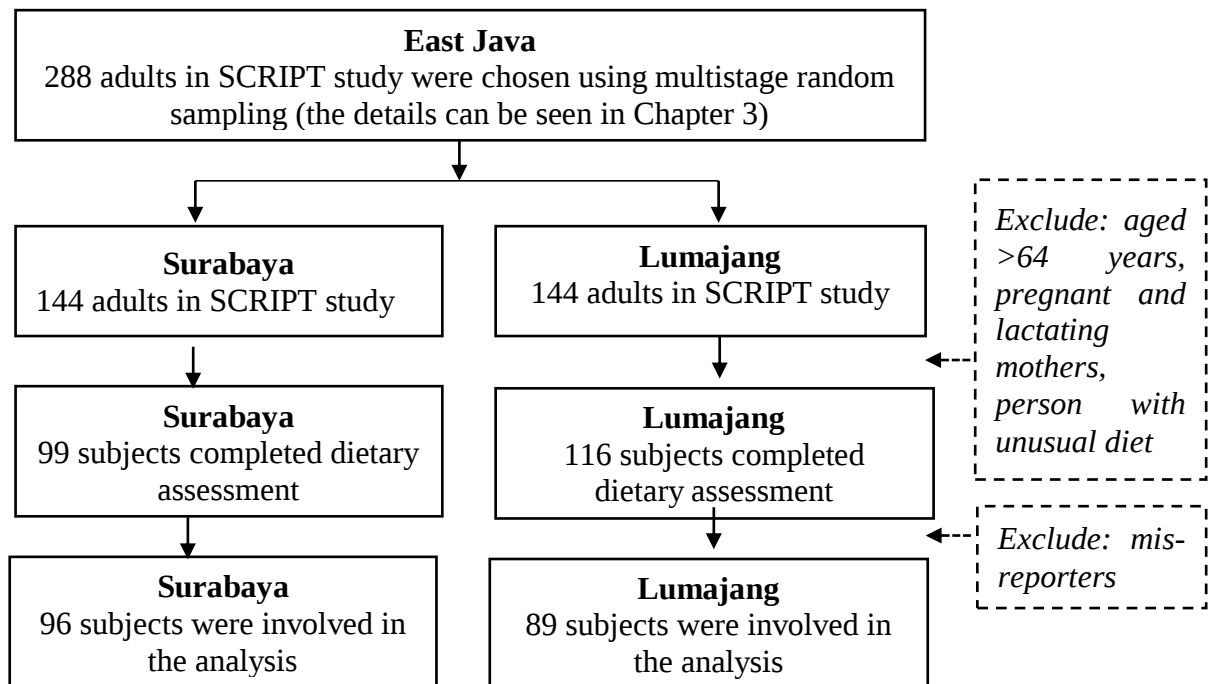


Figure 4.1 Final subject recruitment

The details of subjects' characteristics are shown on table 4.1. This study had almost similar percentage of gender composition in urban and rural area. In term of age group, group of people aged 30 – 49 in both study sites had the highest percentage among other two age groups. In further analysis, significant differences were found in marital status and educational level. No specific occupation dominates (>50%) two areas, but housewives group reached the greatest percentage

since data collection conducted in houses. In contrast, as second biggest percentage was skill workers for urban area, and farmers for rural area.

Table 4.1 Socio-economic and demographic characteristics of subjects

Variable	Urban ^a (n=96)	Rural ^a (n=89)	Total ^b (n=185)
Gender			
Women	49 (49.0)	48 (53.9)	97 (52.4)
Men	47 (51.0)	41 (56.1)	88 (47.6)
Age			
19-29 years	34 (35.4)	38 (42.7)	72 (38.9)
30-49 years	52 (52.5)	39 (43.8)	91 (49.2)
50-64 years	10 (10.4)	12 (13.5)	22 (11.9)
Educational level ¹			
Lower education	11 (11.5)	44 (49.4)	55 (29.7)
Secondary education	72 (75.0)	42 (47.2)	114 (61.6)
Higher education	13 (13.5)	3 (3.4)	16 (8.6)
Marital status ²			
Yes	62 (64.6)	72 (80.9)	134 (72.4)
No	34 (35.4)	17 (19.1)	51 (27.6)
Occupation			
Professional/skilled workers, executives	18 (18.8)	10 (11.2)	28 (15.1)
Staff administration, operational staff	4 (4.2)	4 (4.5)	8 (4.3)
Sales/ service workers, traders	16 (16.7)	14 (15.7)	30 (16.2)
Farmers, fishermen	1 (1.0)	19 (21.3)	20 (10.8)
Labours, drivers	6 (6.2)	11 (12.4)	17 (9.2)
Students	9 (9.4)	0 (0.0)	9 (4.9)
Housewives	33 (34.3)	27 (30.3)	60 (32.4)
Not working	9 (9.4)	4 (4.5)	13 (7.0)
Economic status			
Wealth - tertile 1	30 (31.2)	33 (37.1)	63 (34.1)
Wealth - tertile 2	46 (47.9)	33 (37.1)	79 (42.7)
Wealth - tertile 3	20 (20.8)	23 (25.8)	43 (23.2)

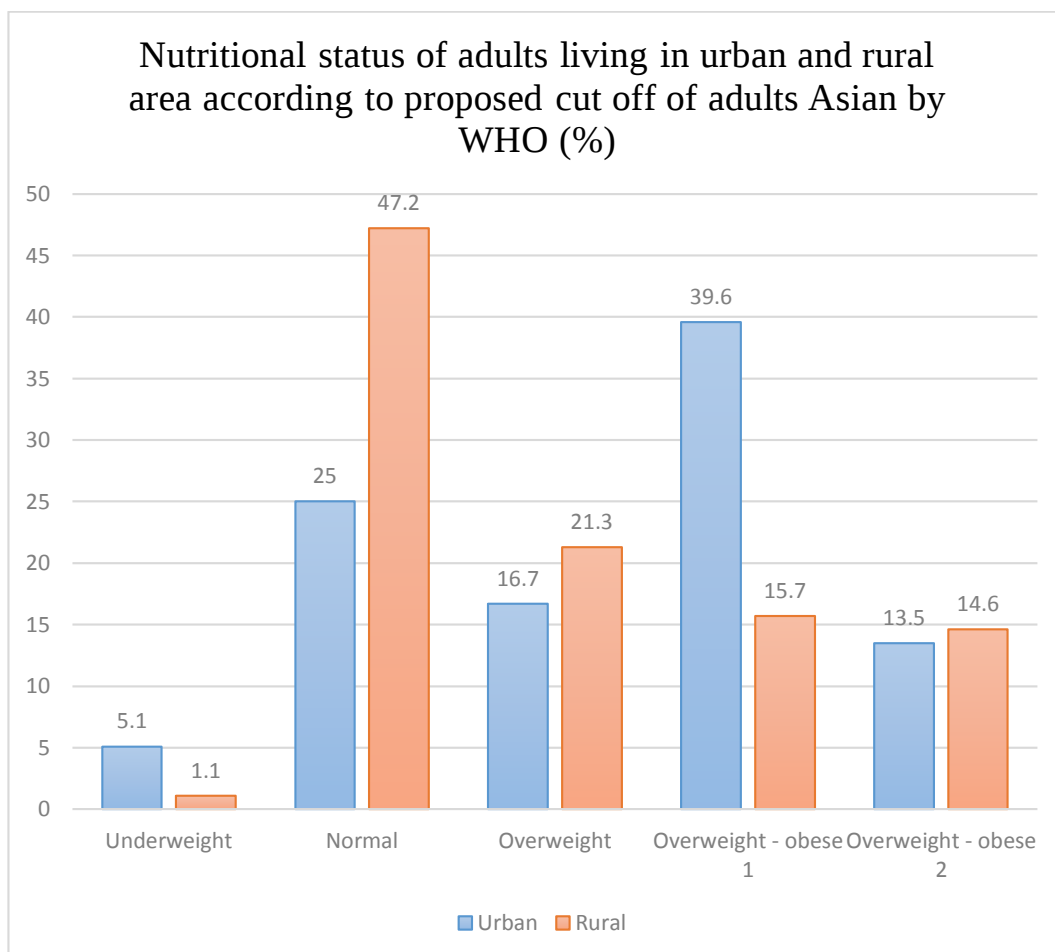
^aColumn percentage, ^bRow percentage

¹Educational level, lower education: never go to school, go to elementary school; secondary education: go to high school; higher education: go to diploma/graduate/post-graduate degree

²Marital status, yes: married; no: single, widow, widower

³Economic status: according to tertile of wealth score. Tertile 1 was the poorest.

Nutritional status assessments used cut off from WHO for Asia population⁸¹. Percentage of normal and overweight – at risk group was higher in rural compared to in urban. However, urban adults showed double percentage of obese 1 rather. Both areas showed similar rate of overweight - obese 2 group.



N=185, Data shown in %

Underweight = <18.5, Normal = 18.5-22.9, Overweight= 23.00-24.9, Overweight - obese 1 = 25.00-29.99, Overweight - obese 2 = >30.00

Figure 4.2 Nutritional Status of Subjects in Urban and Rural Area

4.2. Eating Behavior

According to table 4.2, most of rural population ate 3 times per day, whereas people in the city had almost same percentage between 1-2 times and 3 times groups. Also, people in rural area seem to have more compliance on eating breakfast. Distribution of snacking frequency remained not many differences among urban and rural area in three categories, but still showed no snacking was higher in rural. More than 50% of subjects had one until two times snacking time per day. In addition, both populations remained to consume their meals at home, especially during breakfast. From statistical analysis, only eating place during breakfast and snacking frequency

that showed no significant difference. Other variables found significant differences between urban and rural adults.

Table 4.2 Eating behavior in urban and rural area

Variable	Urban ^a n (%)	Rural ^a n (%)	<i>p-value</i>
Meal frequency ^{1,b}			
≤2 meals	55 (57.3)	22 (24.7)	<0.001*
≥3 meals	41 (42.7)	67 (75.3)	
Snacking frequency ^{1,b}			
No snacking	26 (27.1)	32 (36.0)	0.341
1-2 times	57 (59.4.6)	49 (55.1)	
≥3 times	13 (13.5)	8 (9.0)	
Eating place – breakfast ^{2,c}			
At home	69 (94.5)	78 (94.0)	1.000
Outside home	4 (5.5)	5 (6.0)	
Eating place – lunch ^{3,b}			
At home	53 (76.8)	67 (90.5)	0.026*
Outside home	16 (23.2)	7 (9.5)	
Eating place – dinner ^{4,b}			
At home	63 (80.8)	77 (93.9)	0.012*
Outside home	15 (19.2)	5 (6.1)	
Breakfast habit ^{1,b}			
Never (0 out of 3 times)	14 (14.6)	5 (5.6)	<0.001*
Sometimes (1-2 out of 3 times)	24 (25.0)	2 (2.2)	
Always (3 out of 3 times)	58 (60.4)	82 (92.1)	

^aColumn percentage

^bChi-square test, ^cFisher's exact test

¹n total for meal frequency, snacking frequency, breakfast habit, skipping breakfast = 185; ²n total for eating place – breakfast = 156; ³n total for eating place – lunch = 143; ⁴n total eating place – dinner = 160, total sample for eating place a was not 185 (not all) since not all subjects had breakfast/lunch/dinner

4.3. Diet Quality

Scoring of diet quality were formed by scoring four categories: variety, adequacy, moderation, and overall all balance. From that table 4.3, it found significant differences among urban and rural adults in vegetables and grain/staple foods consumption, fat and saturated fat consumption, also overall balance of macronutrients ratio. Rural adults could hit recommendation for vegetables and grain. Urban adults showed higher consumption on fat and saturated fat, and had higher percentage to not meet acceptable range of macronutrients ratio.

Although variety component did not reflect difference among two areas, further analysis showed most consumed food groups in urban were grain and protein sources, whereas in rural were not only grain and protein sources but also vegetables. In term of protein sources, urban adults mostly consumed beans (tofu and tempeh), fish, and poultry. Rural adults showed almost similarity in beans and fish consumption, as most consumed protein sources. However, besides beans and fish, most of them consumed eggs rather than poultry.

Table 4.3 Components of diet quality

Variable	Category	Urban (n=96)	Rural (n=89)	<i>p</i> - <i>value</i>
Variety				
Food group	1-2 food group(s)	15 (15.6)	6 (6.7)	0.151
	3-4 food groups	71 (74.0)	71 (79.8)	
	5 food groups	10 (10.4)	12 (13.5)	
Protein sources	< 3 protein sources	58 (60.4)	54 (60.7)	0.971
	≥ 3 protein sources	38 (39.6)	35 (39.3)	
Adequacy				
Vegetable ^a	Cut off = 3 serving			0.015*
	No consumption	17 (17.7)	4 (4.5)	
	<50% of cut off	69 (71.9)	77 (86.5)	
	50-99% of cut off	10 (10.4)	8 (9.0)	
Fruit ^a	Cut off = 2 serving			0.382
	No consumption	57 (59.4)	57 (64.0)	
	<50% of cut off	23 (24.0)	19 (21.3)	
	50-99% of cut off	11 (11.5)	5 (5.6)	
Grain/staple food ^{a,b}	≥100% of cut off	5 (5.2)	8 (9.0)	0.007*
	Cut off = per age and gender			
	<50% of cut off	37(38.5)	31 (34.8)	
	50-99% of cut off	56 (58.3)	43 (48.3)	
Fiber ^c	≥100% of cut off	3 (3.1)	15 (16.9)	0.353 ^f
	Cut off = RDA			
	<50% of cut off	95(99.0)	86 (96.6)	
	50-99% of cut off	1 (1.0)	3 (3.4)	
Protein	Cut off =10% of total energy			0.874
	50-99% of cut off	8 (8.3)	8 (9.0)	
	≥100% of cut off	88 (91.7)	81 (91.0)	
Iron ^c	Cut off = EAR			0.886
	<50% of cut off	46 (47.9)	41 (46.1)	
	50-99% of cut off	24 (25.0)	21 (23.6)	
	≥100% of cut off	26 (27.1)	27 (30.3)	
Calcium	Cut off = EAR			0.124
	<50% of cut off	62 (64.6)	45 (50.6)	
	50-99% of cut off	27 (28.1)	32 (36.0)	

Table 4.3 Components of diet quality (Continued)

Variable	Category	Urban (n=96)	Rural (n=89)	<i>p-value</i>
Vitamin C ^c	≥100% of cut off	7 (7.3)	12 (13.5)	0.449
	Cut off = EAR			
	<50% of cut off	78 (81.2)	70 (78.7)	
	50-99% of cut off	11 (11.5)	15 (16.9)	
	≥100% of cut off	7 (7.3)	4 (4.5)	
Moderation				
Total fat	≤20% of total energy	3 (3.1)	16 (18.0)	0.001*
	>20-30% of total energy	33 (34.4)	37 (41.6)	
	>30% of total energy	60 (62.5)	36 (40.4)	
Saturated fat	≤7% of total energy	4 (4.2)	15 (16.9)	0.018*
	>7-10% of total energy	22 (22.9)	18 (20.2)	
	>10% of total energy	70(72.9)	56 62.9)	
Cholesterol	≤300 mg	77 (80.2)	74 (83.1)	0.413
	>300-400 mg	10 (10.4)	11 (12.4)	
	>400 mg	9 (9.4)	4 (4.5)	
Sodium	≤2400 mg	91 (94.8)	86 (96.6)	0.722 ^f
	>2400 mg	5 (5.2)	3 (3.4)	
Overall balance				
Macronutrient Ratio (CH:Protein:Fat)	Acceptable	32 (33.3)	48 (53.9)	0.005*
	Not acceptable	64 (66.7)	41 (46.1)	
Fatty acid ratio	Acceptable	5 (5.2)	10 (11.2)	0.133
	Not acceptable	91 (94.8)	79 (88.0)	

Abbreviation, PUFA = poly unsaturated fatty acid, MUFA = mono unsaturated fatty acid, SFA = saturated fatty acid, RDA = recommended dietary allowance, EAR = estimated average requirement

^aBased on PMK no.41

^bGrain recommendation were according to age and gender specific on PMK no.41, female: 19-29 years= 5 servings, 30-49 years= 4.5 servings, 50-64 years = 4.5 servings, male: 19-29 years= 8 servings, 30-49 years= 7.5 servings, 50-64 years = 6.5 servings

^cEAR (Estimated Average Requirement) were based on age and gender specific on Indonesian Recommended Daily Allowance (RDA) divided by conversion factor.

^dRatio macronutrients (carbohydrate:protein:fat), acceptable= if meet ratio 55-65 : 10-15 : 15-25; or 52-68 : 9-16 : 13-27; or 50-70 : 8-7 : 12-30, otherwise was included as not acceptable.

^eRatio of fatty acid, acceptable= if PUFA/SFA= 1-1.5, MUFA/SFA = 1 – 1.5; or PUFA/SFA= 0.8 – 1.7, MUFA/SFA = 0.8-1.7; otherwise was included as not acceptable.

*p-value = <0.05 (significant), statistical analysis = Chi-square test (without superscript) / Fisher's Exact test (superscript "f")

The difference of total score for each component and overall score can be seen in table 4.4. Significant differences on statistical analysis were found in all scoring systems, except variety. Overall, rural population showed higher score compared to urban population. Median of total score in urban and rural population showed lower than cut off of good diet in DQI-I (60% of total score). Percentage of subjects who reached original cut off of good diet can be seen in table 4.5.

Table 4.4 Comparison of Diet Quality Index – International (DQII) Scoring among urban and rural area

Variable	Urban (n=99)	Rural (n=116)	<i>p-value</i>
Score of variety ¹	14.0 (12.0 – 17.0)	15.0 (12.0 – 17.0)	0.147
Score of adequacy ²	15.0 (13.0 – 18.7)	17.0 (13.0 – 20.0)	0.047*
Score of moderation ³	12.0 (12.0 – 15.0)	15.0 (12.0 – 18.0)	0.001*
Score of overall balance ⁴	0.0 (0.0 – 2.0)	2.0 (0.0 – 4.0)	0.004*
Total score ⁵	43.0 (34.7 – 48.0)	49.0 (39.0 – 54.0)	<0.001 ^{*,TT}

Data shown in median (25th- 75th percentile); ¹Maximum score of variety= 20; ²Maximum score of adequacy= 40; ³Maximum score of moderation= 24, ⁴Maximum score of overall balance= 10; ⁵Maximum score of total score= 94

**p-value* <0.05 (significant); T-test (with superscript “TT”) / Mann-Whitney non-parametric test (without superscript)

Table 4.5 Classification of diet quality

Variable	Urban ^a n (%)	Rural ^a n (%)	<i>p-value</i>
Diet quality (n=185)			
Good ¹	3 (3.1)	7 (7.9)	0.200
Poor ²	94 (96.9)	82 (92.1)	
Diet quality (n=185)			
Above median ³	36 (37.5)	53 (59.6)	0.003*
Below median ⁴	60 (62.5)	36 (40.4)	

^aColumn percentage

¹Good = total score >60% of full score, ²Poor = total score ≤60% of full score

³Above median = total score > median, ⁴below median = total score ≤median

**p-value* <0.05 (significant), chi-square test

Since percentage of good diet using original cut off was very small, this study decided to use median as cut off. The study found urban adults had higher percentage of below median group rather than rural population.

4.4. Factors Associated with Diet Quality

4.4.1 Eating behavior

From all statistical analysis, almost all eating behavior variables did not show any significant association with diet quality in both urban and rural area. Only meal frequency that showed significant relationship with diet quality. It remained that greater frequency of meal and snacking lead to higher score of diet quality. Variables on table 4.6 were involved in multivariate analysis if *p-value* showed less

than 0.25. Thus, meal frequency, snacking frequency, and eating place during dinner were included in logistic regression.

Table 4.6 Association of eating behavior and diet quality

Variable	Diet quality		<i>p-value</i>	Crude OR (CI 95%)
	Below median	Above median		
Meal frequency ¹				
≤2 times	47 (61.0)	30 (39.0)	0.036*	1.886 (1.041-3.418)
≥3 times	49 (45.4)	59 (54.6)		1
Snacking frequency ¹				
No snacking	33 (56.9)	25 (43.1)	0.069	2.640 (0.928-7.511)
1-2 times	56 (52.8)	50 (47.2)	0.108	2.240 (0.837-5.993)
≥3 times	7 (33.3)	14 (66.7)		1
Eating place – breakfast ²				
At home	75 (51.0)	72 (49.0)	0.744 ^f	1.302 (0.336-5.043)
Outside home	4 (44.4)	5 (55.6)		1
Eating place – lunch ³				
At home	57 (47.5)	63 (52.5)	0.681	0.829 (0.340-2.026)
Outside home	12 (52.2)	11 (47.8)		1
Eating place – dinner ⁴				
At home	66 (47.1)	74 (52.9)	0.135	0.480 (0.181-1.276)
Outside home	13 (65.0)	7 (35.0)		1
Breakfast habit ¹				
Never	11 (57.9)	8 (42.1)	0.558	1.336 (0.507-3.522)
Sometimes	14 (53.8)	12 (46.2)	0.769	1.134 (0.490-2.624)
Always	71 (50.7)	69 (49.3)		

Data shown in row percentage

* *p-value* <0.05 (significant); Chi-square test/Fisher's exact test (with superscript "f")

¹n total for meal frequency, snacking frequency, breakfast habit, skipping breakfast= 185; ²n total for eating place – breakfast = 156; ³n total for eating place – lunch = 143; ⁴n total eating place – dinner = 160, total sample for eating place a was not 185 (not all) since not all subjects had breakfast/lunch/dinner

4.4.2 Socio-economy and demography

Statistical analysis was done to see association of socio-economy-demography and diet quality. From statistical analysis (table 4.7), age and living area were significantly associated to diet quality. Therefore, those two variables were included in the multivariate analysis. However, marital status was also included in the multivariate analysis because it has *p-value* below 0.25.

Table 4.7 Association of socio-economy-demography and diet quality

Variable	Diet quality ^a		<i>p</i> -value	Crude OR (95%CI)
	Below median	Above median		
Gender				
Women	52 (53.6)	45 (46.4)	0.624	0.865 (0.486-1.542)
Men	44 (50.0)	44 (50.0)		1
Economic status ^b				
Wealth - tertile 1	29 (46.0)	34 (54.0)	0.222	0.614 (0.281-1.343)
Wealth - tertile 2	42 (53.2)	37(46.8)	0.598	0.817 (0.386-1.730)
Wealth - tertile 3	25 (58.1)	18 (41.9)		1
Education				
Lower education	19 (34.5)	36 (65.4)	0.266	0.528 (0.171-1.628)
Secondary school	69 (60.5)	45 (39.5)	0.425	1.533 (0.537-4.379)
Higher education	8 (50.0)	8 (50.0)		1
Living area				
Urban	60 (62.5)	36 (37.5)	0.003*	2.454 (1.358-4.433)
Rural	36 (40.4)	53 (59.6)		1
Age group				
19 – 29 years	43 (59.7)	29 (40.3)	0.004*	1.618 (1.674-15.187)
30 – 49 years	48 (52.7)	43 (47.3)	0.015*	3.795 (1.291-11.162)
50 -64 years	5 (22.7)	17 (77.3)		1
Marital status				
No	32 (62.7)	70 (52.2)	0.073	1.842 (0.951-3.568)
Yes	64 (47.8)	19 (37.3)		1

^aRow percentage, N=185^bEconomic status: according to tertile of wealth score. Tertile 1 was the poorest.**p*-value = 0.05 (significant), Chi-square test

4.4.3 Multivariate analysis of factors associated with diet quality

Multivariate analysis was conducted to see effect of interaction among predictors of diet quality. In the final model, variables associated with score diet quality below median were snacking frequency, living area, and age. People who did not consume any snack during a day might increase risk on having diet quality score below median compared to them who consumed ≥ 3 snacks per day. People who lived in urban also had higher risk to have lower diet quality compared to others who lived in rural area. In addition, younger adults or 19-29 years age group also had higher risk to have score of diet quality below median.

To see the effect of living area on the association between snacking frequency and diet quality, further stratification was conducted. Analysis showed that snacking frequency was significantly associated with diet quality only in urban population, not in rural population. In term of snack type, urban adults mostly

consumed coffee, *ote-ote/bakwan* (fried flour), fruits, and fried tofu/tempeh during snacking time. Whereas, rural adults mostly consumed coffee, fruits, and chips.

Table 4.8 First step of multivariate analysis: factors associated with below median score of diet quality

Variable	B	S.E.	Wald	p-value	OR (CI 95%)	Nmin	Nmax
Snacking frequency¹							
No snack	1.598	0.667	5.741	0.017*	4.945	1.338	18.283
1-2 times	1.491	0.637	5.474	0.019*	4.441	1.274	15.482
≥3 times	Reference						
Meal frequency							
≤2 meals	0.327	0.392	0.694	0.405	1.378	0.643	2.992
>2 meals	Reference						
Eating place – dinner							
Outside home	0.373	0.538	0.480	0.488	1.452	0.506	4.165
At home	Reference						
Marital status							
Single	0.193	0.438	0.195	0.659	1.213	0.515	2.861
Married	Reference						
Age							
19-29 years	1.683	0.740	5.169	0.023*	5.381	1.261	22.955
30-49 years	1.548	0.695	4.966	0.026*	4.704	1.205	18.364
50-64 years	Reference						
Living area							
Urban	0.807	0.376	4.599	0.032*	2.242	1.072	4.688
Rural	Reference						

N = 160, (total subjects 185 – dinner skippers 25)

*p-value < 0.05 (significant), logistic regression – backward LR

Table 4.9 Final model of multivariate analysis: factors associated with below median score of diet quality

Variable	B	S.E.	Wald	p-value	OR (CI 95%)	Nmin	Nmax
Snacking frequency¹							
No snack	1.580	0.662	5.704	0.017*	4.857	1.328	17.767
1-2 times	1.503	0.634	5.617	0.018*	4.494	1.297	15.570
≥3 times	Reference						
Age							
19-29 years	1.777	0.712	6.224	0.013*	5.912	1.464	23.881
30-49 years	1.576	0.690	5.207	0.022*	4.834	1.249	18.709
50-64 years	Reference						
Living area							
Urban	0.980	0.348	7.939	0.005*	2.664	1.348	5.268
Rural	Reference						

N = 160, (total subjects 185 – dinner skippers 25)

*p-value < 0.05 (significant), logistic regression – backward LR

CHAPTER 5 DISCUSSION

5.1. Subjects' Characteristics

The study found that urban population had greater percentage on adults who attended higher education. They also showed greater percentage of adults worked as professional/skilled workers/executives, compared to rural adults who showed more percentage on agriculture activity. Economic status showed different trends, highest percentage of urban adults was in tertile 2 group, whereas rural adults showed similar percentage among tertile 1 (poorest economic status) and tertile 2 group. This findings were in line with general differences of urban and rural population characteristics^{84–86}, and it was normal to affect to how people eat due to its relationship with food choice and food preferences⁸⁷.

As additional information, this study gathered information about nutritional status used cut off from WHO for Asia Population. This study suggested to pay more attention on urban population, since result showed only 25% of them have normal nutritional status (47% in rural adults), and 39% of them were classified as obese 2 group, or two times higher than obese 2 rate in rural population.

5.2. Diet Quality of Adults Living in Urban and Rural Area

In this study, total diet quality score was significantly different between urban and rural. However, both study sites showed poor score since each site had score below original cut off. Generally, score of each component also showed greater score in rural dwellers compared to urban dwellers.

Variety component of diet quality did not show difference in both areas. Although p-value of food group variety was not significantly different in urban and rural, percentage of subjects who consumed at least three types of food group was higher in rural. From dietary intake, rural adults ate vegetables besides grain and protein sources. In contrast, urban adults showed more subjects who skipped vegetables in their diet. Most consumed food groups in urban diet were grain and protein sources only. Specific for protein sources, both living areas showed similar trends. Protein sources frequently consumed by urban and rural population were tempeh and tofu which belong to beans group, followed by fish. However, besides

consuming beans and fish, most consumed protein sources in urban was poultry. Whereas, rural population preferred to choosing eggs rather than poultry.

Other result showed difference in adequacy score. Rural adults had greater fulfillment of vegetables and grain recommendation. For vegetables consumption, similar finding was found in the study in US. The study found rural counterparts have higher percentage to meet vegetables guidelines.⁸⁸ In other study about fruits and vegetables by Hall *et al* that recited in Southeast Asians comparison study showed, urban and rural intake were significant across eleven countries, and adults in urban had higher risk to have low vegetables intake in Bangladesh and Phillipines.^{89,90} Possible reason of this finding is, rural adults might have better access to consume vegetables. As it is known, accessibility can influence vegetables consumption.⁹¹ Rural adults might have better access to find vegetables since rural area in this study had more agriculture activity compared to urban site and approximately twenty-percent of them were farmers. So, vegetables might be more accesible in rural.

Rural population did not only show higher percentage to meet vegetables recommendation, but also higher in percentage of grain adequacy. Dietary assessment of this study found rural adults ate tuber, corn rice, and instant noodles, instead of rice. Even, some of them ate noodles with rice. Rural population also had more meals compared to urban, with grain mostly eaten during that time.

Moderation component showed significant results on fat and saturated fat consumption between urban and rural. Compared to rural adults, urban adults had higher consumption in fat and saturated fat. Urban adults showed more consumption on fried foods and animal fat such *rawon*, *krengsengan*, *paru* (cow lung), and *babat* (cow tripe). Dairy products were also more easily found in urban adults' intake. When people become more urban they may have higher consumption on fats, saturated fat, and sugary foods.⁹² The use of social media network, commercial network and information flows in urban area play a role on triggering consumption of foods rich in sugar, fat, and salt, for example: advertisement and promotion of fast food restaurant.⁵⁷

In term of overall balance, significant difference was found in macronutrients ratio between urban and rural. There were acceptable ranges that

should be met, but urban adults was found to not meet acceptable cut off compared to urban adults. More than fifty percent of urban population had percent of fat more than thirty-percent which is maximum percentage of fat in daily intake, so they could not meet minimal desirable ratio of macronutrients. There was possibility to increase risk on having health problems in urban population compared to rural population. Having imbalance macronutrients might lead to some problems. For example, a low intake of protein was related to impaired immune response, but excessive intake of protein might lead to upper digestive tract cancer and kidney cancer. In the other side, excessive intake of carbohydrate and fat increase risk of obesity and chronic diseases.⁹³

5.3. Eating Behavior of Adults Living in Urban and Rural Area

Among urban and rural, only snacking frequency and eating place during breakfast had no significant difference. Trend of snacking frequency was similar between two areas, but rural adults showed less frequency of snacking. Also, most of subjects ate at home during breakfast. Subjects in rural had higher percentage of people ate ≥ 3 times per day, whereas subjects in the city had higher percentage in people who ate less than three times per day. Rural adults also showed higher breakfast eaters compared to urban adults. In addition, percentage of subjects who ate at home was higher in urban compared to adults in rural area.

Study by Ba *et al* was in line with study result that found percentage of breakfast skipper was higher in urban rather than in rural.⁹⁴ Literatures mentioned that most adults skip breakfast due to lack of time^{19,95}, oversleeping⁹⁶, and habit⁹⁷. This breakfast practice showed tendency to influence total meals eaten during a day, especially in urban. Urban population showed lower meal frequency compared to rural population, because they also have higher breakfast skippers. In term of snacking frequency, the study showed similar pattern across those areas, 1-2 snacking frequency per day. Findings from other studies remained similarity that at least most of adults eat one snack in one day^{98,99}.

For eating places, most of subjects in this study still showed traditional patterns. High proportions of people ate at home still dominates study results. However, not all adults who consumed meals at home ate home-prepared foods. Some of them especially in urban tended to buy meals rather than cooking.

Literature mentioned that urban dwellers tend to spend money for convenience foods more than their rural counterparts. Urban have closer access to ready access to food retail outlets, street vendors (particularly in poorer areas) and marketing campaigns. At the end, urban residents are more exposed to highly processed and non-traditional foods than rural residents⁵⁷.

Among three eating occasion, lunch was eating occasion that have biggest percentage of eating out. This result was in line with other literatures that mention lunch were frequent taken away from home^{100,101}. No clear explanation regarding this fact, but it might because during that time people still worked or had other activity outside home.

5.4. Association of Diet Quality and Eating Behavior

From bivariate analysis, eating behavior that showed significant association with diet quality ($p < 0.05$) was only meal frequency. After considering all variables (include socio-economy and demography) with $p < 0.25$, multivariate analysis found snacking frequency as eating behavior that associated with diet quality

In bivariate analysis meal frequency was associated with diet quality. Further analysis found that higher meal frequency was correlated with higher score of some adequacy components and total diet quality score. Although showing different nutrients, study by Leech *et al* found that higher meal frequency was associated with higher intakes of some nutrients/food group. As meal frequency increased, people showed higher intake of vegetables (women only), cereals (source of grain), and dietary fiber.¹⁸ Whereas, in this study found that higher meal frequency was correlated with higher score of adequacy: grain, iron, calcium and total diet quality score. However, after adjusted by other variables, multivariate analysis showed no association between meal frequency and diet quality.

From the study, eating place showed no significant results in bivariate and multivariate analysis. There is possibility if people might control what to eat or might choose healthier menu while eating outside home. Attitude during eating might be influenced by many factors: cognition, hedonic, emotion, and environments. Those type of factors might lead to different eating practices.¹⁰² Previous studies also found that knowledge and awareness on health and nutrition was associated with diet quality^{103,104} In other words, eating place might not always

determine diet quality since factors related eating practice also knowledge and awareness of health and nutrition could influence diet quality.

Further analysis also conducted to investigate likelihood association of diet quality and meal preparation, but it showed no significant result. Possible reason of the result might be related to cooking practice. As further explanation, concept of a healthy cooking constructed from several principals, such as: methods/skills, flavoring, minimal/additional usage of certain ingredients. Example of healthy cooking principals (to prevent chronic diseases) are avoiding deep frying, minimal usage of animal fat, added sugar, and processed food, also reducing salt.¹⁰⁵ Therefore, there is possibility that the way to cook influencing quality of diet rather than only knowing where food have been eaten or where food have been prepared.

In literature, breakfast habit was associated with diet quality since breakfast skippers had inadequate micronutrients intake and imbalance macronutrients ratio. Breakfast skippers have lower satiety, then they tend to eat more in other meal time and have over intake of fat and added sugar.^{19,106} However, this study found no significant result toward diet quality. There are two possible reasons behind the study result. Firstly, not all breakfast skippers in the study have lower diet quality since they do not face “over eating” phenomenon. It might be caused skipping breakfast already become their life style so they do not eat in other meals time. Secondly, they who eat breakfast regularly do not always have greater diet quality since composition and size of meal during breakfast also determine diet quality.¹⁰⁷

Snacking frequency was the only eating behavior that associated with diet quality in the final analysis. Results showed that adults who had no snack during whole day had higher risk to have score of diet quality below median compared to they who had ≥ 3 snacking time (3-5 snacking time) per day. Previous study mentioned that greater consumption of snack increased probability on having better score of diet quality.¹⁷ In addition, other study found modest association between snack frequency and diet quality. Higher score of diet quality tended to be appeared in higher frequency from 0 to 3 snacking frequency and showed little decreasing score in ≥ 4 snacking frequency. From study by Zizza *et al* it was found that snacking frequency was positively associated with total fruit, whole fruit, whole grains, milk, oils, and sodium component scores.²⁴ Similar with study by Zizza *et*

al , additional analysis in this study also showed snacking frequency (numerical data) was correlated with score of fruits adequacy.

Further analysis showed that urbanicity influenced the association of snacking frequency and diet quality. Stratification showed that snacking frequency was significant only in urban adults. From the data, no snacking group was also higher in rural compared to urban. Most consumed snack in urban population were fruits, fried tofu/tempeh, and *ote-ote/bakwan*. Coffee was also highly consumed in urban, so does in rural, but rural adults showed higher percentage. Coffee consumed by subjects was non-instant and instant coffee. It might contain sugar and milk that influence diet quality. Too frequent consumption of coffee was not suggested since it was sugary beverage, provide carbohydrate/energy, and influence macronutrients ratio. Others snack mostly eaten by rural adults were chips and fruits. Snacking in urban showed association with diet quality since fruits might contribute to increase variety of food groups and adequacy of fiber and vitamin. Tofu/tempeh also became source of plant-protein. Usually, people also eat tofu that also served/made together with vegetables or egg. In fact, it might contribute to vegetables and protein adequacy as well. Tempeh is also good source of fiber. Both tofu/tempeh might supply fat (especially unsaturated fatty acid) that also needed by adults.¹⁰⁸ However, fried tofu/tempeh usually already processed through deep-frying method. Therefore, to prevent from excessive intake of fat/saturated fat, tofu/tempeh consumption during snacking time should be noticed its frequency and ammount. *Ote-ote/bakwan* (fried flour) was also frequent in urban adults. Consuming this food might contribute to grain adequacy. However, similar with fried tofu/tempeh it needs awareness on frequency and portion of its consumption since it was cooked with deep-frying method.

Besides snacking frequency, in the final model showed that age group was also associated with diet quality. People aged 19-29 years showed higher risk to have below median score compared to adults aged 50-64 years. This finding was similar with previous study that found young adults had lower diet quality compared to the older adults.¹³ This study found that most of older adults were classified into above median group. In general, data showed that older adults had greater variety of diet compared to younger adults. Percentage of subjects who

consumed fruits and vegetables was higher in older adults rather than other adults age group, especially younger adults group.

In brief, after considering other variables eating behavior that remain association with diet quality was snacking frequency. Furthermore, promotion on healthy snacking should be addressed, especially for urban population. Coffee should be consumed wisely regarding its sugar content. Having protein sources food such as fried tofu/tempeh as snack was allowed, but it should be eaten in moderation. Fruits consumption during snacking time is preferable, especially to improve fruits consumption that still low not only in this study sites, but also in general Indonesian population.

5.5. Strength and Limitation of the Study

Results found in this study might be influenced by limitation of the study. This study did not use real cut off of total diet quality when determine poor diet and good diet, since the study found very small percentage of subjects who had score >60 % of perfect score. Therefore, this study used median as cut off to determine poor diet and good diet. In this case, there is possibility to have different result with future studies that aims to see the association of eating behavior and diet quality in other populations. Over reporters that excluded in the study was also high so total subjects involved in the study was lower. However, it still met minimum sample to assess difference among urban and rural population. On the other side, this study has strenght on sampling method. PPS used in this study also help to ensure representativeness of subjects from two study sites.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

- a. The study found that urban population had greater percentage on adults who attended higher education. They also showed greater percentage of adults worked as professional/skilled workers/executives, compared to rural adults who showed more agriculture activity. Economic status showed different trends, highest percentage of urban adults was in tertile 2 group, whereas rural adults showed similar percentage among tertile 1 (poorest economic status) and tertile 2 group.
- b. Diet quality assessments between two study sites showed score of DQI-I were lower than the standard minimum of good diet (60% of full score). The median score was 43 and 49 in urban and rural, respectively. There was significant difference of total score of DQI-I, score of adequacy, score of moderation, and score of overall balance. From the scoring, urban adults showed lower score compared to rural adults. They had lower adequacy on vegetable and grain, higher consumption on fat and saturated fat, also had more percentage of subjects who did not meet recommendation ratio of macronutrients compared to rural adults.
- c. Eating behavior variables were significantly associated with diet quality between urban and rural were meal frequency, eating place during lunch and dinner, and breakfast habit. Snacking frequency showed no significant difference but no snacking group remained higher in rural. In term of meal frequency, urban adults showed higher proportion of ≤ 2 meals compared to rural adults. They also had lunch and dinner outside home and skipped breakfast. Both group tended to have breakfast at home.
- d. Final model of analysis showed that snacking frequency was eating behavior factor that associated with diet quality after adjusted by socio-economy and demography. Living area was found to be the the factor influencing association between snacking frequency and diet quality. Significant association of snacking frequency and diet quality was found

only in urban, but not in rural. No snacking group had higher risk to have lower diet quality.

- e. In general, there were differences of eating behavior and diet quality among urban and rural adults. Type of living area seem important to affect eating behavior and diet quality. After considering all variables, snacking frequency was significantly associated with diet quality in urban area, but not in rural.

6.2 Recommendation

Diet promotion on healthy eating should be addressed to achieve high quality diet among urban and rural population. Since overall scores showed significant gap toward perfect score of DQI-I, generally they are suggested to consider variety of food, type of food, also quantity of food consumed on daily basis. In general, they are suggested to eat more varied food groups and protein sources. They are also suggested to limit consumption on fats, sugary foods and highly processed foods, such as animal fats (i.e. cows organ), fried foods, package foods, especially for urban population. Both areas are also suggested to increase their fruits and vegetables intake. However, urban population are highly asked to eat more vegetables since vegetables were less likely to consume compared to rural.

Regarding eating behavior, snacking consumption is suggested to maintain quality of diet, but it should consider type of snack consumed in the diet. Coffee should be consumed wisely regarding its sugar content. Having protein sources food such as fried tofu/tempeh as snack was allowed, but it should be eaten in moderation. Fruits consumption during snacking time is preferable, especially to improve fruits consumption that still low not only in this study sites, but also in general Indonesian population.

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APPENDICES

Appendix 1. Manuscript

Universitas Indonesia

Diet Quality & Eating Behavior of Adults Living in Urban and Rural Area

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Arindah NS, researcher, conducted research and arranged report of the study; Helda K, principal investigator of SCRIPT study (this study was part of main study "SCRIPT"), research advisor, assisted the data collection, data analysis, and report development; Fiastuti W, research advisor, advised on proposal and report development.

Names for Citation:

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ABSTRACT

Introduction:

Diet consist of complex foods. Thus, to clarify whether people have good or poor diet, assessment of diet is more preferable using an index. Studies mentioned that urbanicity might influence diet quality, as well as eating behavior. This study aimed to see eating behavior and diet quality among adults living urban and rural area. **Methods:** A cross sectional study was conducted in a megapolitan city and a regency located in Indonesia. Subjects in this study was adults aged 19-64 years. Data collection used 2 x 24-h recall and structured questionnaire. Diet Quality Index-International (DQI-I) was considered as tool to assess diet quality.

Results: Significant association of eating behavior towards living area was found in term of meal frequency, eating place during lunch and dinner, also breakfast habit. People in urban had 1-2 meal, eat outside home, and skip breakfast. The study also found significant difference of diet quality score (total score, adequacy, moderation, and overall balance) between urban and rural adults. Urban adults had lower diet quality score compared to rural adults. They showed higher consumption on fat and saturated fats, less likely to not meet vegetables and grain adequacy, also macronutrients ratio. **Conclusion:** Diet quality and eating behavior remained difference among urban and rural adults. Consumption on fat

was strong component that influence study result, besides vegetables consumption, grain adequacy, and macronutrients ratio. Promotion to have balanced diet should be more massive, especially in urban population.

Keywords: diet quality, eating behavior, urbanicity

INTRODUCTION

Studies stated urban and rural population have different characteristics. In Indonesia, the definition of urban and rural setting follows the government's laws. The Law No. 32/2004 on Local Governance is referred by The National Development Planning Board (Bappenas) to determine three administrative categories of urban areas. These categories are: 1) urban areas as autonomous regions (city governments); 2) urban areas within district boundaries (district capital towns); and 3) urban areas spilling over into one or more adjacent administrative areas. Both city and district/regency have the same status as administrative government, but in district/regency predominantly has agriculture as main occupation. An area that has agriculture as main activities is considered as rural area⁵⁴.

A systematic review from 17 Indonesian studies shows that urban population is strongly associated with overweight and obesity in all stages. In adults aged 19-55 years, chance of being overweight and obesity is higher in urban rather than in rural⁵⁵. Other study mentions that overnutrition in urban area are influenced by multi-factors coming together such as age, marital status, food consumption and physical activity. Adults in urban population tend to have frequent consumption on high fat and high-dense energy food, also have low physical movement or high sedentary lifestyle⁵⁶.

77 Previous study showed there were differences of diet quality among adults living
78 urban and rural ⁹. Other study also found similar results although they focused on
79 women reproductive age only¹⁰. However, other gender specific study showed no
80 differences in the index between urban and rural women ¹¹. Different findings from
81 several studies can be understood because each study used different index to assess
82 diet quality. Recently, there are several existing index to assess diet quality.
83 Assessing diet using index seems more fair because most of indices include more
84 that one nutrients/components in the assessment, since people eat foods (more than
85 one nutrient) not only single nutrient.

86 In the other side, previous studies found diet quality was related to eating behavior,
87 include meal frequency, breakfast habit, and eating out habit ^{17–24}. However, study
88 about diet quality and eating behavior among urban and rural population is still
89 limited. Therefore, study to assess diet quality and eating behavior is expected to
90 give more knowledge to improve dietary behavior in urban and rural area.

91 Diet Quality index – International (DQI-I) is one of indices that shows more
92 preferable to be used in Indonesia since it already used to examine in Asian
93 countries. It also contains of wider components, not only for the adequacy but also
94 variety, moderation, and overall balance. The nutrients included in the index also
95 consider recommended allowance from each country that might differ across
96 countries.

97 **MATERIALS AND METHODS**

98 This study already received permission from “FKUI Research Ethical Committee”
99 and government from the national level to the local level. Moreover, this study also
100 conducted by ensuring basic principal of bioethics, include asking voluntary

101 participation from candidates of subjects (offered informed consent), keeping
102 confidentiality of study information, and avoiding harmful action to the
103 participants.

104 A cross sectional study was conducted in Indonesia, involving one capital city
105 (Surabaya) as urban site and one regency (Lumajang) with main agricultural
106 activity as rural site. Subjects in this study was adults aged 19-64 years, without
107 specific diet. Subjects involved in this study were taken from another study
108 conducted by SEAMEO RECFON, which is SCRIPT, study about protein transition
109 related to socio-cultural aspects. Total of 185 subjects was choosen using cluster
110 sampling, after considering mis-reporting dietary intake. Data collection used 2 x
111 24-h recall and structured questionnaire. Diet Quality Index-International (DQI-I)
112 was considered as tool to assess diet quality.

113 ***Dietary assessment***

114 There were four components of DQI-I: variety, adequacy, moderation, and overall
115 balance. Variety component (20 score) included scoring of variety of food groups
116 and protein sources. Adequacy component (40 score) specified scoring of
117 vegetables, fruits, grain, fiber, protein, iron, calcium, and vitamin c. Moderation
118 component (26 score) focused on what should limit in the diet such as fat, saturated
119 fat, sodium, cholesterol. This present study adjusted to not assess empty calories
120 food since limitation of empty calories food list in Indonesia and calculation during
121 study phase was not possible (limitation of nutrient list).

122 ***Eating behavior assessment***

123 Structured questionnaire consist of question: 1)meal frequency, 2)snacking
124 frequency, 3)breakfast habit, 4)eating place.Meal frequency and snacking

frequency referred to yesterday eating occasion. Breakfast habit was assessed in the last three days, classified into never, sometimes, and never. Eating frequency was separated among breakfast, lunch, dinner. Subjects were asked regarding place of eating, outside home or at home.

129

130 **RESULTS**

131 Table 1 shows almost similar percentage of gender composition in urban and rural
132 area (purposely tried to have comparable total women and men during data
133 collection). In terms of age group, group of people aged 30 – 49 in both study sites
134 has the highest percentage among other two age groups. Similarity also can be
135 found on marital status, not only in Surabaya but also in Lumajang, mostly, subjects
136 are married. However, percentage of people who go to secondary school and university
137 is lower in rural area compared to urban area. No specific occupation dominates
138 (>50%) two areas, but housewives group reaches the greatest percentage since data
139 collection conducted in houses. In contrast, as second biggest percentage is skill
140 workers for urban area, and farmers for rural area.

141 It can be seen in table 2 most of rural population ate 3 times per day, whereas people
142 in the city have almost same percentage between 1-2 times and 3 times groups.
143 Also, people in rural area seem to have more compliance on eating breakfast.
144 Percentage of snacking frequency remains not many differences among urban and
145 rural area in three categories. More than 50% of subjects have two times snacking
146 time per day. In addition, both populations remain to consume their meals at home,
147 especially during breakfast. From statistical analysis, only eating place during
148 breakfast and snacking frequency that shows no significant relationship toward

149 living area. Other variables found significant differences between urban and rural
150 adults.

151 From that table 3, it shows significant differences among urban and rural adults in
152 vegetables and grain/staple foods consumption, fat and saturated fat consumption,
153 also overall balance of macronutrients ratio. Rural adults had more percentage of
154 subjects who could hit recommendation for vegetables and grain. Whereas, urban
155 adults shows higher consumption on fat and saturated fat, and had higher percentage
156 to not meet acceptable range of macronutrients ratio. As shown on table 4, the
157 difference of total score can be proven by statistical test $p < 0.05$. Significant
158 differences on statistical analysis were found all scoring systems, except variety.
159 Overall, rural population showed higher score compared to urban population.

160 **DISCUSSION**

161 Significant association of eating behavior towards living area was found in term of
162 meal frequency, eating place during lunch and dinner, also breakfast habit. People
163 in urban had 1-2 meal, eat outside home, and skip breakfast. Compared to urban
164 population, rural population ate 3 meals per day, and have lower percentage of
165 eating out and skipping breakfast.

166 Result of previous study was in line with study result that found percentage of
167 breakfast skipper was higher in urban rather than in rural ⁹⁴ Literatures mentioned
168 that most adults skip breakfast due to lack of time^{19,95}, oversleeping⁹⁶, and habit⁹⁷.
169 This breakfast practice showed tendency to influence total meals eaten during a day,
170 especially in urban. Urban population showed lower meal frequency compared to
171 rural population, because they also have higher breakfast skippers. In term of
172 snacking frequency, the study showed similar pattern across those areas, 1-2

173 snacking frequency per day. Findings from other studies remained similarity that at
174 least most of adults eat one snack in one day^{98,99}.

175 Most consumed snack in urban population were fruits, fried tofu/tempeh, and *ote-*
176 *ote/bakwan* (fried flour). Coffee was also highly consumed in urban, so does in
177 rural, but rural adults showed higher percentage. Coffee consumed by subjects was
178 non-instant and instant coffee. It might contain sugar and milk that influence diet
179 quality. Too frequent consumption of coffee was not suggested since it was sugary
180 beverage, provide carbohydrate/energy, and influence macronutrients ratio. Others
181 snack mostly eaten by rural adults were chips and fruits.

182 For urban adults, tofu/tempeh consumption could become source of plant-protein.
183 Usually, people also eat tofu that also served/made together with vegetables or egg.
184 In fact, it might contribute to vegetables and protein adequacy as well. Tempeh is
185 also good source of fiber. Both tofu/tempeh might supply fat that also needed by
186 adults. However, fried tofu/tempeh usually already processed through deep-frying
187 method. Therefore, to prevent from excessive intake of fat/saturated fat,
188 tofu/tempeh consumption during snacking time should be noticed its frequency and
189 amount. *Ote-ote/bakwan* (fried flour) was also frequent in urban adults. Consuming
190 this food might contribute to grain adequacy. However, similar with fried
191 tofu/tempeh it needs awareness on frequency and portion of its consumption since
192 it was cooked with deep-frying method. If urban adults should pay attention on fried
193 tofu/tempeh and *ote-ote/bakwan* (fried flour), rural adults should control their chips
194 consumption. Chips might contribute to carbohydrate, saturated fat, as well as
195 sodium intake in the diet.

196 For eating places, most of subjects in this study still showed traditional patterns.
197 High proportions of people ate at home still dominates study results. However, not
198 all adults who consumed meals at home ate home-prepared foods. Some of them
199 especially in urban tended to buy meals rather than cooking. Literature mentioned
200 that urban dwellers tend to spend money for convenience foods more than their
201 rural counterparts. Urban have closer access to ready access to food retail outlets,
202 street vendors (particularly in poorer areas) and marketing campaigns. At the end,
203 urban residents are more exposed to highly processed and non-traditional foods than
204 rural residents ⁵⁷.

205 Among three eating occasion, lunch was eating occasion that have biggest
206 percentage of eating out. This result was in line with other literatures that mention
207 lunch were frequent taken away from home ^{100,101}. No clear explanation regarding
208 this fact, but it might because during that time people still worked or had other
209 activity outside home, so they had lunch outside home.

210 In this study, total diet quality score was significantly different between urban and
211 rural. However, both study sites showed poor score since each site had score below
212 original cut off. Generally, score of each component also showed greater score in
213 rural dwellers compared to urban dwellers.

214 In term of diet quality, there was significant difference of diet quality across study
215 sites. Generally, rural adults showed lower score compared rural adults. Lower
216 score and significant difference were found in total score of DQI-I and all
217 components of scoring showed significant difference, except variety component.

218 Variety component of diet quality did not show difference in both areas. Although
219 p-value of food group variety was not significantly different in urban and rural,
220 percentage of subjects who consumed at least three types of food group was higher
221 in rural. From dietary intake, rural adults ate vegetables besides grain and protein
222 sources. In contrast, urban adults showed higher percentage of subjects who skipped
223 vegetables in their diet. Most consumed food groups in urban diet were grain and
224 protein sources only. Specific for protein sources, both living areas showed similar
225 trends. Protein sources frequently consumed by urban and rural population were
226 tempeh and tofu which belong to beans group, followed by fish. However, besides
227 consuming beans and fish, most consumed protein sources in urban was poultry.
228 Whereas, rural population preferred to choosing eggs rather than poultry.

229 Other result showed difference in adequacy score. Rural adults had greater
230 fulfillment of vegetables and grain recommendation. For vegetables consumption,
231 similar finding was found in the study in US. The study found rural counterparts
232 have higher percentage to meet vegetables guidelines⁸⁸. In other study about fruits
233 and vegetables by Hall *et al* that recited in Southeast Asians comparison study
234 found that urban and rural intake were significant across eleven countries, and
235 adults in urban had higher risk to have low vegetables intake in Bangladesh and
236 Phillipines^{89,90}. Possible reason of this finding is, rural adults might have better
237 access to consume vegetables. As it is known, accessibility can influence
238 vegetables consumption⁹¹. Rural adults might have better access to find vegetables
239 since rural area in this study had more agriculture activity compared to urban site
240 and approximately twenty-percent of them were farmers. So, vegetables might be
241 more accesible in rural.

242 Rural population did not only show higher percentage to meet vegetables
243 recommendation, but also higher in percentage of grain adequacy. Dietary
244 assessment of this study found rural adults ate tuber in between their meals (i.e.
245 cassava and traditional foods made from cassava/other tubers) and instant noodles.
246 Even, some of them ate noodles with rice. Rural population also had more meals
247 compared to urban, with grain mostly eaten during that time.

248 Moderation component showed significant results on fat and saturated fat
249 consumption between urban and rural. Compared to rural adults, urban adults had
250 higher consumption in fat and saturated fat. Urban adults showed more
251 consumption on fried foods and animal fat such *rawon*, *krengsengan*, *paru* (cow
252 lung), and *babat* (cow tripe). Dairy products was also more easily found in urban
253 adults' intake. When people become more urban they may have higher consumption
254 on fats, saturated fat, and sugary foods ⁹². The use of social media network,
255 commercial network and information flows in urban area play a role on triggering
256 consumption of foods rich in sugar, fat, and salt, for example: advertisement and
257 promotion of fast food restaurant ⁵⁷.

258 In term of overall balance, significant difference was found in macronutrients ratio
259 between urban and rural. There were acceptable ranges that should be met, but
260 urban adults showed more percentage of subjects who could not meet acceptable
261 cut off compared to urban adults. More than fifty percent of urban population had
262 percent of fat more than thirty-percent which is maximum percentage of fat in daily
263 intake, so they could not meet minimal desirable ratio of macronutrients. There
264 were possibility to increase risk on having health problems in urban population
265 compared to rural population. Having imbalance macronutrients might lead to some

266 problems. For example, a low intake of protein was related to impaired immune
 267 response, but excessive intake of protein might lead to upper digestive tract cancer
 268 and kidney cancer. In the other side, excessive intake of carbohydrate and fat
 269 increase risk of obesity and chronic diseases⁹³.

270 **CONCLUSION**

271 In brief, eating behavior remains different pattern between urban and rural
 272 population. Urban-inhabitants showed the shift of frequency of meal frequency from
 273 three times to be less than three times per day. Breakfast skipper and eating out
 274 group were also more exist in urban compared to rural. In term of diet quality, urban
 275 adults showed lower score regarding DQI-I, not only for adequacy, but also
 276 moderation, overall balance, and total score. They showed higher consumption of
 277 fat and saturated fat, lower vegetables and grain adequacy, also less likely to meet
 278 desirable ratio of macronutrients. Promotion to have balanced diet should be more
 279 massive, especially in urban population. Adults are suggested to eat variety of
 280 foods, limit fat/saturated fat consumption, also increase consumption of fruits and
 281 vegetables.

282

283 **Acknowledgement**

284 Acknowledge to SCRIPT Project team, included Indonesia, Malaysia, and US team.
 285 This study was part of SCRIPT Project that conducted in Indonesia.

286

287 **Conflict of interest**

288 No conflict of interest was found in this study

289

290 **References**

291 **References**

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414 **Table 1.** Socio-demographic characteristics of the subjects

Variable	Urban ^a (n=96)	Rural ^a (n=89)	Total ^b (n=185)
Gender			
Women	49 (49.0)	48 (53.9)	97 (52.4)
Men	47 (51.0)	41 (56.1)	88 (47.6)
Age			
19-29 years	34 (35.4)	38 (42.7)	72 (38.9)
30-49 years	52 (52.5)	39 (43.8)	91 (49.2)
50-64 years	10 (10.4)	12 (13.5)	22 (11.9)
Educational level ¹			
Lower education	11 (11.5)	44 (49.4)	55 (29.7)
Secondary education	72 (75.0)	42 (47.2)	114 (61.6)
Higher education	13 (13.5)	3 (3.4)	16 (8.6)
Marital status ²			
Yes	62 (64.6)	72 (80.9)	134 (72.4)
No	34 (35.4)	17 (19.1)	51 (27.6)
Occupation			
Professional/skilled workers, executives	18 (18.8)	10 (11.2)	28 (15.1)
Staff administration, operational staff	4 (4.2)	4 (4.5)	8 (4.3)
Sales/ service workers, traders	16 (16.7)	14 (15.7)	30 (16.2)
Farmers, fishermen	1 (1.0)	19 (21.3)	20 (10.8)
Labors, drivers	6 (6.2)	11 (12.4)	17 (9.2)
Students	9 (9.4)	0 (0.0)	9 (4.9)
Housewives	33 (34.3)	27 (30.3)	60 (32.4)
Not working	9 (9.4)	4 (4.5)	13 (7.0)
Economic status			
Wealth - tertile 1	30 (31.2)	33 (37.1)	63 (34.1)
Wealth - tertile 2	46 (47.9)	33 (37.1)	79 (42.7)
Wealth - tertile 3	20 (20.8)	23 (25.8)	43 (23.2)

415 ^aColumn percentage, ^bRow percentage

416 ¹Educational level, lower education: never go to school, go to elementary school;
 417 secondary school: go to high school; higher education: go to
 418 diploma/graduate/post-graduate degree

419 ²Marital status, yes: married; no: single, widow, widower

420 ³Economic status: according to tertile of wealth score. Tertile 1 was the
 421 poorest..

430 **Table 2.** Eating behavior in urban and rural area

Variable	Urban ^a n (%)	Rural ^a n (%)	<i>p-value</i>
Meal frequency ^{1,b}			
≤2 meals	55 (57.3)	22 (24.7)	<0.001*
≥3 meals	41 (42.7)	67 (75.3)	
Snacking frequency ^{1,b}			
No snacking	26 (27.1)	32 (36.0)	0.341
1-2 times	57 (59.4.6)	49 (55.1)	
≥3 times	13 (13.5)	8 (9.0)	
Eating place – breakfast ^{2,c}			
At home	69 (94.5)	78 (94.0)	1.000
Outside home	4 (5.5)	5 (6.0)	
Eating place – lunch ^{3,b}			
At home	53 (76.8)	67 (90.5)	0.026*
Outside home	16 (23.2)	7 (9.5)	
Eating place – dinner ^{4,b}			
At home	63 (80.8)	77 (93.9)	0.012*
Outside home	15 (19.2)	5 (6.1)	
Breakfast habit ^{1,b}			
Never (0 out of 3 times)	14 (14.6)	5 (5.6)	<0.001*
Sometimes (1-2 out of 3 times)	24 (25.0)	2 (2.2)	
Always (3 out of 3 times)	58 (60.4)	82 (92.1)	

431 ^aColumn percentage

432 ^bChi-square test, ^cFisher's exact test

433 ¹n total for meal frequency, snacking frequency, breakfast habit, skipping
 434 breakfast= 185; ²n total for eating place – breakfast = 156; ³n total for eating place
 435 – lunch = 143; ⁴n total eating place – dinner = 160, total sample for eating place a
 436 was not 185 (not all) since not all subjects had breakfast/lunch/dinner

459 **Table 3.** Components of diet quality

Variable	Category	Urban (n=96)	Rural (n=89)	<i>p</i> - <i>value</i>
Variety				
Food group	1-2 food group(s)	15 (15.6)	6 (6.7)	0.151
	3-4 food groups	71 (74.0)	71 (79.8)	
	5 food groups	10 (10.4)	12 (13.5)	
Protein sources	< 3 protein sources	58 (60.4)	54 (60.7)	0.971
	≥ 3 protein sources	38 (39.6)	35 (39.3)	
Adequacy				
Vegetable ^a	Cut off = 3 serving			0.015*
	No consumption	17 (17.7)	4 (4.5)	
	<50% of cut off	69 (71.9)	77 (86.5)	
	50-99% of cut off	10 (10.4)	8 (9.0)	
Fruit ^a	Cut off = 2 serving			0.382
	No consumption	57 (59.4)	57 (64.0)	
	<50% of cut off	23 (24.0)	19 (21.3)	
	50-99% of cut off	11 (11.5)	5 (5.6)	
Grain ^{a,b}	≥100% of cut off	5 (5.2)	8 (9.0)	0.007*
	Cut off = per age and gender			
	<50% of cut off	37(38.5)	31 (34.8)	
	50-99% of cut off	56 (58.3)	43 (48.3)	
Fiber ^c	≥100% of cut off	3 (3.1)	15 (16.9)	0.353 ^f
	Cut off = RDA			
	<50% of cut off	95(99.0)	86 (96.6)	
	50-99% of cut off	1 (1.0)	3 (3.4)	
Protein	Cut off =10% of total energy			0.874
	50-99% of cut off	8 (8.3)	8 (9.0)	
	≥100% of cut off	88 (91.7)	81 (91.0)	
Iron ^c	Cut off = EAR			0.886
	<50% of cut off	46 (47.9)	41 (46.1)	
	50-99% of cut off	24 (25.0)	21 (23.6)	
	≥100% of cut off	26 (27.1)	27 (30.3)	
Calsium ^c	Cut off = EAR			0.124
	<50% of cut off	62 (64.6)	45 (50.6)	
	50-99% of cut off	27 (28.1)	32 (36.0)	
	≥100% of cut off	7 (7.3)	12 (13.5)	
Vitamin C ^c	Cut off = EAR			0.449
	<50% of cut off	78 (81.2)	70 (78.7)	
	50-99% of cut off	11 (11.5)	15 (16.9)	
	≥100% of cut off	7 (7.3)	4 (4.5)	
Moderation				
Total fat	≤20% of total energy	3 (3.1)	16 (18.0)	0.001*
	>20-30% of total energy	33 (34.4)	37 (41.6)	
	>30% of total energy	60 (62.5)	36 (40.4)	
Saturated fat	≤7% of total energy	4 (4.2)	15 (16.9)	0.018*
	>7-10% of total energy	22 (22.9)	18 (20.2)	
	>10% of total energy	70(72.9)	56 62.9)	
Cholesterol	≤300 mg	77 (80.2)	74 (83.1)	0.413
	>300-400 mg	10 (10.4)	11 (12.4)	
	>400 mg	9 (9.4)	4 (4.5)	
Sodium	≤2400 mg	91 (94.8)	86 (96.6)	0.722 ^f
	>2400 mg	5 (5.2)	3 (3.4)	

460 **Table 3. Components of diet quality (Continued)**

Variable	Category	Urban (n=96)	Rural (n=89)	<i>p</i> - <i>value</i>
Overall balance				
Macronutrient Ratio (CH:Protein:Fat)	Acceptable	32 (33.3)	48 (53.9)	0.005*
	Not acceptable	64 (66.7)	41 (46.1)	
Fatty acid ratio	Acceptable	5 (5.2)	10 (11.2)	0.133
	Not acceptable	91 (94.8)	79 (88.0)	

461 Abbreviation, PUFA = poly unsaturated fatty acid, MUFA = mono unsaturated fatty
 462 acid, SFA = saturated fatty acid, RDA = recommended dietary allowance, EAR =
 463 estimated average requirement.

464 ^aBased on PMK no.41

465 ^bGrain recommendation were according to age and gender specific on PMK no.41,
 466 female: 19-29 years= 5 servings, 30-49 years= 4.5 servings, 50-64 years = 4.5
 467 servings, male: 19-29 years= 8 servings, 30-49 years= 7.5 servings, 50-64 years =
 468 6.5 servings

469 ^cEAR (Estimated Average Requirement) were based on age and gender specific on
 470 Indonesian Recommended Daily Allowance (RDA) divided by conversion factor.

471 ^dRatio macronutrients (carbohydrate:protein:fat), acceptable= if meet ratio 55-65
 472 : 10-15 : 15-25; or 52-68 : 9-16 : 13-27; or 50-70 : 8-7 : 12-30, otherwise was
 473 included as not acceptable.

474 ^eRatio of fatty acid, acceptable= if PUFA/SFA= 1-1.5, MUFA/SFA = 1 – 1.5; or
 475 PUFA/SFA= 0.8 – 1.7, MUFA/SFA = 0.8-1.7; otherwise was included as not
 476 acceptable.

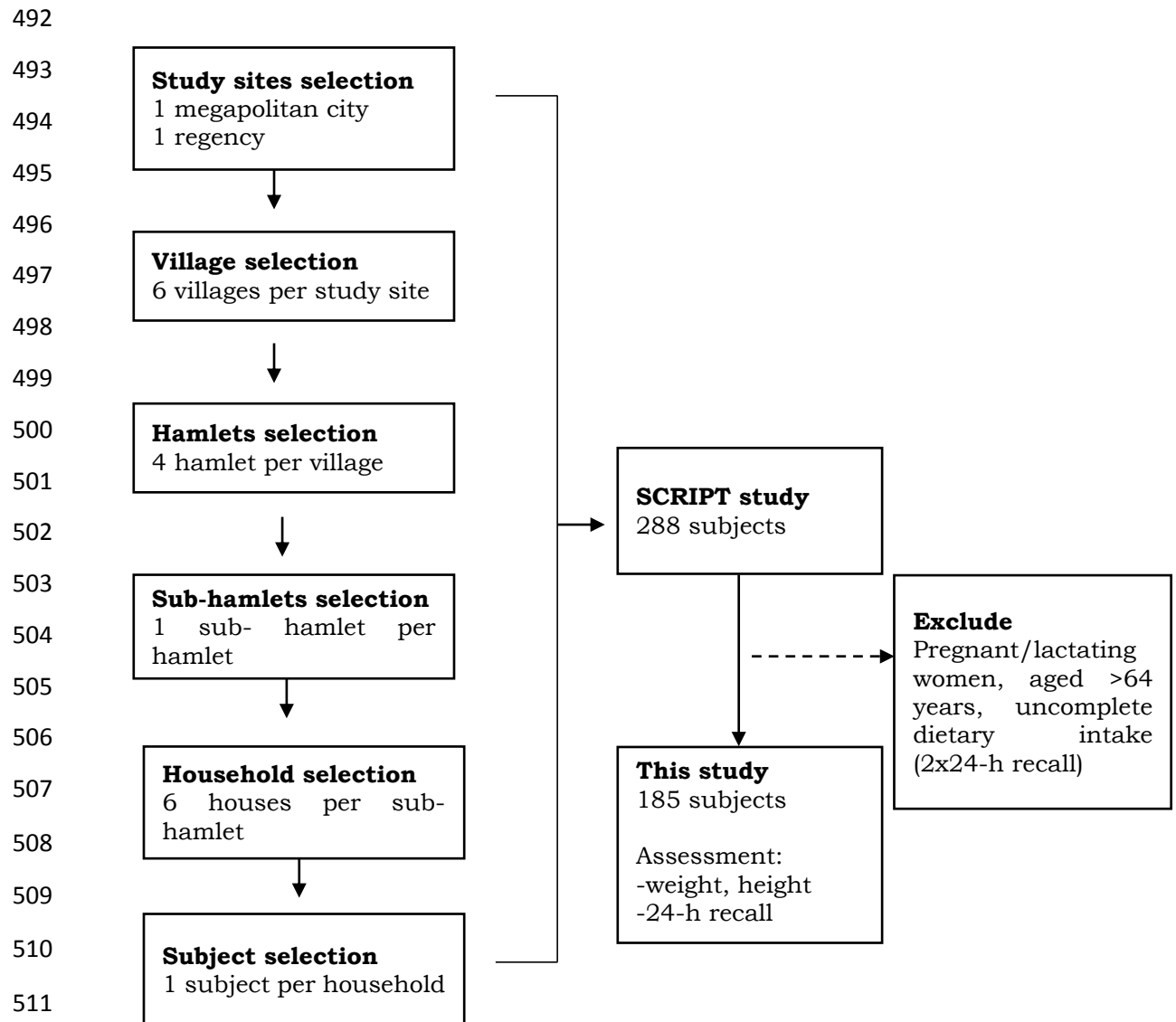
477 **p*-value = <0.05 (significant), statistical analysis = Chi-square test (without
 478 superscript) / Fisher's Exact test (superscript "f")

480 **Table 4. Comparison of Diet Quality Index – International (DQII) Scoring among**
 481 **urban and rural area**

Variable	Urban (n=99)	Rural (n=116)	<i>p</i> - <i>value</i>
Score of variety ¹	14.0 (3.0 – 20.0)	15.0 (6.0 – 20.0)	0.147*
Score of adequacy ²	15.0 (9.0 – 32.0)	17.0 (10.0 – 26.0)	0.047*
Score of moderation ³	12.0 (3.0 – 27.0)	15.0 (6.0 – 27.0)	0.001*
Score of overall balance ⁴	0.0 (0.0 – 8.0)	2.0 (0.0 – 6.0)	0.004*
Total score ⁵	43.0 (26.0 – 66.0)	49.0 (33.0 – 64.0)	<0.001*, ^{TT}

482 ¹Maximum score of variety= 20; ²Maximum score of adequacy= 40; ³Maximum
 483 score of moderation= 24, ⁴Maximum score of overall balance= 10; ⁵Maximum score
 484 of total score= 94

485 **p*-value <0.05 (significant); T-test (with superscript "TT") / Mann-Whitney non-
 486 parametric test (without superscript)



512 **Figure 1.** Sampling and data collection flow

Appendix 2. Ethical approval



UNIVERSITAS INDONESIA
FAKULTAS KEDOKTERAN

Gedung Fakultas Kedokteran UI
Jl. Salemba Raya No.6, Jakarta 10430
PO.Box 1358
T. 62.21.3912477, 31930371, 31930373,
3922977, 3927360, 3153236,
F 62 21 3912477, 31930372, 3157288,
E. humas@fk.ui.ac.id, office@fk.ui.ac.id
fk.ui.ac.id

Nomor : 927 /UN2.F1/ETIK/2017

KETERANGAN LOLOS KAJI ETIK

ETHICAL APPROVAL

Komite Etik Penelitian Kesehatan Fakultas Kedokteran Universitas Indonesia dalam upaya melindungi hak asasi dan kesejahteraan subyek penelitian kedokteran, telah mengkaji dengan teliti protokol berikut informasi yang diberikan kepada calon subjek yang berjudul:

The Ethics Committee of the Faculty of Medicine, University of Indonesia, with regards of the Protection of human rights and welfare in medical research, has carefully reviewed the research protocol including the information given to the potential subjects entitled:

"Socio-Cultural and Economic Drivers of Protein Transition in Indonesia".
No. protokol: 17-10-1000

Peneliti Utama : Helda Khusun, PhD
Principal Investigator

Nama Institusi : SEAMEO REC FON FKUI
Name of the Institution

dan telah menyetujui protokol berikut informasi yang diberikan kepada calon subjek.
and approves the above mentioned protocol including the information given to the potential subjects.



09 OCT 2017

Ketua
Chairman

Rianto

Prof. Dr. dr. Rianto Setiabudy, SpFK

* *Ethical approval* berlaku satu tahun dari tanggal persetujuan.
** Peneliti berkewajiban

1. Menjaga kerahasiaan identitas subyek penelitian.
2. Memberitahukan status penelitian apabila
 - a. Setelah masa berlakunya keterangan lolos kaji etik, penelitian masih belum selesai, dalam hal ini *ethical approval* harus diperpanjang.
 - b. Penelitian berhenti di tengah jalan.
3. Melaporkan kejadian serius yang tidak diinginkan (*serious adverse events*).
4. Peneliti tidak boleh melakukan tindakan apapun pada subyek sebelum protokol penelitian mendapat lolos kaji etik dan sebelum memperoleh *informed consent* dari subyek penelitian.
5. Menyampaikan laporan akhir, bila penelitian sudah selesai.
6. Cantumkan nomor protokol ID pada setiap komunikasi dengan KEPK FKUI-RSCM.

Semua prosedur persetujuan dilakukan sesuai dengan standar ICH-GCP.
All procedure of Ethical Approval are performed in accordance with ICH-GCP standard procedure.

Appendix 3. Permission letter from Ministry of Home Affairs

 KEMENTERIAN DALAM NEGERI REPUBLIK INDONESIA DIREKTORAT JENDERAL POLITIK DAN PEMERINTAHAN UMUM Jl. Medan Merdeka Utara No. 7 Jakarta Pusat, Telp. (021) 3450038, DKI Jakarta 10110	
REKOMENDASI PENELITIAN NOMOR : 440.02 / 4501 / 2017 / PPT	
DASAR	: 1. Peraturan Menteri Dalam Negeri Nomor 41 Tahun 2010 tentang Organisasi dan Tata Kerja Kementerian Dalam Negeri (Berita Negara Republik Indonesia Tahun 2010 Nomor 316), sebagaimana telah diubah dengan Peraturan Menteri Dalam Negeri Nomor 14 Tahun 2011 tentang Perubahan Atas Peraturan Menteri Dalam Negeri Nomor 41 Tahun 2010 tentang Organisasi dan Tata Kerja Kementerian Dalam Negeri (Berita Negara Republik Indonesia Tahun 2011 Nomor 168); : 2. Peraturan Menteri Dalam Negeri Nomor 7 Tahun 2014 tentang Perubahan Atas Peraturan Menteri Dalam Negeri Nomor 64 Tahun 2011 tentang Pedoman Penerbitan Rekomendasi Penelitian.
MENIMBANG	: Surat dari Seameo Recfon, nomor 1040/RECFON-DIR/X/2017/2017 tanggal 18 Oktober 2017, Perihal Permohonan Rekomendasi Penelitian
NAMA	: Helda Khusun
ALAMAT	: Jln. Jend. A. Yani No. 14 RT004/RW009, Kel. Utan Kayu Utara, Kec. Matraman, Kota Jakarta Timur Provinsi DKI Jakarta
JABATAN	: Peneliti Utama
NOMOR TELPON	: 08128586856
JUDUL PENELITIAN	: <i>"Studi Sosial, Budaya dan Ekonomi Dalam Kaitannya Dengan Transisi Protein di Indonesia"</i>
BIDANG PENELITIAN	: Kesehatan
LOKASI PENELITIAN	: Provinsi Bali, DKI Jakarta, Jawa Barat, Jawa Timur, Sulawesi Selatan dan Sumatera Barat
WAKTU PENELITIAN	: (November 2017 – April 2018)
STATUS PENELITIAN	: Baru
ANGGOTA TIM PENELITIAN	: Dr. Judhiastuty Febrihartanty, Roselyne Anggraini, M. Gizi, Annisa Dwi Utami, S. Gz, Arindah Nur Sartika, S. Gz dan Wanda Lasepa, S. Gz
Dikeluarkan di : Jakarta Pada Tanggal : 31 Oktober 2017	
a.n. DIREKTUR JENDERAL POLITIK DAN PEMERINTAHAN UMUM SEKRETARIS DITJEN,	
	
DIDI SUDIANA, SE. MM Pembina Utama Madya (IV/d) NIP. 19610109 201306 1 001	
*ketentuan penelitian dan tembusan di halaman belakang	

Appendix 4. Permission letter from local government (East Java)



PEMERINTAH PROVINSI JAWA TIMUR
BADAN KESATUAN BANGSA DAN POLITIK
 JALAN PUTAT INDAH NO.1 TELP. (031) - 5677935, 5681297, 5675493
 SURABAYA - (60189)

Surabaya, 13 Desember 2017

Nomor : 070/ 14751 / 209.4/2017
 Sifat : Biasa
 Lampiran : 1 (satu) lembar
 Perihal : Penelitian/Survey/Research

K e p a d a
 Yth. 1. Walikota Surabaya
 2. Bupati Lumajang
 Cq. Kepala Bakesbangpol dan Linmas
 di
T E M P A T

Menunjuk surat : Dirjen. Politik dan Pemerintahan Umum Kementerian Dalam Negeri
 Nomor : 440.02/4501/Polpum
 Tanggal : 31 Oktober 2017

Bersama ini memberikan Rekomendasi kepada :

Nama : Ir. Helda Khusun MSC dkk.
 A l a m a t : Jl. Jend A. Yani no. 14 Kel. Utan Kayu Utara Matraman Jakarta Timur
 Pekerjaan : Peneliti
 Kebangsaan : Indonesia

bermaksud mengadakan penelitian/survey/research :

Judul : Studi Sosial, Budaya dan Ekonomi dalam Kaitannya dengan Transisi Protein di Indonesia
 Tujuan/bidang : Wawancara / Kesehatan
 Penanggungjawab : Ir. Helda Khusun MSC
 Peserta : Judhiastuty Februhartanty, Roselyne Anggraini, M. Gizi, Annisa Dwi Utami S. Arindah Nur Sartika, S Gz dan Wanda Lasepa, S.Gz
 Waktu : 6 bulan
 Lokasi : Kota Surabaya dan Kabupaten lumajang

Sehubungan dengan hal tersebut, diharapkan dukungan dan kerjasama pihak terkait untuk memberikan bantuan yang diperlukan. Adapun kepada peneliti agar memperhatikan hal-hal sebagai berikut :

1. Berkewajiban menghormati dan mentaati peraturan dan tata tertib yang berlaku di daerah setempat;
2. Pelaksanaan penelitian/survey/research agar tidak disalahgunakan untuk tujuan tertentu yang dapat mengganggu kestabilan keamanan dan ketertiban di daerah setempat;
3. Melaporkan hasil penelitian dan sejenisnya kepada Bakesbangpol Provinsi Jawa Timur.

Demikian untuk menjadi maklum.

a.n. KEPALA BADAN KESATUAN BANGSA DAN POLITIK
 PROVINSI JAWA TIMUR
Kepala Bidang Budaya Politik


Drs. Ec. SUBEKTI, MM
 Pembina
 NIP. 19620116 198903 1 006

Tembusan :
 Yth. 1. Dirjen. Politik dan Pemerintahan Umum
 Kementerian Dalam Negeri ;
 2. Yang bersangkutan.

Appendix 5. Permission letter from local government (Surabaya)



PEMERINTAH KOTA SURABAYA
BADAN KESATUAN BANGSA, POLITIK DAN PERLINDUNGAN MASYARAKAT
 Jl. Tambaksari No. 11 Telp. (031) 99443016 - 99443066
 SURABAYA (60136)

Surabaya, 25 Januari 2018

Kepada

Yth. 1. Kepala Dinas Kesehatan Kota Surabaya
 2. Camat Se Kota Surabaya (Terlampir)

di – SURABAYA

Nomor : 070/ 0671 /436.8.5/2018
 Lampiran : -
 Hal : Penelitian

REKOMENDASI PENELITIAN

Dasar : 1. Peraturan Menteri Dalam Negeri Nomor 64 Tahun 2011 tentang Pedoman Penerbitan Rekomendasi Penelitian, sebagaimana telah diubah dengan Peraturan Menteri Dalam Negeri Nomor 7 Tahun 2014 tentang Perubahan Atas Peraturan Menteri Dalam Negeri Nomor 64 Tahun 2011 ;
 2. Peraturan Walikota Surabaya Nomor 37 Tahun 2011 Tentang Rincian Tugas dan Fungsi Lembaga Teknis Daerah Kota Surabaya, Bagian Kedua Badan Kesatuan Bangsa, Politik dan Perlindungan Masyarakat.

Memperhatikan : Surat Kepala Badan Kesatuan Bangsa dan Politik Provinsi Jawa Timur tanggal 13 Desember 2017 Nomor : 070/14751/209.4/2017 Hal : Penelitian/Survey/Research

Plt. Kepala Badan Kesatuan Bangsa dan Politik Kota Surabaya memberikan rekomendasi kepada :

a. Nama : Dr. Ir.Helda Khusun, M. Sc
 b. Alamat : Jl. Jend. A. Yani No. 14 RT. 004 RW. 009 Kel. Utan Kayu Utara Kec. Matraman Kota Jakarta Timur
 c. Pekerjaan/Jabatan : Peneliti
 d. Instansi/Organisasi : SEAMEO Recfon Universitas Indonesia Jakarta
 e. Kewarganegaraan : Indonesia

Untuk melakukan penelitian/survey/kegiatan dengan :

a. Judul / Thema : Studi Sosial. Budaya dan Ekonomi dalam Kaitannya Dengan Transisi Protein Di Indonesia
 b. Tujuan : Penelitian
 c. Bidang Penelitian : Kesehatan
 d. Penanggung Jawab : Dr. Ir.Helda Khusun, M. Sc
 e. Anggota Peserta : Judhiastuty Febrihartanty, Roselyne Anggraini, Pramesti Widya Hapsari, Annisa Dwi Utami, Arindah Nur Sartika, Wanda Lasepa
 f. Waktu : 3 (Tiga) Bulan, TMT Surat Dikeluarkan
 g. Lokasi : Dinas Kesehatan, 31 Kecamatan Kota Surabaya

Dengan persyaratan :

1. Penelitian/survey/kegiatan yang dilakukan harus sesuai dengan surat permohonan dan wajib mentaati persyaratan/peraturan yang berlaku di Lokasi/Tempat dilakukan Penelitian/survey/kegiatan;
2. Saudara yang bersangkutan agar setelah melakukan Penelitian/survey/kegiatan wajib melaporkan pelaksanaan dan hasilnya kepada Kepala Bakesbang, Politik dan Linmas Kota Surabaya;
3. Penelitian/survey/kegiatan yang dilaksanakan tidak boleh menimbulkan keresahan dimasyarakat, disintegrasi bangsa atau mengganggu keutuhan NKRI ;
4. Rekomendasi ini akan dicabut/tidak berlaku apabila yang bersangkutan tidak memenuhi persyaratan seperti tersebut diatas.

Demikian atas bantuannya disampaikan terima kasih.

a.n. KEPALA BADAN,
 Plt. Sekretaris



Appendix 6. Permission from local government (Lumajang)



PEMERINTAH KABUPATEN LUMAJANG
BADAN KESATUAN BANGSA DAN POLITIK
 Jalan : Arif Rahman Hakim No. 1 Telp./Fax. (0334) 881586 e-mail : kesbangpol@lumajang.go.id
LUMAJANG - 67313

SURAT PEMBERITAHUAN UNTUK MELAKUKAN PENELITIAN/SURVEY/KKN/PKL/KEGIATAN
 Nomor : 072/155/427.75/2018

Dasar : 1. Peraturan Menteri Dalam Negeri Nomor 64 Tahun 2011 tentang Pedoman Penerbitan Rekomendasi Penelitian, sebagaimana telah diubah dengan Peraturan Menteri Dalam Negeri Nomor 7 Tahun 2014 tentang Perubahan atas Peraturan Menteri Dalam Negeri Nomor 64 Tahun 2011 ;
 2. Peraturan Daerah Kabupaten Lumajang Nomor 20 Tahun 2007 tentang Susunan Organisasi dan Tata Kerja Badan Kesatuan Bangsa dan Politik Kabupaten Lumajang.

Menimbang : Surat Direktur SEAMEO RECFON Jakarta Nomor: 017/RECFON-DIR/ST-60/I/2018 tanggal 15 Januari 2018 perihal Permohonan Izin Penelitian dan Surat Kepala Bidang Budaya Politik Badan Kesatuan Bangsa dan Politik Provinsi Jawa Timur Nomor: 070/14751/209.4/2017 tanggal 13 Desember 2017 Perihal: Penelitian/Survey/Research atas nama Ir. HELDA KHUSUN, M.Sc., Ph.D., DKK

Atas nama Bupati Lumajang, memberikan rekomendasi kepada :

1. Nama : Ir. HELDA KHUSUN, M.Sc., Ph.D.,
2. Alamat : Jl. Jenderal A. Yani No. 14 004/009, Utan Kayu Utara, Matraman, Jakarta Timur
3. Pekerjaan/Jabatan : Dosen
4. Instansi/NIM : Seameo Recfon Jakarta
5. Kebangsaan : Indonesia

Untuk melakukan Penelitian/Survey/KKN/PKL/Kegiatan :

1. Judul Proposal : Studi Sosial, Budaya, dan Ekonomi dalam Kaitannya dengan Transisi Protein di Indonesia
2. Tujuan : Penelitian
3. Bidang Penelitian : Kesehatan
4. Penanggung jawab: dr. Muchtaruddin Mansyur, M.S., Sp.Ok, PhD
5. Anggota/Peserta : 5 (lima) Orang
6. Waktu Penelitian : 22 Januari 2018 s/d 30 April 2018
7. Lokasi Penelitian : Kabupaten Lumajang

Dengan ketentuan : 1. Berkewajiban menghormati dan mentaati peraturan dan tata tertib di daerah setempat/lokasi penelitian/survey/KKN/PKL/Kegiatan;
 2. Pelaksanaan penelitian/survey/KKN/PKL/Kegiatan agar tidak disalahgunakan untuk tujuan tertentu yang dapat mengganggu kestabilan keamanan dan ketertiban di daerah/lokasi setempat;
 3. Wajib melaporkan hasil penelitian/survey/KKN/PKL/Kegiatan dan sejenisnya kepada Bupati Lumajang melalui Badan Kesatuan Bangsa dan Politik Kab. Lumajang setelah melaksanakan penelitian/survey/KKN/PKL/Kegiatan;
 4. Surat Pemberitahuan ini akan dicabut dan dinyatakan tidak syah/tidak berlaku lagi apabila ternyata pemegang Surat Pemberitahuan ini tidak mematuhi ketentuan tersebut di atas.

Lumajang, 22 Januari 2018

Tembusan Yth. :

1. Bpk. Bupati Lumajang (sebagai laporan).
2. Sdr. Ka. Polres lumajang,
3. Sdr. Ka. BAPPEDA Kab. Lumajang,
4. Sdr. Ka. Dinas Kesehatan Kab. Lumajang,
5. Sdr. Camat Se-Kabupaten Lumajang,
6. Sdr. Direktur Seameo Recfon, Jakarta,
7. Sdr. Yang Bersangkutan.

a.n KEPALA BADAN KESBANG DAN POLITIK



HERI SANTO, SH
 Sekretaris
 NIP. 19630112 1985031 012

Appendix 7. Permission letter from SEAMEO RECFON



SEAMEO RECFON
SOUTHEAST ASIAN MINISTERS OF EDUCATION ORGANIZATION
REGIONAL CENTRE FOR FOOD AND NUTRITION

SURAT TUGAS

Nomor 051/RECFON-ST/S-10/II/2018

Deputi Direktur Administrasi SEAMEO RECFON memberikan tugas kepada,

No	Nama	Posisi
1.	Roselynn Anggraini	<i>Co-Principal Investigator</i>
2.	Arindah Nur Sartika	Field supervisor
3.	Hendra Tri Kusuma W.	Field supervisor
4.	Arini Izzatullah	Enumerator
5.	Cynthia Febrina Wono	Enumerator
6.	Dina Roshida	Enumerator
7.	Intan Kusumawardhani	Enumerator
8.	M. Hanif Asrori	Enumerator
9.	Nimas Teta Puspitasari	Enumerator
10.	Rizky Ayu Kartikasari	Enumerator
11.	Sinta Ayu Oktaviana	Enumerator

untuk melakukan pengumpulan data responden serta bertanggung jawab atas semua kelengkapan dan kerahasiaan data dalam penelitian dengan judul: **"Studi Sosial, Budaya, dan, Ekonomi Dalam Kaitannya Dengan Transisi Protein di Indonesia"** pada bulan Februari - Maret 2018 di Kota Surabaya dan Kabupaten Lumajang, Provinsi Jawa Timur.

Surat tugas ini dibuat untuk dilaksanakan dengan penuh tanggung jawab dan dilaporkan hasil kegiatannya.

13 Februari 2018

Deputi Direktur Administrasi,


Drs. Agus Haryanto, M.Ed., Ph.D.

Appendix 8. Questionnaire

Naskah Penjelasan

Studi Kualitas Diet dan Perilaku Makan pada Orang Dewasa di Kawasan Perkotaan dan Pedesaan di Jawa Timur

Peneliti: Arindah Nur Sartika

Program Studi Ilmu Gizi, Fakultas Kedokteran, Universitas Indonesia

Jl. Salemba Raya no.6, Jakarta Pusat; telp: 021-31930208; Fax: 021-3152532

Email: arindahnursartika@gmail.com; no.hp: 081285242330

Pendahuluan

Angka kegemukan di Indonesia pada orang dewasa terus meningkat dari tahun ke tahun. Pada perhitungan status gizi orang dewasa, indeks massa tubuh (IMT) merupakan indeks yang biasa digunakan untuk menentukan apakah orang tersebut mengalami kegemukan atau tidak. Seseorang dikatakan gemuk apabila memiliki $IMT > 23$. Dari perhitungan tersebut diketahui bahwa faktor utama yang mempengaruhi kenaikan IMT adalah kenaikan berat badan. Kenaikan berat badan disebut berhubungan dengan diet atau kebiasaan makan sehari-hari. Jika kenaikan berat badan yang menimbulkan kenaikan IMT (kejadian kegemukan) berkaitan dengan diet, sedang angka kegemukan di Indonesia terus meningkat, maka menimbulkan pertanyaan terkait kualitas diet orang dewasa di Indonesia. Selain itu, timbul pula pertanyaan bagaimana kualitas diet menurut wilayah tempat tinggal mengingat Indonesia tidak hanya terdiri dari kawasa perkotaan (*urban*), tetapi juga wilayah yang terdiri dari kawasan pedesaan (*rural*), serta bagaimana kaitannya dengan perilaku makan dan faktor sosial-ekonomi dan demografi. Namun studi mengenai hal-hal tersebut masih sedikit di Indonesia, sehingga pelaksanaan studi tersebut akan membantu para akademisi, masyarakat, dan juga pemangku kepentingan.

Tujuan

Menilai kualitas diet pada orang dewasa di kawasa perkotaan (*urban area*) dan pedesaan (*rural area*) serta asosiasinya dengan perilaku makan dan sosial-ekonomi-demografi.

Manfaat penelitian

Calon partisipan jika bergabung dalam studi dapat mengetahui kualitas diet yang ditentukan dari data asupan makanan.

Partisipan

Subjek atau partisipan studi ini adalah orang dewasa berusia 20-59 tahun yang tinggal di wilayah yang ditentukan oleh peneliti, dibuktikan dengan kartu tanda penduduk atau data kependudukan lainnya.

Appendix 8. Questionnaire (Continued)**Data yang diambil**

Data yang diambil dalam penelitian adalah data sosial-ekonomi-demografi dan perilaku makan serta asupan makanan.

Hak calon partisipan

Calon partisipan berhak menentukan keikutsertaannya dalam studi ini tanpa paksaan dari pihak manapun. Perlu diketahui bahwa identitas partisipan dalam studi akan dijaga kerahasiaannya oleh tim peneliti. Adapun hasil studi berhak diketahui oleh partisipan ketika studi telah selesai dilaksanakan. Apabila terdapat hal-hal yang memberatkan partisipan di kemudian hari maka partisipan diperbolehkan untuk tidak lagi ikut serta dalam penelitian.

Appendix 8. Questionnaire (Continued)

Formulir Persetujuan

**Studi Kualitas Diet dan Perilaku Makan pada Orang Dewasa di Kawasan
Perkotaan dan Pedesaan di Jawa Timur**

Peneliti: Arindah Nur Sartika

Program Studi Ilmu Gizi, Fakultas Kedokteran, Universitas Indonesia

Jl. Salemba Raya no.6, Jakarta Pusat; telp: 021-31930208; Fax: 021-3152532

Email: arindahnursartika@gmail.com; no.hp: 081285242330

Setelah mendengar dan membaca penjelasan mengenai latar belakang, tujuan, manfaat, dan prosedur penelitian “**Kualitas Diet dan Perilaku Makan pada Orang Dewasa di Kawasan Perkotaan dan Pedesaan di Jawa Timur**” maka saya bertandatangan di bawah ini:

Nama :

Alamat:

No.hp :

Menyatakan bersedia menjadi responden dalam penelitian tersebut secara sukarela dan bebas tanpa paksaan, dengan catatan apabila suatu hari ada hal yang menyebabkan saya keberatan dengan jalannya penelitian ini maka saya berhak untuk tidak melanjutkan keikutsertaan saya.

.....

.....

(Nama:.....)

ID: __/__/__/____

Appendix 8. Questionnaire (Continued)

FORM WAWANCARA/ INTERVIEW FORM

1. Informasi Pengambilan Data

Keterangan Information	Isian Answer	Kode Code	Keterangan Information	Isian Answer	Kode Code
Tanggal wawancara <i>Interview date</i>		[survyDate]	Kode pewawancara <i>Interviewer code</i>		[interviewer]
Waktu mulai <i>Time (begin)</i>		[timeStart]	Kode supervisor <i>Supervisor code</i>		
Waktu selesai <i>Time (finish)</i>		[timeFinish]			
Tanggal pemeriksaan <i>Checking date</i>		[checkDate]	Tanda tangan supervisor <i>Supervisor's signature</i>		

2. Informasi Sosial-Ekonomi-Demografi <i>Socio-economy & demography</i>			Kode
Nama <i>Name</i>			[nameResp] <string>
ID	__/__/__/____		[resp_ID]
Jenis kelamin <i>Gender</i>	01. Laki-laki/ <i>male</i> 02. Perempuan/ <i>female</i>		
Alamat <i>Address</i>			[addrs]
Jenis tempat tinggal <i>Living area</i>	01. Perkotaan (<i>Urban</i>) 02. Pedesaan (<i>Rural</i>)		[livingarea]
No.hp <i>Phone no.</i>			[Hp]
Tanggal lahir <i>Date of birthd</i>	DD-MM-YYYY		[birthDt]
Suku <i>Ethnic</i>	01. Minangkabau 02. Betawi 03. Sunda 04. Jawa 05. Bali 06. Bugis 77. Lainnya 88. Tidak jawab		[ethnic]
Agama <i>Religion</i>	01. Islam 02. Kristen 03. Katholik 04. Hindu 05. Budha 06. Konghuchu 07. Peghayat 88. Tidak jawab/tidak tahu		[religion]

Appendix 8. Questionnaire (*Continued*)

Pendidikan terakhir <i>Highest Education</i>	01. Tidak sekolah/ <i>no school</i> 02. Tidak lulus SD/ <i>not finished elementary school</i> 03. Lulus SD/ MI <i>Finished elementary school</i> 04. Lulus SMP/ MTS <i>Finished junior high school</i> 05. Lulus SMA/ MA <i>Finished senior high school</i> 06. Lulus diploma/S1 <i>Finished bachelor degree</i> 07. Lulus S2/S3 <i>Finished master/doctoral degree</i> 88. Tidak jawab/ <i>no answer</i>		[educ]
Pekerjaan <i>Occupation</i>	01. Pekerja profesional/terlatih, manajerr, PNS <i>Professional/skilled worker, executive</i> 02. Staff administrasi, staff operasional <i>Staff administration, operational staff</i> 03. Bekerja di bidang jasa/perdagangan <i>Sales/ service worker, trader</i> 04. Petani <i>Farmer</i> 05. Buruh, pekerja kasar, supir <i>Labour, driver</i> 06. Pensiunan <i>Pension</i> 07. Pelajar <i>Student</i> 08. Ibu rumah tangga <i>Housewife</i> 09. Tidak bekerja <i>Not working</i>		[occup]
Status pernikahan <i>Marital status</i>	01. Menikah/ <i>married</i> 02. Belum/tidak menikah <i>Single</i> 03. Bercerai/ <i>divorced</i> 88. Tidak jawab/ <i>no answer</i>		[marStat]

Appendix 8. Questionnaire (Continued)

3. INDEKS KEKAYAAN			
1	Apa sumber utama air minum untuk rumah tangga ini? <i>What is your source of drinking water?</i>	1. Ledeng/ PDAM <i>Water from government company</i> 2. Sumur terbuka <i>Opened well</i> 3. Sumur tertutup/ sumur pompa <i>Well with cover/pump</i> 4. Mata air/ sungai/ danau/ air hujan <i>Spring/ river/ lake/ rain water</i> 5. Truk tangki air/ air pikulan <i>Tank/ water that distributed by some vendor</i> 6. Air kemasan, air isi ulang/ gallon <i>Mineral water/ gallon</i> 77 Lainnya/ Others, sebutkan.....	
2	Apakah jenis kakus yang biasanya digunakan anggota rumah tangga ini? <i>What is type of laerine do you use?</i>	1. Kakus sendiri dengan septic tank <i>Private latrine with septic tank</i> 2. Kakus sendiri tanpa septic tank <i>Private latrine without septic tank</i> 3. Kakus bersama/ umum <i>Public laerine</i> 4. Sungai/ parit <i>River/ditch</i> 5. Cubluk/ WC cemplung <i>Latrine at fishpond</i> 6. Halaman/ semak/ hutan <i>Yard/ bush/ fores</i> 77 Lainnya/ Others, sebutkan.....	
3	Apakah di rumah ini memiliki <i>Do you have:</i> 1. Ya/ yes 0. Tidak/ no	a. Listrik / <i>elitrictity</i> b. Radio / <i>radio</i> c. Televisi / <i>television</i> d. Telepon / <i>phone</i> e. Handphone f. Lemari es / <i>refrigerator</i>	
4	Apakah jenis bahan bakar utama yang digunakan untuk memasak? <i>What is your fuel source to cook?</i>	1. Listrik <i>Electricity</i> 2. Gas LPG/ alam <i>Gas/ natural gas</i> 3. Biogas 4. Minyak tanah/ batu bara/ arang <i>Petrolleum/ coal/ charcoal</i> 5. Kayu bakar <i>Wood</i> 6. Tidak ada kegiatan memasak <i>No cooking activity</i> 77 Lainnya/ Others, sebutkan.....	
5	Apakah rumah tangga ini mempunyai: <i>Do you have:</i> 1. Ya/ yes 0. Tidak/ no	a. Sepeda/ <i>Bicycle</i> b. Sepeda motor/ <i>Motorcycle</i> c. Mobil / <i>Car</i> d. Perahu motor /sampan <i>Motorboat/ traditional boat</i> e. Kapal <i>Ship</i>	

Appendix 8. Questionnaire (Continued)

6	Apakah rumah tangga Anda memiliki lahan pertanian/ sawah/ ladang/ kebun? <i>Do you (your household) have land/ricefields/garden?</i>	1. Ya/ yes 2. Tidak/ no	
7	Apakah rumah tangga ini memiliki: <i>Do you have:</i> 1. Ya/ yes 0. Tidak/ no	a. Sapi <i>Cow</i>	
		b. Kerbau <i>Buffalo</i>	
		c. Kuda/ keledai <i>Horse/ donkey</i>	
		d. Kambing/ domba <i>Goat/ sheep</i>	
		e. Babi <i>Pig</i>	
		f. Ayam/ bebek <i>Chicken/ duck</i>	
8	BAHAN BANGUNAN UTAMA LANTAI RUMAH <i>Floor type</i>	1. Tanah <i>Soil</i> 2. Kayu/ papan/ bambu <i>Wood/ bamboo</i> 3. Semen <i>Cement</i> 4. Ubin/ keramik <i>Ceramic</i> 5. Parket <i>Parquet</i> 77 Lainnya, sebutkan..... <i>Others</i>	
9	BAHAN BANGUNAN UTAMA ATAP RUMAH <i>Ceiling material</i>	1. Jerami 2. Bambu/ kayu 3. Seng 4. Genteng 5. Beton 77 Lainnya, sebutkan..... <i>Others</i>	
10	BAHAN BANGUNAN UTAMA DINDING RUMAH <i>Wall material</i>	1. Bambu/ kayu <i>Bamboo/wood</i> 2. Semi permanen <i>Semi-permanent</i> 3. Permanen : bata/ tembok <i>Permanent : brick</i>	

Berat badan/ *weight* : 1)..... 2)..... Rata-rata/ *average*.....

Tinggi badan/ *height* : 1)..... 2)..... Rata-rata/ *average*.....

Appendix 8. Questionnaire (Continued)

4. Perilaku Makan / Eating Behavior

Konsumsi makan pagi/breakfast consumption						
Apakah anda makan pagi.....? <i>Did you eat breakfast.....?</i> 1: ya/yes 2: tidak/no		Jawaban <i>Answer</i>		Kode <i>Code</i>		
Kemarin / <i>yesterday</i>				[breakfast]		
Dua hari lalu / <i>2 days ago</i>						
Tiga hari lalu / <i>3 days ago</i>						
Frekuensi makan (makanan utama)/meal frequency						
Berapa kali anda makan utama kemarin? <i>How many times did you eat yesterday?</i>		Jawaban <i>Answer</i>		Kode <i>Code</i>		
Diisi sesuai hasil 24-h recall <i>Fill based on 24-h recall</i>						
Frekuensi selingan/snacking frequency						
Berapa kali anda makan snack kemarin? <i>How many snacking frequencies did you have yesterday?</i>		Jawaban <i>Answer</i>		Kode <i>Code</i>		
Diisi sesuai hasil 24-h recall <i>Fill based on 24-h recall</i>						
Tempat makan/place of eating						
1.Sarapan <i>Breakfast</i>	Dimanakah Anda sarapan kemarin? <i>Where did you have breakfast yesterday?</i>	Jawaban <i>Answer</i>	Kode <i>Code</i>	Darimanakah makanan tersebut berasal? <i>Where did you get your meal?</i>	Jawaban <i>Answer</i>	Kode <i>Code</i>
	1:Di rumah <i>1: At home</i>		[eatplaceB]	1: Memasak di rumah (sendiri, keluarga) <i>1: Prepared at home</i> 2: Membeli, diberi, various sources <i>2: Bought, got from other people, various sources</i>		[BreakfastPrep]
	2:Lokasi selain rumah <i>2:Outside home</i>					

Appendix 8. Questionnaire (Continued)

	Dimanakah Anda makan siang kemarin? <i>Where did you have breakfast yesterday?</i>	Jawaban <i>Answer</i>	Kode <i>Code</i>	Darimanakah makanan tersebut berasal? <i>Where did you get your meal?</i>	Jawaban <i>Answer</i>	Kode <i>Code</i>
Makan siang <i>Lunch</i>	1:Di rumah <i>1: At home</i>		[eatplaceL]	1: Memasak di rumah (sendiri, keluarga) <i>1: Prepared at home</i>		[LunchPrep]
	2:Lokasi selain rumah <i>2:Outside home</i>			2: Membeli, diberi, various sources <i>2: Bought, got from other people, various sources</i>		
	Dimanakah Anda makan malam kemarin? <i>Where did you have dinner yesterday?</i>	Jawaban <i>Answer</i>	Kode <i>Code</i>	Darimanakah makanan tersebut berasal? <i>Where did you get your meal?</i>	Jawaban <i>Answer</i>	Kode <i>Code</i>
Makan malam <i>Dinner</i>	1:Di rumah <i>1: At home</i>		[eatplaceD]	1: Memasak di rumah (sendiri/keluarga) <i>1: Prepared at home</i>		[DinnerPrep]
	2:Lokasi selain rumah <i>2:Outside home</i>			2: Membeli, diberi, various sources <i>2: Bought, got from other people, various sources</i>		

Appendix 8. Questionnaire (Continued)

KUESIONER 24-H RECALL

24-H RECALL QUESTIONNAIRE

ID responden/ *respondent's ID* : __/__/__/_____

Tanggal wawancara/ *date of interview* : __/__/__/_____

Konsumsi makanan dari bangun hingga tidur				
Waktu <i>Time</i>	Metode Memasak <i>Cooking method</i>	Komposisi/ Bahan Makanan/ Brand <i>Composition/ingredients/brands</i>	Berat Makanan <i>Weight</i>	
			URT <i>Household measurement</i>	Gram <i>gram</i>

Appendix 8. Questionnaire (Continued)

ID responden/ *respondent's ID* : __ / __ / __ / ____

Tanggal wawancara/ *date of interview* : __ / __ / __ / ____

Indormasi pendukung <i>Supporting information</i>	Jawaban <i>Answer</i>	Kode <i>Code</i>
Apakah makanan tersebut adalah makanan yang biasa dimakan? <i>Is that usual food you eat everyday?</i> 1: Ya/yes 2: Tidak/no		[habit]
Jika berbeda, apa perbedaannya? <i>If yes, what is the difference?</i> 1: Lebih banyak/ <i>more than usual food eat every day</i> Alasan/<i>reason</i>..... 2: Lebih banyak/ <i>more than usual food eat every day</i> Alasan/<i>reason</i>..... 		[difference]
Apakah Anda mengkonsumsi suplemen? <i>Do you eat supplement every day?</i> 1: Ya/yes 2: Tidak/no		[supp]
Jika ya seberapa sering? Bentuknya apa (kapsul/tablet/sirup/dll) dan berapa dosisnya? <i>If yes, how often you consume it? Is it capsule, liquid syrup, or what? How about the dosage?</i> 		[consSupp]

Appendix 9. Additional analysis

Table 1. Differences of socio-economy and demography characteristics

Variable	Urban ^a (n=96)	Rural ^a (n=89)	<i>p-value</i>
Gender			
Women	49 (49.0)	48 (53.9)	0.694
Men	47 (51.0)	41 (56.1)	
Age			
19-29 years	34 (35.4)	38 (42.7)	0.368
30-49 years	52 (52.5)	39 (43.8)	
50-64 years	10 (10.4)	12 (13.5)	
Educational level ¹			
Lower education	11 (11.5)	44 (49.4)	<0.001*
Secondary education	72 (75.0)	42 (47.2)	
Higher education	13 (13.5)	3 (3.4)	
Marital status ²			
Yes	62 (64.6)	72 (80.9)	0.013*
No	34 (35.4)	17 (19.1)	
Occupation			
Professional/skilled workers, executives	18 (18.8)	10 (11.2)	0.333
Staff administration, operational staff	4 (4.2)	4 (4.5)	
Sales/ service workers, traders	16 (16.7)	14 (15.7)	
Farmers, fishermen	1 (1.0)	19 (21.3)	
Labours, drivers	6 (6.2)	11 (12.4)	
Students	9 (9.4)	0 (0.0)	
Housewives	33 (34.3)	27 (30.3)	
Not working	9 (9.4)	4 (4.5)	
Economic status			
Wealth - tertile 1	30 (31.2)	33 (37.1)	0.328
Wealth - tertile 2	46 (47.9)	33 (37.1)	
Wealth - tertile 3	20 (20.8)	23 (25.8)	

p-value < 0.05 (significant), chi-square test/ logistic regression (enter)

Appendix 10. Additional analysis (*Continued*)

Table 2. Meals preparation in urban and rural population

	Urban n (%)	Rural n (%)	<i>p-value</i>
Meal preparation- Breakfast (n=156)			
Buy, get, various preparation	18 (24.7)	5 (6.0)	0.001*
Prepared at home	55 (75.3)	78 (94.0)	
Meal preparation- Lunch (n=143)			
Buy, get, various preparation	25 (36.2)	11 (14.9)	0.003*
Prepared at home	44 (63.8)	63 (85.1)	
Meal preparation- Dinner (n=160)			
Buy, get, various preparation	35 (44.9)	15 (18.3)	<0.001*
Prepared at home	43 (55.1)	67 (81.7)	

**p-value* <0.05 (significant), chi-square test
Data shown in column percentage

Table 3. Correlation between snacking frequency and score of diet quality components

	Snacking frequency
Score of fruits	r = 0.216 p = 0.003* n = 185

Snacking frequency = raw frequency, not in group

**p-value* <0.05 (significant), spearman correlation test

Table 4. Correlation between meal frequency and score of diet quality components

	Snack frequency
Score of grain	r = 0.256 p = <0.001* n = 185
Score of iron	r = 0.163 p = 0.026* n = 185
Score of calcium	r = 0.241 p = 0.001* n = 185

meal frequency = raw frequency, not in group

**p-value* <0.05 (significant), spearman correlation test

Appendix 11. Additional analysis (*Continued*)

Table 5. Association between meal preparation and diet quality

Variable	Diet quality		<i>p-value</i>	Crude OR (CI 95%)
	Below median n (%)	Above median n (%)		
Meal preparation-Breakfast (n=156)				
Buy, get, various preparation	14 (60.9)	9 (39.1)	0.288	1.627 (0.659-4.018)
Prepared at home	65 (48.9)	68 (51.1)		1
Meal preparation-Lunch (n=143)				
Buy, get, various preparation	21 (58.3)	15 (41.7)	0.162	1.721 (0.801-3.695)
Prepared at home	48 (44.9)	59 (55.1)		1
Meal preparation-Dinner (n=160)				
Buy, get, various preparation	30 (60.0)	20 (40.0)	0.070	1.867 (0.947-3.683)
Prepared at home	49 (44.4)	61 (55.5)		1

**p-value* <0.05 (significant), chi-square test
Data shown in row percentage

Table 5. Stratification of association between meal preparation and diet quality regarding living area

Variable	Diet quality		<i>p-value</i>	Crude OR (CI 95%)
	Below median n (%)	Above median n (%)		
Urban (n=96)				
Snacking frequency				
No snacking	19 (73.1)	7 (26.9)	0.015	6.107 (1.415-26.356)
1-2 times	37 (64.9)	20 (35.1)	0.031	4.163 (1.137-15.233)
≥3 times	4 (30.8)	9 (69.2)		1
Rural (n=89)				
Snacking frequency				
No snacking	14 (43.8)	18 (56.2)	0.749	1.296 (0.264-6.374)
1-2 times	19 (38.8)	30 (61.2)	0.945	1.056 (0.226-4.936)
>3 times	3 (37.5)	5 (62.5)		1

Data shown in row percentage
p-value <0.05 (significant), chi-square test

