SUSTAINABLE DIETS FOR ALL

RESEARCH PAPER

Indonesia's triple burden of malnutrition

A call for urgent policy change

KEMENTERIAN SOSIAL REPUBLIK INDONESIA

UNIVERSITAS JEMBER

tanoker

Hivos people unlimited

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AUTHORS
Jember University with IIED

IIED:
Dr Anne-Marie Mayer PhD (Nutrition Research Consultant)

Jember University:
Ninna Rohmawati, S. Gz., M.P.H. (Head of Research)
Members of the research team: Dr. Isa Ma'rufi, M.Kes; Dr. Dewi Rokhmah, S.KM., M.Kes.; Khoiron, S.KM., M.Sc. ; Ruli Bahyu Antika, S.KM., M. Gizi; Karera Aryatika, S.Gz., M.Gizi; Dr Manik Nur Hidayati, S.Gz., M.Ph.

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Cover photo: Learning session on food with children in Jember (Tanoker)

CONTENTS

LIST OF FIGURES, TABLES AND BOXES

ABBREVIATIONS

DDS	Dietary diversity score
DSR	Dietary species richness
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus group discussions
IIED	International Institute for Environment and Development
KFC	Kentucky Fried Chicken
MDDW	Minimum Dietary Diversity for Women
MSG	Monosodium glutamate
SD	Standard deviation
SD4ALL	Sustainable Diets for All
UNICEF	United Nations Children's Fund
WFP	World Food Programme
WHO	World Health Organization

EXECUTIVE SUMMARY

The Asia and Pacific Region is home to more than half the world's undernourished children, but also has the fastest growing prevalence of childhood overweight and obesity. The most dramatic increase in overweight in children under five years old has been observed in Southeast Asia, which saw a 128% increase between 2000 and 2017. With micronutrient deficiencies added to undernutrition and overweight/obesity, the result is known as the 'triple burden of malnutrition'. This phenomenon is particularly stark in Indonesia, which is experiencing a very high prevalence of childhood chronic undernutrition (over 30% in 2017) alongside very high rates of overweight (over 11%). Yet there are very little published data available on people's diets in Indonesia and few methods adapted to measure the triple burden.

The food diaries project in East Java was designed to fill this gap and provide information for local and international advocacy on healthy sustainable diets. The survey was undertaken in 2018 in Jember municipality, and included a mix of coastal, lowland and highland areas. The study was conducted as part of the Sustainable Diets for All (SD4ALL) programme implemented by Hivos and IIED in partnership with the Dutch Government. This report describes and reviews the innovative methodology developed for the research, outlines the key findings, and provides recommendations for both policy and methodological improvements.

What were the study's aims and methods?

This study used data generated with and by the local community in Jember to try to better understand their diets and what drives their food choices. It was led by Tanoker, a local non-government organisation (NGO) which advocates for better and healthier eating in the context of the malnutrition challenges outlined above. The study combined a range of innovative data collection and analysis methods:

- Self-administered seven-day food diaries were completed by 97 households, giving 328 individual seven-day personal food and drink records.
- Qualitative interviews and focus group discussions were held with 40 individuals to explore in greater detail the reasons behind consumption patterns.
- Demographic data were collected for each household.
- A daily dietary diversity score was calculated for each individual.
- A dietary species richness score (DSR) captured the diversity of items consumed within each food group. This was constructed using the full list of ingredients provided in the food diaries.
- The frequency of consumption of ultra-processed foods, sweet foods and monosodium glutamate (MSG) was measured. Traditional indicators do not capture the consumption of these types of foods, yet they are important contributors to overweight and obesity.

Key findings

- A sizeable proportion of respondents do not meet the minimum daily dietary diversity target of eating 5 out of the 10 healthy food groups. Over the seven days of record keeping, 35% of adults and 39% of children aged 5-18 ate fewer than 5 food groups. These results are of particular concern for children — 4 in every 10 children do not have a diverse enough diet and are at greater risk of nutrition deficiencies.
- Ultra-processed foods, sweets and MSG are widely consumed, and are potentially related to a range of health problems. The reasons for their consumption include food costs, lack of time, dietary habits, taste preferences and the increasing practice of fast-food consumption. Worryingly, ultra-processed foods were consumed more by children than adults. Sweets were consumed more often by adults.
- The dietary species richness score revealed that although 160 different species are consumed by the sample population overall, in general people rely on just a few foods and there was little diversity within the food groups — for example, 67% of cereal consumption was rice, 61% of nuts and seeds were peanuts, 84% of legumes were soybeans, 61% of meat was chicken, 80% of vitamin A-rich fruit were papaya and 98% of vitamin A-rich vegetables were carrots.
- Few people grow their own food — mostly sourcing it from markets and a variety of vendors.
- Food choices are driven by several factors, including cost, dietary habits, health factors, and time and food availability. Poverty and the cost of food were very clear factors limiting dietary diversification.

Recommendations

Towards a healthier diet

For adults and children in Jember to meet the dietary diversity target, they need to consume a wider range of nutrient-rich foods, particularly vitamin A-rich fruits and vegetables, eggs, pulses, nuts and seeds, whilst reducing unhealthy choices such as ultra-processed foods, oils, fats and sweets. The good news is there is a large diversity of foods available in the region, and much potential to improve diets by using these foods more in local cuisine. Achieving healthier diets requires action on several fronts:

- Action to improve children's diets. This includes improving the food culture in schools, developing a whole-family approach to providing healthy foods at home, and supporting healthy cooking using the wealth of local food diversity.
- Stronger regulation of commercial food processing, and better use of local dietary guidelines. Policies should aim to increase the diversity of foods sold by market vendors and improve the availability of and access to local, healthy, seasonal food in these markets.
- Better alignment between dietary needs and agricultural policy. Farmers need to be supported to practise sustainable agriculture, avoid using agro-chemicals and improve agricultural diversification. Subsidies that solely target staple crops should be reviewed. The reasons behind the limited homestead production of fresh foods should be explored and community initiatives set up to promote it.

Towards a more integrated methodology

Despite the urgent need to address the triple burden of under-nutrition, overweight/obesity, and micronutrient deficiency, there is a lack of suitable methods and indicators for understanding and measuring it. The serious nutrition problems reflected in the triple burden are currently being considered and dealt with as separate issues, and not necessarily viewed as a single problem. A more holistic approach is needed for assessing diets and food systems, using indicators and assessment methods that can map, understand and address the triple burden of malnutrition in an integrated way:

- Researchers need straightforward, ready-to-use participatory dietary assessment methods that cover all age groups and genders. It is important to be able to assess school-age children, adolescents and men separately instead of focusing almost exclusively on infants, young children and women of reproductive age.
- A new easy-to-use dietary indicator that accounts for both healthy and unhealthy foods would be useful — perhaps including negative scoring for unhealthy foods.
- The dietary species richness score is a promising new indicator that can potentially link sustainable agriculture practices, agro-biodiversity and diets.
- Self-administered food diaries are a step forward from the expert-driven approach to research, offering a method that allows people to collect their own dietary data, while saving some time and effort. But data analysis remains a skilled and laborious endeavour. Combining food diaries with accessible electronic recording methods (for example, a specially programmed app for a mobile phone) would ensure they are still participatory, while sophisticated software would enable semi-automated analysis, saving time and money and encouraging more data collection.

These actions would help to build a fuller picture of diets in different contexts for use in policies and programmes aimed at tackling the urgent problem of the triple burden of malnutrition.

1. INTRODUCTION: THE TRIPLE BURDEN OF MALNUTRITION

The world is facing a growing nutrition crisis: low and middle-income countries are struggling with a 'triple burden of malnutrition', an incongruous situation in which large shares of their populations are either hungry, suffering from micronutrient deficiencies (hidden hunger), or dealing with the consequences of overweight and obesity — or more than one of these conditions simultaneously (Pinstrup-Andersen and Watson II 2011). Globally, 149 million children are stunted (too short for their age), 50 million children are wasted (too thin for their height), 340 million children (or 1 in 2) suffer from deficiencies in essential vitamins and nutrients such as vitamin A and iron, and 40 million children are overweight or obese (Islam 2019). While undernutrition is a major contributing factor to child illness, disability and death, overnutrition in childhood can lead to diet-related non-communicable diseases such as diabetes and cardiovascular disease in later life.

Poor diets are a major contributory factor to all forms of malnutrition. Globally in a 24 hour-period, almost 45% of children aged 6 to 24 months had no fruit or vegetables and almost 60% had no animal-sourced foods. Access to ultra-processed foods is increasing, even in remote areas (Islam 2019)

This phenomenon, whereby poor countries are shifting from undernutrition to the triple burden, is known as 'the nutrition transition'. The serious nutrition problems reflected in the triple burden are currently being considered as separate issues, and not necessarily perceived in an integrated way. Doing so would allow changes to be made to the whole food system. For example, in the UN system UNICEF leads on undernutrition while the World Health Organization (WHO) leads on overweight, thinness, child overweight and anaemia (Development Initiatives 2018). Food security is led by the Food and Agriculture Organization and the World Food Programme.

The Asia and Pacific Region is home to more than half the world's undernourished children, and also has the fastest-growing prevalence of childhood overweight and obesity. The most dramatic increase in overweight in children under five years of age has been observed in Southeast Asia (7% prevalence in 2017), which saw a 128% increase from 2000. This pattern of malnutrition is particularly stark in Indonesia, which has a very high prevalence of childhood chronic undernutrition (over 30% in 2017) alongside very high rates of overweight (over 11%). Indonesia is one of the seven countries in the region that is experiencing a 'public health concern' on both counts (FAO 2018).

There are very little published data available on the diets of people living in Indonesia. The food diaries project was designed to fill this gap and provide information for local and international advocacy on healthy sustainable diets. The survey was undertaken in 2018 in Jember in East Java, and included a mix of coastal, lowland and highland areas. The study was conducted as part of the Sustainable Diets for All (SD4ALL) programme (2016-2020) — an advocacy programme working to improve diets for all people in Uganda, Zambia, Kenya, Bolivia and Indonesia, coordinated by Hivos, IIED and partners in the countries.[1] This report describes and reviews the innovative methodology developed for the research, outlines the key findings, and provides recommendations for both policy and methodological improvements.

The triple burden in Jember, Indonesia

Although Indonesia has seen rapid economic growth and income increases in recent decades, improvements in the standards of living across the country have been starkly unequal. Despite the economic gains, malnutrition remains widespread: in 2013 more than one in ten children under five were overweight, over a third were stunted, and more than 13% were wasted. About a third of women of reproductive age had anaemia, and 8% were diabetic. At the same

1 https://www.iied.org/sustainable-diets-for-all.

Children carrying snacks, Jember (Tanoker)

time, 15% of children and adolescents (5-19 years) were overweight, as were about a third of women and a quarter of men (Development Initiatives 2018). Some of these trends appear to be related to urbanization, which has led to more women working outside the household — meaning less time to prepare food at home and greater consumption of processed food (McAuliffe 2016). Climate change, including extreme weather events, and continued urbanisation are two other risk factors for food insecurity in Indonesia (House 2019).

The national data on diets for infants and young children (aged 6-23 months) show that most do not consume an adequate diet. According to the *Indonesia Demographic and Health Survey 2017*, 60% of children have an adequately diverse diet, and 72% of children are fed the minimum number of times appropriate for their age; but only 40% of children are fed a minimum acceptable diet (adequate diversity and frequency). There is a clear relationship between dietary adequacy, wealth and education. The percentage of children fed according to recommended infant and young child feeding (IYCF) practices increases with increasing mother's education and household wealth. Only 13% of children whose mothers have no education are fed according to recommended IYCF practices, compared to 54% of those whose mothers are educated above secondary level. Similarly, 28% of children from households in the lowest wealth quintile are fed according to recommended IYCF practices, compared with 57% of those from households in the highest quintiles (National Population and Family Planning Board, Statistics Indonesia et al. 2017) The Demographic and Health Survey does not include data on older children or other demographic groups.

The BPS (Indonesian Statistics Bureau) collected dietary data in 2016 which revealed that while cereal and tuber intake was as recommended by the Indonesian national dietary guidelines (FAO 2014), consumption of vegetables and fruit was below the recommended intake, and sugar and oil consumption was too high. Diets are heavily reliant on rice, while non-starchy foods make up only 30% of diets; this low share signals possible deficiencies (House 2019).[2]

In another study of Southeast Asia, including Indonesia, adults' consumption patterns were explored using focus group discussions. This study found that although traditional foods were still the first choice, a transition to western foods was occurring, especially in the urban areas (Lipoeto, Lin et al. 2012).

Jember municipality in East Java is a good location to explore the challenges of malnutrition in Indonesia. Agriculture is still a key economic activity in the region, but urbanization is proceeding rapidly — as are changes to diets. A recent study suggests that people are concerned about their diets and would like to eat healthier food-, but they face several challenges. For example, unhealthy processed foods are readily available and foods such as fish and fruit are more difficult to find. There is limited land on which to grow healthy foods.

Children eat unhealthy food outside the home — including when at school. Even at home they prefer unhealthy foods and might refuse to eat healthily. Family income is often insufficient to buy healthy food (SCN-CREST and TANOKER 2017). Another study found that only 58% of the population in East Java were able to afford a nutritious diet (WFP 2017). There is also a perception that food is unappealing

2 Our results from the food diaries analysis cannot be assessed against these national dietary guidelines because we do not know the quantities of foods consumed, only whether or not particular foods have been consumed over a week.

Food diaries photo (Food diaries participants)

without added monosodium glutamate (MSG). Information on healthy eating and the dangers of processed food is not widely available, and there is widespread advertising and promotion of unhealthy food in the media.

What is the food diaries project?

The food diaries study uses data generated with and by the local community in Jember to try to better understand their diets and what drives their food choices. The study was led by the Faculty of Community Health at the University of Jember and Tanoker, a local non-government organisation (NGO) which advocates for better and healthier eating in the context of the malnutrition challenges outlined above. There were three main reasons for conducting this research:

1. To assess whether the communities are meeting dietary recommendations and if there are any differences between children and adults, socio-economic groups or geographic locations.
2. To generate guidance and act as a point of reference for interventions by NGOs and other groups to improve healthy local food availability in the community.
3. To generate advocacy materials or references for various stakeholders working on food diversity and healthy local food availability in the context of collaborative parenting (parenting by the community, not just the parents).

The research explored a number of questions that are locally relevant for Tanoker and its advocacy activities in Jember. For example: what foods are consumed, and how diverse is the diet? Are these diets adequate, and according to what standards? Where do people get their food? And why do people eat what they eat? These questions are also relevant for a broader national and international audience, as they reflect the nutritional challenges faced by other emerging economies, and illustrate the shifts in dietary patterns taking place with urbanisation. Moreover, the use of food diaries to collect the data (as explained below) offered the chance to evaluate this dietary assessment method. Finally, as research in which citizens were actively involved in data collection and interpretation, the research offers an illustration of the opportunities for citizen science.

Research on diets and nutrition can too often be extractive: outside experts typically collect data that are interpreted and analysed far from the communities, without any meaningful engagement. Policy based on this type of data can have significant blind spots regarding the interests, concerns and priorities of the people it is supposed to help. This study puts the voices and experiences of local citizens at the centre of the research. Its rationale is that if the community can generate its own evidence this can promote more effective and independent lobbying and advocacy in the determination and implementation of food policies.

The research involved some methodological innovations that may provide alternatives to current ways of assessing dietary patterns. For example, traditional methods involve face-to-face interviews conducted by trained enumerators, whereas self-recorded dietary data collection offers a less time-consuming alternative. The usual method of assessing dietary diversity asks respondents to recall what they have consumed over a 24-hour period; this information is recorded by enumerators and classified into food groups. In this research respondents recorded information in a diary at each mealtime over a seven-day period, providing a possibly more accurate account of their meals and over a longer time period. Finally, most surveys just record the number of food groups that are consumed to produce the usual dietary diversity measures. Food diaries allow all ingredients to be recorded individually, thus providing a rich and detailed source of data. This has allowed us to 'dig deeper' and to use an innovative dietary species richness index to describe diets that has been developed for linking diets to biodiversity (Lachat, Raneri et al. 2018).

2. ASSESSING DIETS

The strengths and weaknesses of nutrition and dietary assessment tools

It is important to be able to understand the triple burden of malnutrition in countries experiencing the nutrition transition in order to prevent it. This means understanding diets, which is achieved using dietary assessments and analysing data using dietary indicators to compare populations.

Dietary assessment methods include questionnaires or self-administered diaries asking individuals or households to recall the food and drinks consumed; there is also a range of qualitative and quantitative techniques and ways of analysing data (Food and Agriculture Organization 2018). All dietary assessment methods have limitations, however. It is difficult to achieve accurate recording due to systematic and random biases in collecting data — whether using self-recorded or expert-administered methods. In all cases, people can be tempted to exaggerate their consumption of healthy foods and under-record unhealthy choices. Nevertheless, food diaries offer respondents some control and can be more accurate as people fill them in after each meal and therefore do not have to try to recall what was eaten over the past few days.

For dietary surveys to report results in a systematic and valid way that allows comparison across and within populations it is necessary to use indicators to judge how healthy the diets are and whether they meet current recommendations. Most dietary indicators have been developed to understand dietary diversity as it relates to micronutrient malnutrition as a key determinant of chronic under-nutrition (stunting) and are therefore focused on the 6 to 23 month-old-child and its mother or carer (FAO 2016). For example,

- The World Health Organization has developed the Minimum Dietary Diversity for Young Children (6 to 24 months) indicator, recommending a minimum of four out of seven food groups (WHO 2010)
- The Minimum Dietary Diversity for Women (MDDW) is constructed from 10 food groups. Adequacy is defined as daily consumption of at least five of 10 of these food groups by women aged 15 to 49 (FAO and FANTA 2016).

These two indicators are inadequate for surveys that include all demographic groups because they have only been validated for women and young children. They also only assess dietary diversity in terms of the broad food groups, rather than a full range of within-group dietary diversity. Finally, they fail to account for the consumption of 'unhealthy foods' that are likely to contribute to overweight and chronic diseases.

What methods were used in this study?

This study has tried to fill some of these methodological gaps by using innovative approaches to assessing diets related to the triple burden of malnutrition:

- We issued diaries to each household in the sample for recording all meals eaten (including all ingredients) by all household members over a seven-day period.
- We used in-depth interviews with heads of households and community figures (formal and informal) to explore reasons behind consumption patterns in more depth. We also carried out focus group discussions to present the results of food diaries analysis back to the community for their information, and we collected socio-economic data for each household.
- We used a dietary diversity score to indicate the number of 'healthy' food groups consumed by each individual each day. Known as the Minimum Dietary Diversity for Women (MDDW) score (see above), this has a target daily consumption of five out of the 10 food groups (FAO and FANTA 2016). Though created for women aged 15 to 49, in the absence of any other suitable indicator we used this indicator and the recommended target for everyone over 5 years old.
- We used a dietary species richness score (DSR) to capture the diversity of items consumed within each food group. This is constructed using the full list of ingredients provided in the food diaries. The DSR was developed for use in studies on biodiversity and nutrition. There is some evidence that a higher DSR is related to an adequate diet in terms of micronutrient nutrition (Lachat et al. 2018).

Box 1 What are ultra-processed foods and monosodium glutamate?

Ultra-processed food

Ultra-processed food is a concept devised by the Brazilian nutrition researcher Carlos Monteiro, who uses the term to refer to the processing of substances derived from foods by e.g. baking, frying, extruding, moulding, re-shaping, hydrogenation and hydrolysis. Ultra-processed foods generally include a large number of additives such as preservatives, sweeteners, sensory enhancers, colorants, flavours and processing aids, but little or no whole food. They may be fortified with micronutrients and are generally considered as obesogenic. There is no widely accepted definition, but for this analysis, ultra-processed foods are defined by the authors as 'highly processed foods and drinks made by large or small-scale industry that reduces the food's nutritional content'. A full definition is available in (Monteiro et al. 2019).

Monosodium glutamate (MSG)

MSG is widely used in Asian cuisine and its reputation as an unhealthy component of diets is well known. A recent review stated the following: 'Different reports revealed increased hunger, food intake, and obesity in human subjects. Limited studies have been carried out on humans to check possible hepatotoxic, neurotoxic, and genotoxic effects of monosodium glutamate. Available literature showed that increased consumption of monosodium glutamate may be associated with harmful health effects' (Kazmi, Fatima et al. 2017). A special focus on MSG is therefore warranted.

- We measured separately the frequency of consumption of ultra-processed foods, and sweet foods. Traditional indicators do not capture the consumption of these types of foods, yet they are important contributors to overweight and obesity (Box 1). Currently, there are no suitable dietary indicators to capture consumption of these undesirable foods.[3] We also included a special analysis of monosodium glutamate (MSG) because this was a food ingredient of special concern to the research team (**Box 1**).

Data collection

Data were collected between November 2017 and February 2018 by Jember University and Tanoker Foundation with support from IIED and Hivos. Multistage sampling was used to first select six sub-districts that represented the area's three main geographical locations: Ledokombo and Sumberjambe Sub-districts (highlands), Tanggul and Kaliwates Sub-districts (lowlands), and Ambulu and Puger Sub-districts (coastal). Neighbourhood units were then selected systematically and the households were then randomly selected. The sample included 97 households representing a total of 328 individuals, with approximately equal numbers from each sub-district (Table 1). The sample was evenly distributed between the six sub-districts and three geographical areas.

Dietary patterns were recorded using self-reported food diaries. The household member who was responsible for food preparation was asked to record the meals consumed by each member of the household. For meals outside the home, she/he asked each member separately about what they had eaten during the day. Data sheets were used to record food consumed in each 24-hour period (breakfast, morning snacks, lunch, afternoon snacks, dinner, night snacks) over seven consecutive days. For composite dishes the respondent had to record all the ingredients, however small

3 Indicators of consumption of ultra-processed foods are available, but could not be used in this research because they require quantities of food consumed. For example, the *Percentage of energy comprised of ultra-processed foods* indicator is specifically designed to calculate how much dietary energy is consumed as ultra-processed foods (INDDEX Project. (2018). "Data4Diets: Building Blocks for Diet-related Food Security Analysis. Accessed on 19 September 2019." from https://inddex.nutrition.tufts.edu/data4diets). This indicator, however, was not suitable for this analysis because it requires quantities and food diaries did not record quantities of foods. The *Diet quality index* includes quantification of foods that should be used in moderation (total fat, saturated fat, cholesterol, sodium, empty calorie foods) but this also requires food quantities, so was not suitable for this analysis (Herforth, A. and A. Rezpa (2019). "Defining and measuring diet quality worldwide" https://news.gallup.com/opinion/gallup/199436/defining-measuring-diet-quality-worldwide.aspx).

Table 1. Distribution of food diary and in-depth interview respondents

Sub-district	Geographic characteristics	Food diaries		In-depth interview respondents	
		Households	Individuals	Community and religious leaders	Households
Ledokombo	Highlands	16	53	2	5
Sumberjambe	Highlands	16	52	2	5
Tanggul	Lowlands	16	58	2	4
Kaliwates	Lowlands	16	55	2	5
Ambulu	Coastal	17	52	2	4
Puger	Coastal	16	58	2	5
Total		97	328	12	28

the quantity. Photos were also taken of each meal to be used for verification purposes. Research enumerators visited each household every day during the seven-day period to ensure the recording was done correctly and to provide further information if required. An example of a completed form is shown in Annex 1.

In addition to the food diaries, qualitative interviews and focus group discussions were held and analysed for 40 individuals to explore in greater detail the reasons behind consumption patterns. Demographic data were also collected for each household. Income and total household expenditure were recorded only once per household in the data set and usually for the male head of household. To determine the relationship between diet, income and total expenditure, this information was applied to all household members.

'Highest education level achieved' was recorded for each individual, although for children still in education this does not apply. Instead the education level of the oldest female in the household was assigned to all children of 0 to 18 years in that household to understand the influence of female education level on diet.

Data analysis

There are two ways of classifying foods: 1) a complete list of 18 foods that includes both 'healthy' foods that contribute to dietary adequacy as well as 'unhealthy' foods (oils and fats, spices, condiments and beverages, sweets and ultra-processed foods); or 2) a more restricted categorisation involving 10 food groups that relate to diets that are adequate in micronutrients (Table 2). For this analysis we have broadly defined 'healthy foods' as those included in the 10-group classification and the remaining food groups as 'unhealthy'. This classification system is not watertight, but helps us describe the diets in an understandable and inclusive way.

In the absence of any recognised indicators of ultra-processed foods recorded from food diaries, we have reported these foods in a similar way to all the other food groups. The frequency of consumption of ultra-processed foods (as a food group) was reported over a week. For MSG the overall frequency of consumption was reported because MSG is a particular food additive of interest in this population.

Food diary data were computerised, cleaned and analysed in Microsoft Excel. For each meal the individual ingredients were recorded as separate entries. With 328 respondents over seven days, five meals per day and several ingredients for each meal, the result was tens of thousands of food consumption records. Each ingredient was categorised into the 18 food groups and a yes/no indicator constructed for each individual for each food group when this food was consumed at least once during a 24-hour period. This was done for each of the seven days separately and the data reported as weekly frequency of consumption. These data were then analysed to calculate the following scores.

Calculating the dietary diversity score

The daily dietary diversity score was constructed by recoding the 18 food groups into the 10 food groups for each individual each day using the classification system shown in Table 2. The number of food groups consumed each day was then totalled to calculate the Minimum Dietary Diversity for Women (MDDW) score (see above). This has a target daily consumption of at least 5 out of the 10 food groups (FAO and FANTA 2016). Though created for women aged 15 to 49, in the absence of any other suitable indicator we used this indicator and the 5-group target for everyone over 5 years.

Table 2. Correspondence between the two systems of food classification (10 groups vs 18 groups)

10 groups system	18 groups system
Grains, white roots and tubers, and plantains	Cereals
	White roots and tubers
Dark green leafy vegetables	Dark green leafy vegetables
Eggs	Eggs
Meat, poultry and fish	Fish
	Meat and poultry
	Organ meat
Dairy	Milk and milk products
Nuts and seeds	Nuts and seeds
Other vitamin A-rich fruits and vegetables	Vitamin A-rich fruits
	Vitamin A-rich vegetables and tubers
Other fruits	Other Fruits
Other vegetables	Other vegetables
Pulses (beans, peas and lentils)	Pulses (beans, peas and lentils)
Not included	Spices, condiments, beverages
	Sweets
	Ultra-processed foods
	Oils and fats

Cooking competition (New Generation Indonesian Cooking)

Calculating the dietary species richness score

To calculate the DSR each food ingredient was recoded according to its source species using its common name in English (for example wheat). Using the example of wheat, all processed forms of that food are coded as wheat, such as bread, noodles, flour, biscuits etc. Some foods appear in more than one food group, for example cassava leaves and cassava root both get coded as cassava but appear in two different food groups. Also, animal sourced foods are coded by the animal (for example milk and beef are recorded as cow, and chicken liver and eggs are both recorded as chicken). Foods that are not clearly traceable to a species are excluded from the DSR score, such as salt, seasoning and MSG. Sugar is recorded as 'sugar cane' or 'palm' etc. depending on its source. In the case of foods that have not been described in detail, an 'unspecified' code is assigned. For example, 'fish unspecified' where the species was not recorded, or 'meat unspecified' for sausage.

Methodological limitations

- Data were collected in just one season (the rainy season), and not necessarily the most food insecure season, so results are not representative of the full year.
- The use of self-reported food diaries has not been validated for accuracy and foods eaten outside the home could be under-reported and the ingredients not fully known. There could be systematic under-reporting of foods known to be unhealthy or obesogenic. On the other hand, the experience and attention given to diet during the recording period may have either changed food choices or encouraged over-reporting of perceived healthy foods.
- The dietary species richness score was used retrospectively and therefore the respondents were not primed to record the species (for example we needed 'tuna' but respondents wrote 'fish'), so there are some gaps or 'unspecified' foods.
- In this assessment we have used the 10-food group dietary diversity score for everyone over five and reported separately on unhealthy foods. There were no guidelines available to report on these unhealthy foods so the results cannot be compared easily with other studies.
- The data collected do not include quantities, so foods may be counted even when small quantities are consumed. Some allowance has been made for this by classifying garlic and shallots as condiments due to their customary use in very small quantities.
- The number of young children (0 to 5 years) was just 26 in this sample of 97 households which is too small for an analysis of their diets. This is a missed opportunity to examine the diets of this age group, which is usually vulnerable to malnutrition.

3. RESULTS

Wherever possible data are presented separately for adults and children and for males and females to establish whether there are important differences between these demographic groups. Also, of interest is the relationship between diets and socio-economic variables — such as income and education.

Demographic and socio-economic characteristics

Table 3 summarises the demographic information. Children have been divided into younger than 5 years and 5 to 18 years old, though the young group is not well represented in the sample (8%). For this reason, special sub-group analyses for the young children have not been carried out. The sample is quite equally distributed between male and female.

A large proportion of adults (63%) were educated to senior high school level or above, while the children were still at various stages in their education. Most adults were married (83%). There was a range of jobs, with entrepreneur and housewife being the most common. There was very large variability in income and expenditure in the sample. Wages were recorded most commonly just for male adults because few women worked for wages, with the average male monthly wage being 1.7 million rupiah (109 euros). Only eight women earned wages, including widows and other female household heads (Table 4). Overall household expenses were again mostly recorded just for adult males, with the monthly average in that group being 0.8 million rupiah (51 euros). For further analysis of the relationship between diet and income, the income of the household was applied computationally to all household members. Similarly, for analysing the relationship between female education and diet, the education of the oldest female was applied computationally to all children.

Table 3. Demographic characteristics

Characteristic	Adults 18+	Children 5-18	Children < 5	Total
	N (%)	N (%)	N (%)	N (%)
All	222 (67.7)	80 (24.4)	26 (7.9)	328 (100)
Male	102 (46.0)	41 (51.3)	14 (53.9)	157 (47.9)
Female	120 (54.1)	39 (48.8)	12 (46.2)	171 (52.1)
	mean ± SD	mean ± SD	mean ± SD	mean ± SD
Age (years)	36.9 ± 11.8	10.5 ± 4.0	2.6 ± 1.4	27.8 ± 16.7
Children per household	1.4 ± 1.0			0.9 ±1.0
Education	N (%)	N (%)	N (%)	N (%)
Preschool		1 (1.3)	19 (73.1)	20 (6.1)
Kindergarten		37 (46.3)	7 (26.9)	44 (13.4)
Did not complete primary school	6 (2.7)	5 (6.25)		11 (3.4)
Primary school	39 (17.6)	24 (30)		63 (19.2)
Junior high school	35 (15.8)	6 (7.5)		41 (12.5)
Senior high school	113 (50.1)	7 (8.8)		120 (36.6)
Undergraduate	27 (12.2)			27 (8.2)
Postgraduate	2 (0.9)			2 (0.61)

Table 3. Demographic characteristics (cont.)

Characteristic	Adults 18+	Children 5-18	Children < 5	Total
Marital status	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Single	31 (14.0)	80 (100)	26 (100)	137 (41.8)
Married	185 (83.3)			185 (56.4)
Widow	6 (2.7)			6 (1.8)
Job	**N (%)**	**N (%)**	**N (%)**	**N (%)**
Student	16 (7.2)	72 (90.0)	5 (19.2)	93 (28.4)
Not working yet	3 (1.3)	6 (7.5)	21 (80.8)	30 (9.2)
Housewife	60 (27.0)			60 (18.3)
Entrepreneur	68 (30.6)	1 (1.3)		69 (21.0)
Employee	20 (9.0)	1 (1.3)		21 (6.4)
Farmer	24 (10.8)			24 (7.3)
Labourer	12 (5.4)			12 (3.7)
Teacher	8 (3.6)			8 (2.4)
Other occupation	7 (4.2)			7 (2.1)
Unemployed	3 (1.4)			3 (0.9)
Retired	1 (0.5)			1 (0.3)
Income & expenses per month	**mean ± SD**	**mean ± SD**	**mean ± SD**	**mean ± SD**
Income				
Total average (rupiah)	952,568 ± 1,634,947	0	0	
Male average	1,720,784 ± 1,284,135	0	0	
Female average	299,583 ± 1,621,371	0	0	
Expenses				
Total average (rupiah)	409,527 ± 574,727	0	0	
Male average	794,265 ± 508,625	0	0	
Female average	82,500 ± 398,930	0	0	

Table 4. Income distribution by gender (adults only)

			Monthly income bands (rupiah)		
Sex	No recorded income	0 to <=1,000,000	>1,000,000	>2,000,000	
	N (%)	N (%)	N (%)	N (%)	Total
Male	13 (12.8%)	22 (21.6%)	44 (43.1%)	23 (22.6)	102
Female	112 (93.3%)	1 (0.8%)	1 (0.8%)	6 (5%)	120
Total	125 (56.3)	23 (10.4%)	45 (20.3%)	29 (13.1%)	222

Table 5. Weekly frequency of consumption of 18 food groups (all 328 respondents)

	Times per week (% of respondents)							
Food group (18)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Cereals	1%	0%	0%	0%	0%	1%	0%	98%
Dark green leafy vegetables	3%	16%	26%	26%	16%	8%	5%	0%
Eggs	5%	10%	14%	19%	23%	14%	11%	4%
Fish	6%	11%	20%	23%	15%	15%	7%	3%
Meat and poultry	13%	14%	18%	16%	14%	13%	8%	5%
Milk and milk products	69%	14%	5%	3%	2%	2%	2%	3%
Nuts and seeds	31%	27%	19%	14%	5%	3%	1%	0%
Oils and fats	1%	0%	0%	1%	2%	4%	14%	78%
Organ meat (offal)	73%	19%	5%	2%	1%	0%	0%	0%
Other fruits	23%	17%	14%	14%	11%	10%	6%	5%
Other vegetables	2%	2%	2%	7%	12%	19%	27%	31%
Pulses (beans, peas and lentils)	2%	1%	5%	10%	8%	22%	28%	25%
Spices, condiments, beverages	1%	0%	0%	0%	1%	2%	12%	85%
Sweets	5%	7%	8%	15%	12%	16%	16%	21%
Ultra-processed foods	13%	14%	16%	22%	16%	11%	6%	3%
Vitamin A-rich fruit	87%	9%	3%	0%	1%	0%	0%	0%
Vitamin A-rich vegetables and tubers	43%	30%	16%	7%	2%	1%	0%	0%
White roots and tubers	25%	26%	25%	13%	8%	2%	1%	0%

The green shading relates to the highest percentages in each row

Dietary patterns

As mentioned above, there are no integrated ways to present the dietary data — so we report on 'healthy' aspects and 'unhealthy' aspects separately, and also report detailed species-level results separately from dietary diversity scores. The results of the food diaries analysis are therefore first presented using the 18 food group classification to show the patterns of consumption that contribute to either nutrient-dense dietary diversity or less healthy food choices. Then we report on the narrower range of foods that relate to nutritional adequacy, including the dietary diversity scores. Ultra-processed foods and sweet foods are presented separately to build a full picture of the problems of the triple burden of malnutrition in Jember. To reflect the full range of foods consumed we then present the results of the dietary species richness scores and look at dietary diversity within each food group. The sources of food are presented to understand possible entry points for influencing food choices. Finally, the drivers of food choices are explored drawing on the focus group discussions and interviews. The aim is to understand why people eat what they eat, so as to identify entry points for advocacy.

Weekly consumption of the 18 food groups (including 'healthy' and 'unhealthy' foods)

Table 5 shows the weekly pattern of consumption of the 18 food groups. This shows that cereals, oils and fats, beverages and spices are consumed every day by most households; while 'non-vitamin A-rich' vegetables, pulses and sweets are also frequently consumed. Conversely, dairy products and offal are rarely consumed. It is significant that some of the most commonly consumed groups (oils, fats, beverages and spices) do not build nutrient-rich dietary diversity.

The percentage of individuals who consumed each of the food groups in 24 hours was averaged over 7 days and reported separately for children (5 to 18) and adults (Figure 1). There were similar patterns for adults and children — though milk and milk product consumption were slightly higher for children, it was less than 5% for both children and adults. Ultra-processed food consumption was higher for children than adults.

Cooking competition (New Generation Indonesian Cooking)

Figure 1. Daily consumption of each of the 18 food groups (averaged over 7 days)

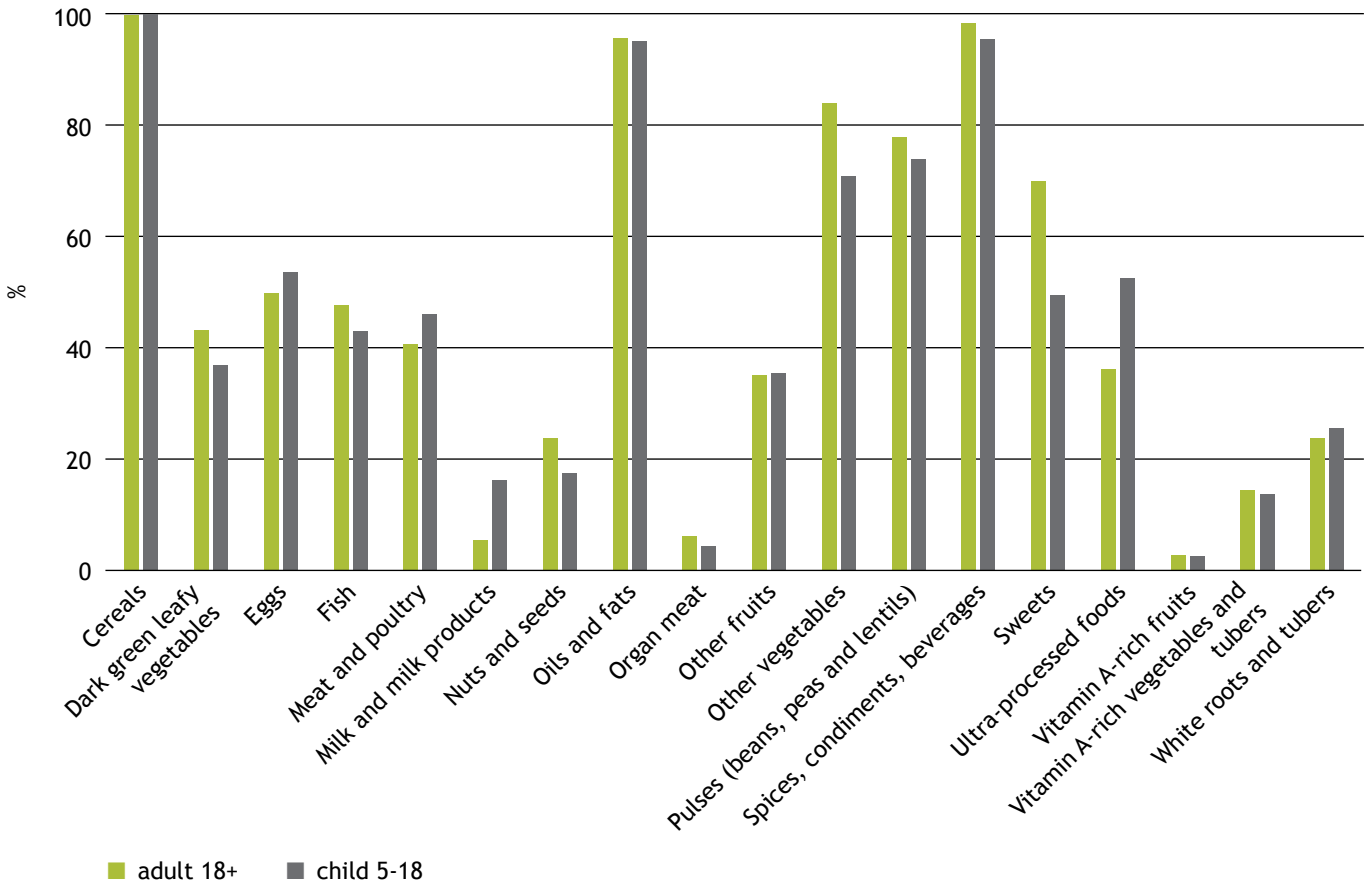
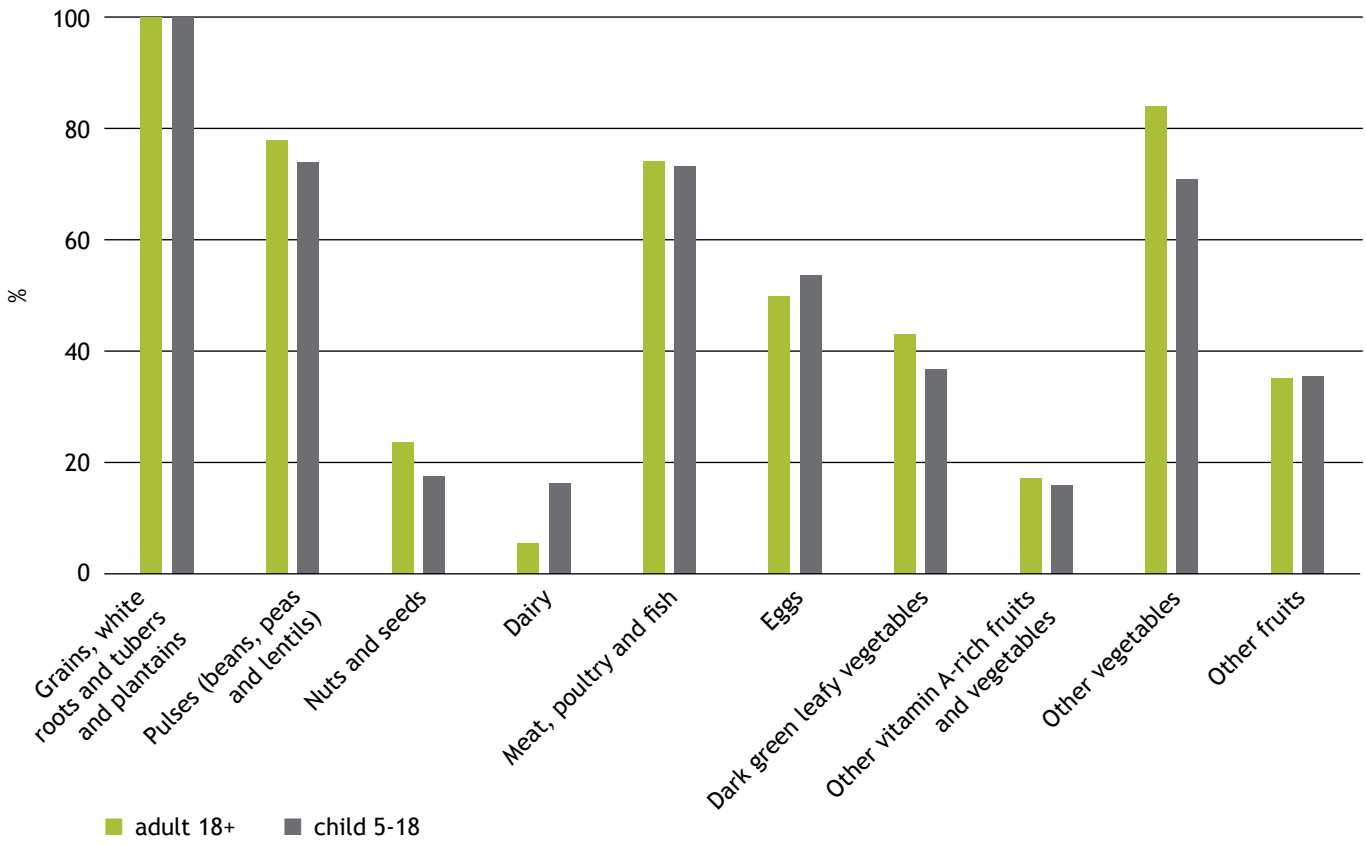


Figure 2. Daily consumption each of the 10 food groups (averaged over 7 days)



Weekly consumption of the 10 'healthy' food groups

We re-classified the 18 food groups into the 10 food groups that have been shown to relate to micronutrient adequacy in the diet (FAO and FANTA 2016). In our sample, the most commonly consumed food groups for building nutrient-rich diets are grains; white roots, tubers and plantains; pulses; meat; and non-vitamin A-rich vegetables (Figure 2). Dairy foods, vitamin A-rich fruit and vegetables, and nuts and seeds were the least consumed of the 10 food groups. The consumption of nuts, seeds and vegetables is lower for children than adults, but milk and milk product consumption is higher for children. From these results we can see that increased consumption of nuts, seeds, dairy foods, eggs, dark green leafy vegetables, other vitamin A-rich vegetables and fruit would help to boost dietary diversity.

The recommended dietary diversity target is to consume at least 5 out of the 10 food groups per day. The Dietary Diversity Score is constructed using these 10 food groups. On average, the people in our sample consumed about five different food groups every day, out of a possible 10, with very little differences between men and women, adults and children, or between days of the week (Table 6, 7). These averages, however, do not tell the full story because a sizable proportion of individuals consumed less than the target five food groups. Over the seven days 35% of adults and 39% of children aged 5-18 did not meet this recommendation (Table 8, Figure 3). These results are of particular concern for children as they show that 4 in 10 children aged 5 to 18 are not consuming an adequately diverse diet.

For adults and children to meet the dietary diversity target of more than five food groups per day, greater consumption of a range of nutrient-rich foods is needed, particularly

Table 6. Average daily dietary diversity score (10 food groups) (averaged over the week)

	Dietary diversity score					
	Male		Female		Total	
	DDS Ave ± SD	N	DDS Ave ± SD	N	DDS Ave ± SD	N
Adult 18+	5.0 ±0.9	102	5.1 ± 0.9	120	5.1 ±0.9	222
Child 5-18	5.1 ±1.0	41	4.8 ±0.8	39	4.9 ±0.9	80

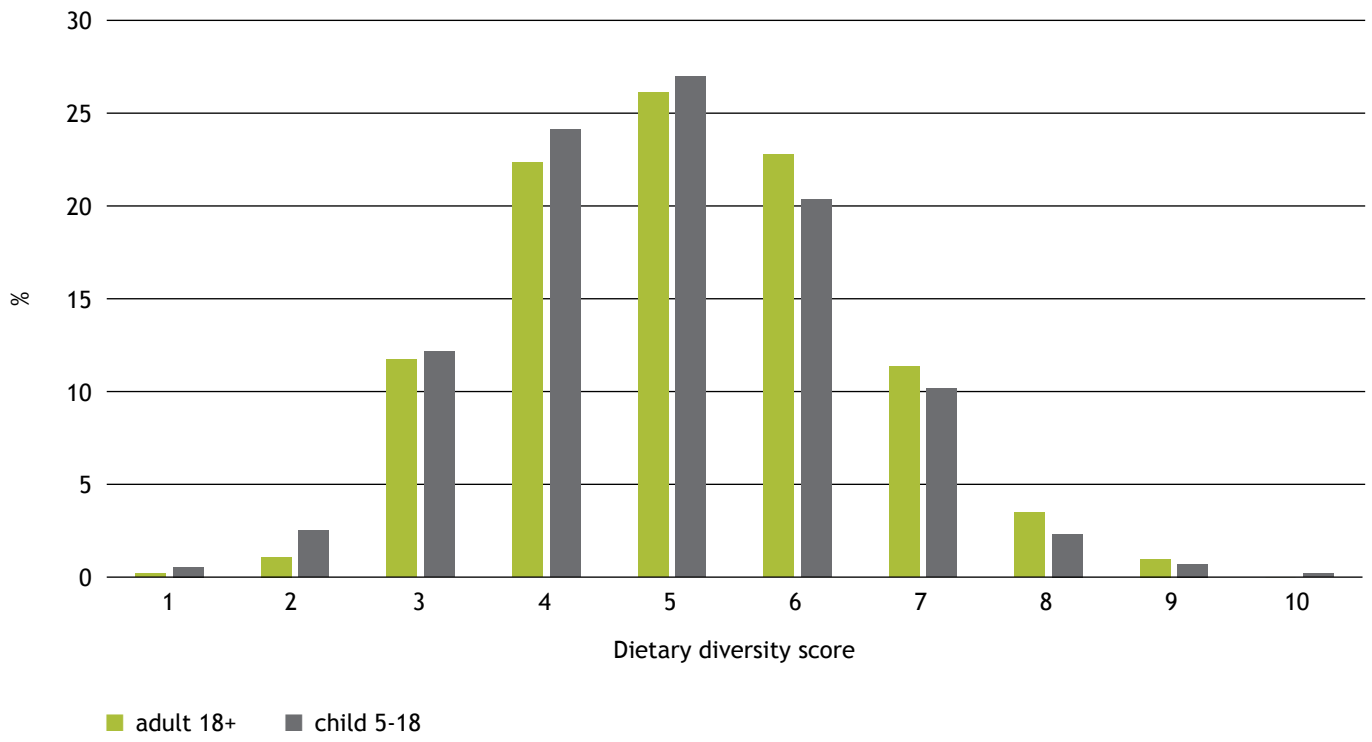
Table 7. Average daily dietary diversity score (10 food groups) for each day

	Dietary diversity score							
	Mon	Tues	Weds	Thurs	Fri	Sat	Sun	Average
Adult 18+	5.1	5.1	5.1	5.2	5.1	5.2	5.0	5.1
Child 5-18	5.0	5.1	4.8	4.9	4.9	5.1	4.8	4.9

Table 8. Daily dietary diversity scores for individual respondents shown for each day

	Adult 18+	Child 5-18
DDS	N (%)	N (%)
< 4 food groups	202 (13.0%)	85 (15.2%)
4 food groups	347 (22.3%)	135 (24.1%)
5 to 6 food groups	760 (48.9%)	265 (47.3%)
7 or more	245 (15.8%)	75 (13.4%)
Total	1,554 (100.0%)	560 (100.0%)

Figure 3. Percentage frequency of daily dietary diversity scores



vitamin A-rich fruits and vegetables, eggs and pulses, nuts and seeds.

Socio-economic and geographical differences in dietary diversity scores

When we look at dietary diversity in relation to socio-economic variables, we find that wealthier, more educated people with higher food expenditures tend to have a slightly more diverse diet (Table 9). For adults, the DDS was 4.7 for those with the lowest educational attainment, compared to 5.7 for those with highest level of education. The DDS for children was 4.7 for households with a mother/carer with the lowest level of education and 6.1 for households with a mother/carer with the highest level of education. There was also slightly higher dietary diversity for adults in the highest household income group and the highest total household expenditure group (Table 9). Higher expenditure on food appears to be linked to higher dietary diversity — particularly for children (Table 10). However, because of the high level of variability in the data, none of these comparisons was statistically significant (based on a t-test at the 0.05 level of significance).

Table 9. Daily dietary diversity score by education, household income, household monthly expenses and geographic region

	Adult 18+		Child 5-18	
	Ave ± SD	N	Ave ± SD	N
Education				
Less educated (up to and including junior high)	4.7 ±0.7	80	4.7 ±0.8	41
Senior high school	5.2 ±0.9	113	5.1 ±1.0	36
Higher education	5.7 ±0.9	29	6.1 ±1.4	3
HH monthly income				
<=1,000,000	5.1 ±0.7	50	5.0 ±1.1	16
>1,000,000 to 2,000,000	4.9 ±0.8	109	4.8 ±0.7	42
>2,000,000	5.4 ±1.1	63	5.1 ±1.1	22
HH monthly expenses				
<=700,000	5.0 ±0.8	66	4.9 ±0.8	21
>700,000 to 1,000,000	5.0 ±0.8	93	4.9 ±0.9	37
>1,000,000	5.3 ±1.1	63	5.0 ±1.0	22
Geographic region				
Coastal	5.2 ±1.0	71	5.1 ±1.1	26
Highlands	5.0 ±0.8	74	4.8 ±0.8	24
Lowlands	5.1 ±0.9	77	4.9 ±0.9	30
Total	5.1 ±0.9	222	4.9 ±0.9	80

Note: for the analysis, the education of the mother/carer has been applied to the child and the total household income and expenditure has been applied to each individual.

Fresh fruits and vegetables, spices and nuts (New Generation Indonesian Cooking)

Table 10. Weekly food expenditure (rupiahs) and average daily dietary diversity

	Adult 18+		Child 5-18		Under 5		Total	
DDS	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
<4.5	120,052	73,375	94,988	29,684	101,108	104,210	110,847	69,737
4.5-5.5	104,655	47,761	106,538	40,155	135,500	72,679	106,847	47,667
>5.5	129,734	67,331	160,093	75,294	126,308	87,871	135,659	70,549
Total	117,202	62,983	115,884	54,610	116,183	90,950	116,799	63,515

The total monthly expenditure was a specific question posed to the household respondent whereas the weekly food expenditure was calculated by adding up all the individual food expenditures from the food diaries.

Consumption of ultra-processed foods and sweets

Ultra-processed foods were consumed regularly, especially by children. This is important because of their implications — along with sweet foods — for overweight and obesity (as described above). Overweight and obesity are part of the triple burden of malnutrition and therefore consumption of these foods is part of that problem. This analysis adopts a unique way of reporting these foods. However, this means that no comparisons can be made with other research.

A majority of respondents (58%) consumed ultra-processed foods at least three times a week; 80% consumed sweets at least three times a week (Table 11). There are variations among the different age groups: 51% of adults, 71% of children aged 5-18 and 73% of children under five consume ultra-processed foods at least three times per week. Children, including children under five, therefore consume more ultra-processed foods than adults, which is a concern for the quality of their diets. Seven out of 10 children

Table 11. Weekly consumption of sweets and ultra-processed foods by age

	Times per week								
Ultra-processed foods	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**>=3**
Adult 18+	15.3%	14.9%	18.9%	22.5%	14.4%	9.9%	2.7%	1.4%	50.9%
Child 5-18	3.8%	12.5%	12.5%	17.5%	18.8%	13.8%	15.0%	6.3%	71.3%
Under 5	15.4%	7.7%	3.8%	26.9%	19.2%	15.4%	3.8%	7.7%	73.1%
Total	12.5%	13.7%	16.2%	21.6%	15.9%	11.3%	5.8%	3.0%	57.6%
Sweets	0	1	2	3	4	5	6	7	>=3
Adult 18+	1.8%	4.1%	7.7%	12.2%	10.4%	17.6%	20.7%	25.7%	86.5%
Child 5-18	10.0%	11.3%	10.0%	21.3%	16.3%	11.3%	10.0%	10.0%	68.8%
Under 5	23.1%	19.2%	3.8%	19.2%	7.7%	15.4%	0.0%	11.5%	53.8%
Total	5.5%	7.0%	7.9%	14.9%	11.6%	15.9%	16.5%	20.7%	79.6%

Procession, Jember (Sena Aji/Hivos)

consume ultra-processed foods regularly. As for sweets, 87% of adults, 69% of children aged 5-18 and 54% of children under 5 consume them at least three times per week. Therefore, sweets appear to be consumed more often by adults (Table 11).

Ultra-processed foods make up around 2% of all food items consumed. The foods most commonly consumed in the ultra-processed category are instant noodles (23%), chili sauce (11%), condensed milk (10%), chocolate (6%) and wafers (6%). Sweets make up 4% of food items consumed and mainly consist of granulated sugar (98%). Supplementary Table 1 contains a full list.

Frequent consumption of these unhealthy foods by a large proportion of the population points to diets of poor quality. However, in the absence of any standards or other reports for comparison it is difficult to be precise about their contribution to the triple burden of malnutrition in this population.

Drivers of ultra-processed food consumption

The focus group discussions provide some insights into what is driving the consumption of ultra-processed food. Some of the reasons mentioned include the convenience of instant noodles when food is not available in the house, and ease of access in school canteens or from vendors outside the school for children.

Discussants also mentioned that new fast-food outlets are available and that eating patterns have changed:

> *"…In the past we usually ate home cooked meals, but now we often eat out. Before we didn't have McDonalds, KFC, but now we often eat junk food." (Respondent, lowlands).*

> *"…Usually it's because I am lazy to cook, so I buy instant food… I only live with my husband, and my husband works shifts, so if I return home my husband would go to work, and vice versa. And because of that I don't feel like cooking, because nobody will eat them anyway." (Respondent, lowlands).*

There are also concerns over the preservatives used in ultra-processed foods — households try to avoid foods containing preservatives. There is also concern over the food safety of ready-to-eat foods.

> *"…The chili sauce is usually either crawled by flies or bad, and the meats look like they contain borax. As far as I know, there are lots of foods sold around campus that are not hygienic, so I am more concerned about the hygiene." (Respondent, lowlands).*

Monosodium glutamate (MSG)

MSG is given particular focus in this analysis because it is one of the most widely consumed condiments and is a potentially harmful part of the diet. The most frequently consumed spices/ condiments were salt (23%), garlic (18%), shallots (14%), MSG (11%) and chillies (5%). On average adults consume MSG 10 times per week, while children aged 5-18 *and* children under 5 consume it 7 times a week. MSG was used by 72% of respondents at some time over the seven-day period. Children's consumption was less than adults overall.

Drivers of MSG consumption

The reasons behind use of MSG were explored in focus group discussions. The use of MSG is related to taste, the habit of

using it for flavouring and the fear that meals will not be acceptable without it.

> *"If I don't use artificial seasoning at home, I won't feel confident in my cooking. I am from Madura, so if the food doesn't taste spicy, well …" (Respondent, 34 years old, coastal area)*

It was also mentioned that MSG is a cheap way to flavour foods — if more money was available then garlic and shallots could be used for flavouring instead of MSG.

However, some respondents reported that they had heard of some health issues with MSG and were trying to cut back in their own cooking. Eating outside the home is a challenge because bought foods often contain MSG.

Dietary species richness

The range of food species consumed by the sample population was broad, with approximately 160 different foods consumed in total (Supplementary Table 2). Non-vitamin A-rich fruits and vegetables, dark green leafy vegetables and fish were the most diverse food groups. However, only a relatively narrow range of foods is consumed frequently (Supplementary Table 3). This is particularly apparent for cereal consumption, 67% of which is accounted for by rice (Figure 4). Similarly, 61% of the nuts and seeds consumed are peanuts; soybeans account for 84% of legumes and chicken accounts for 61% of meat. Consumption of vitamin A-rich foods is also concentrated on a few species — mostly papaya (80% of fruits) and carrots (98% of vegetables).

In our sample, people consumed 13 different food species a day on average, with little difference between genders, though children's consumption was slightly lower than adults'. There was also little variability according to geographic area. In more educated households DSR was greater in children between 5 and 11 years of age than in less educated households, but the sample is too small for valid comparison (Table 12). Over the course of the whole week, daily species richness increased on average to 32 species (Table 13), which shows that there was some variability in the diet over the week. Again, the lack of publications on weekly DSR with which to compare makes it difficult to speculate on whether this is adequate or otherwise.

Figure 4. Diversity within each food group

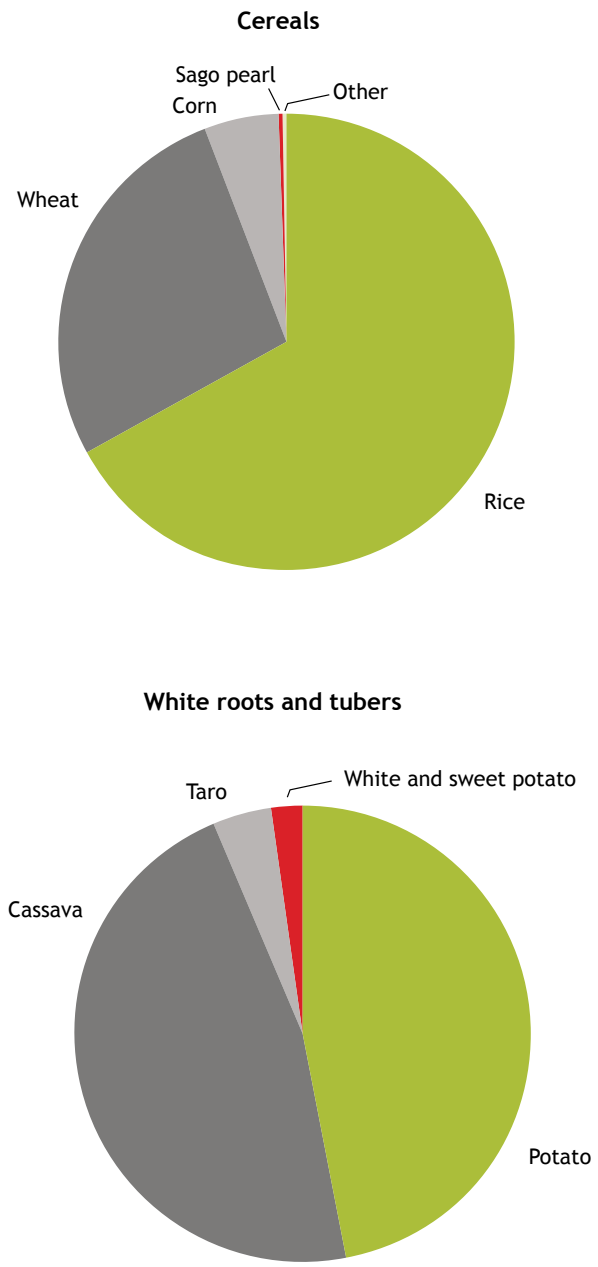


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Figure 4. Diversity within each food group (cont.)

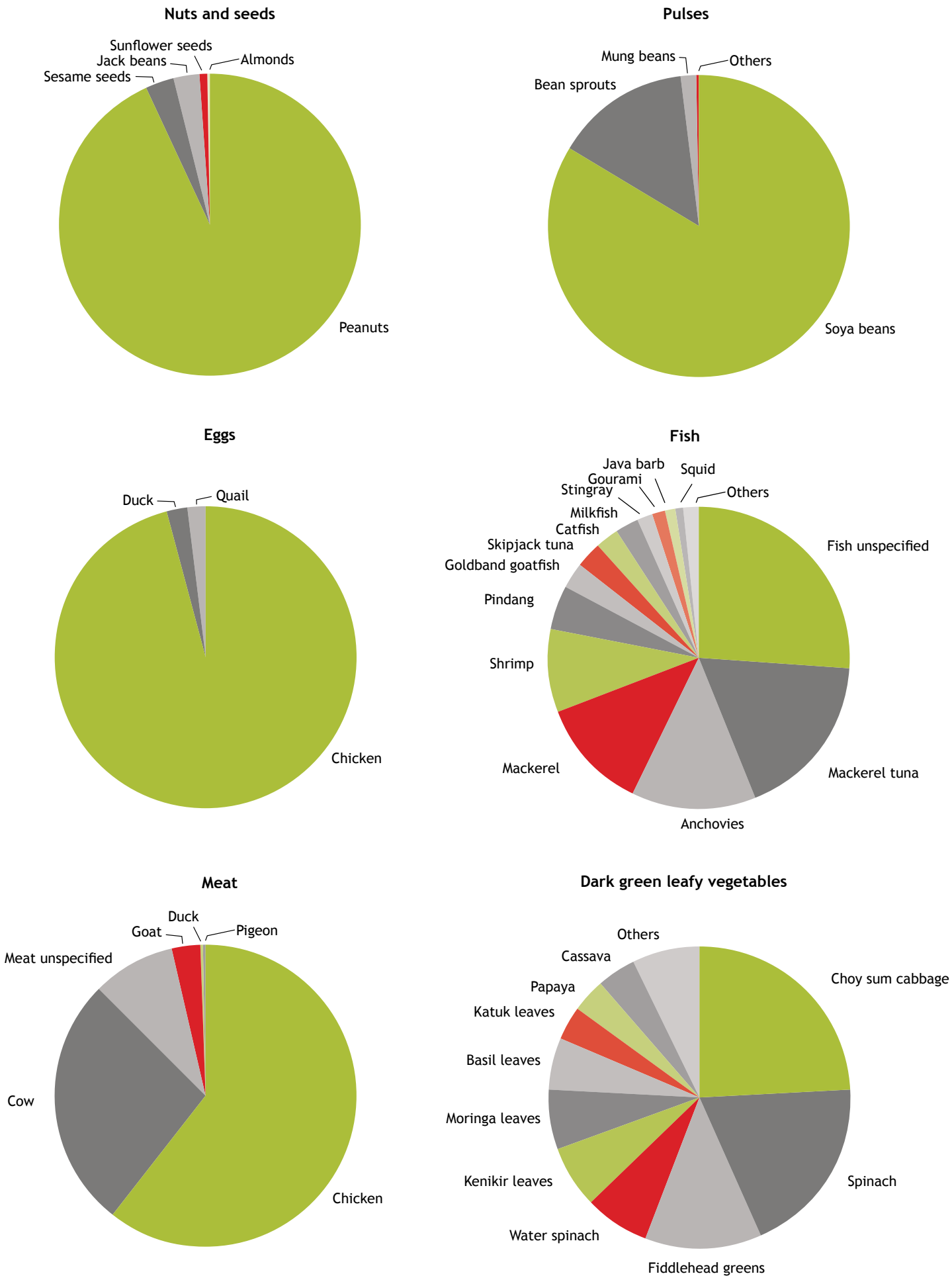
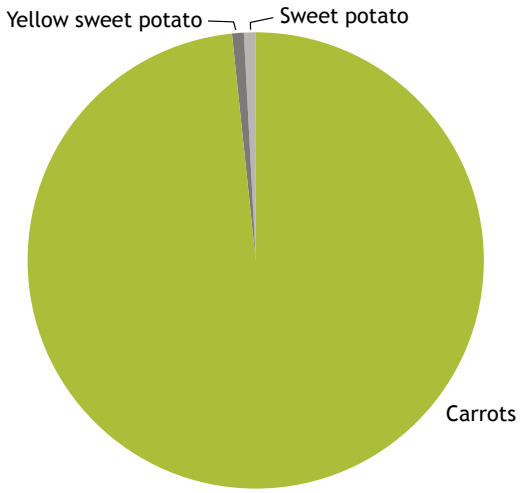
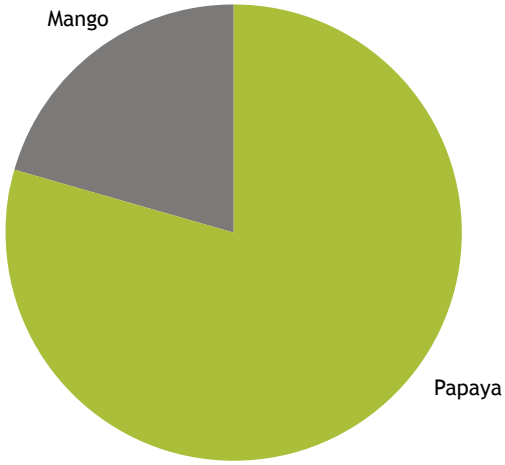


Figure 4. Diversity within each food group (cont.)

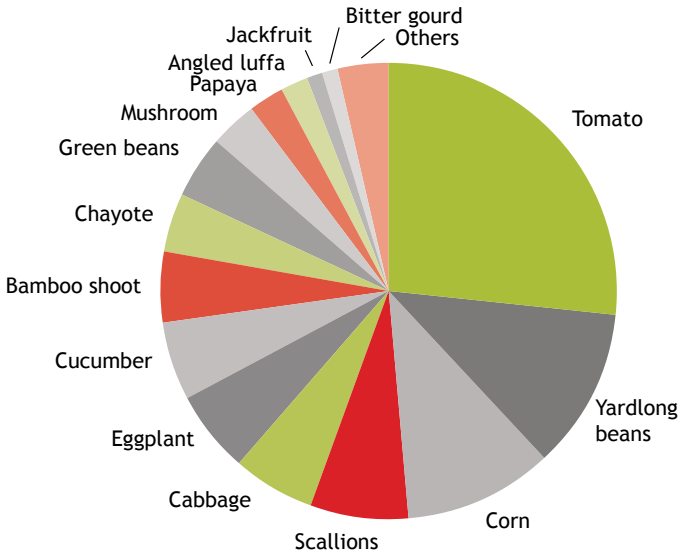
Vitamin A rich vegetables



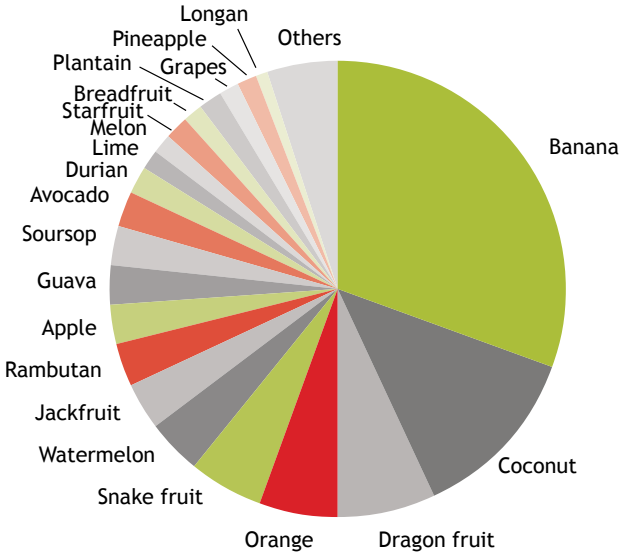
Vitamin A rich fruits



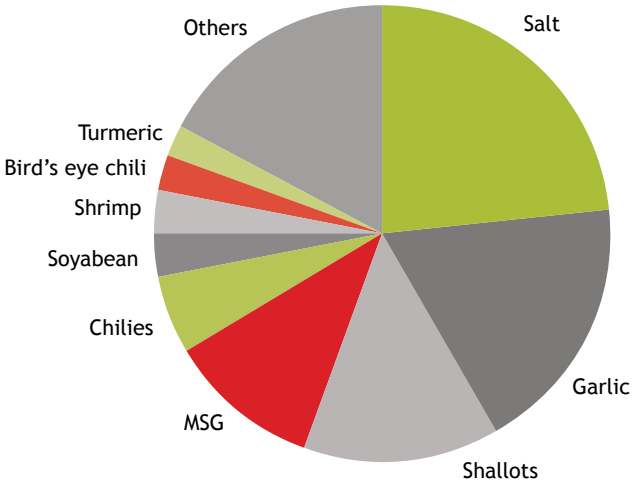
Non-vitamin A-rich vegetables



Non-vitamin A-rich fruit



Spices and condiments



Buyng and selling food in local store (Tanoker)

Table 12. Daily species richness score (weekly average) and socio-economic factors

	Adult 18+		Child 5-18		Under 5		Total	
	mean ± SD	N	mean ± SD	N	mean ± SD		mean ± SD	N
Gender								
Male	13.3 ±2.8	102	12.4 ±2.9	41	10.2 ±4.4	14	12.8 ±3.1	157
Female	13.4 ±2.6	120	11.7 ±2.8	39	9.8 ±2.4	12	12.8 ±2.8	171
Location								
Coast	13.2 ±2.7	71	12.0 ±2.9	26	10.3 ±3.8	13	12.6 ±3.0	110
Highlands	12.6 ±1.8	74	10.8 ±1.8	24	10.8 ±1.7	7	12.1 ±1.9	105
Lowlands	14.2 ±3.2	77	13.2 ±3.2	30	8.5 ±4.6	6	13.6 ±3.5	113
Education level								
Less educated (up to and including junior high)	12.5 ±2.4	80	11.6 ± 2.8	41	10.2 ±1.6	5	12.1 ±2.6	126
Senior high school	13.7 ±2.8	113	12.3 ±2.6	36	10.3 ±3.5	19	13.0 ±3.0	168
Higher education	14.4 ±2.5	29	16.7 ±2.7	3	6.3 ± 7.5	2	14.2 ±3.4	34
Overall average	13.4 ±2.7	222	12.1 ±2.9	80	10.0 ±3.5	26	12.8 ±3.0	328

Note: the mother/ carer's education level has been applied to the children.

Table 13. Total species richness consumed over one week, by age and sex

	Adult 18+		Child 5-18		Under 5		Total	
	mean ± SD	N	mean ± SD	N	mean ± SD	N	mean ± SD	N
Male	32.7 ±7.0	102	31.6 ±7.8	41	25.5 ±11.2	14	31.8 ±7.9	157
Female	34.4 ±7.0	120	30.5 ±7.7	39	24.4 ± 6.8	12	32.8 ±7.6	171
Total	**33.6 ±7.0**	**222**	**31.1** ± 7.8	**80**	**25.0 ±9.3**	**26**	**32.3 ±7.8**	**328**

Food sources

There is a variety of potential sources of foods in the study area, ranging from food stalls and markets to vendors around offices, canteens and home production. Significantly, our study found that despite many households being rural or peri-urban, most foods were purchased from outdoor markets or mini-markets rather than produced by the household itself, with the exception of vitamin A-rich fruits where 50% were from households' own gardens. Mini-markets are small convenience shops — typically selling a wide range of processed foods. In this analysis most ultra-processed foods and dairy products were bought there (Table 14).

Table 14. Source of all foods

Food group	Canteen	Office vendor	Street vendor	Food stall	Fresh veg seller	Market	Mini market	Neighbour	Own garden	Party or event	Others
Cereals	1%	1%	6%	10%	5%	31%	26%	3%	11%	5%	1%
Dark green leafy vegetables	1%	1%	5%	16%	19%	38%	4%	4%	11%	2%	0%
Eggs	1%	0%	4%	7%	10%	38%	28%	3%	1%	6%	2%
Fish	0%	1%	3%	4%	36%	48%	3%	3%	0%	1%	1%
Flesh meats	3%	1%	13%	25%	8%	22%	3%	6%	1%	18%	1%
Milk and milk products	1%	0%	2%	2%	0%	10%	37%	0%	0%	2%	46%
Nuts and seeds	4%	1%	9%	28%	8%	32%	6%	4%	0%	7%	1%
Oils and fats	1%	0%	4%	7%	18%	44%	18%	3%	1%	4%	1%
Organ meat	1%	2%	14%	17%	34%	20%	2%	5%	0%	6%	1%
Other fruits	1%	1%	10%	7%	2%	32%	4%	12%	21%	9%	1%
Other vegetables	0%	1%	3%	10%	32%	39%	4%	4%	5%	3%	1%
Pulses (beans, peas and lentils)	1%	1%	7%	11%	27%	42%	5%	2%	0%	2%	1%
Spices, condiments beverages	0%	0%	3%	5%	29%	46%	11%	2%	1%	2%	0%
Sweets	1%	1%	4%	6%	10%	41%	27%	4%	1%	5%	0%
Ultra processed	5%	1%	16%	9%	2%	15%	40%	5%	0%	5%	2%
Vitamin A rich fruits	0%	0%	0%	6%	3%	20%	10%	8%	49%	4%	0%
Vitamin A rich vegetables and tubers	1%	1%	8%	6%	35%	35%	2%	3%	0%	9%	1%
White roots and tubers	2%	1%	17%	9%	16%	32%	3%	6%	9%	5%	1%
Total	1%	0%	5%	8%	21%	40%	14%	3%	3%	4%	1%

4. WHAT'S DRIVING FOOD CHOICES?

The interviews and focus group discussions provide some insights into what is driving the food choices of individuals and households. We have identified six broad sets of drivers: 1) poverty or food affordability; 2) availability; 3) convenience; 4) health and safety concerns; 5) culture and tradition; 6) knowledge of food preparation.

Poverty or food affordability

Poverty and the cost of food were clear drivers of food choice. For example, respondents report mostly consuming fruit that is homegrown or when it is cheap at the market. In the coastal communities, fish is used as a means of exchange or for income to meet daily necessities. These findings accord with a World Food Programme study on the cost of diet in Indonesia that showed that about 40% of people cannot afford to eat a full range of nutritious foods (WFP 2017).

> *"The way to get food is mostly by buying rather than growing because in the coastal area the houses are small. In addition, because most foods are obtained by buying it is a little challenging for the fishermen's family during the dry season, it is difficult to get a lot of catches. The activity of pawning goods is common in coastal communities during the dry season; we do that so we can buy food." (Puger respondent)*

> *"The habit is to eat well but not healthy. We have many challenges, the income limitation and buying power, it makes people care about rice more than the side dish, and they just want to feel full." (Community leader)*

> *"They eat 3 times a day; most they eat vegetables because they have many here. But their food is not yet diverse, a few already diverse but not many. They rarely eat meat and chicken. For fish they eat processed fish." (Religious leader)*

> *"I want my child to eat good food for his health. Maybe right now you won't see the impact, but later on you will." (Kaliwates FGD)*

> *"Tempe and tofu are cheap and easily available — even cheaper than instant noodles.*
>
> *That accounts for the frequency of consumption of those foods" (Jember University)*

Food availability

The foods people consume is greatly influenced by local availability, especially fresh foods.

> *"Many people rely on door-to-door groceries vendors in their neighbourhood, and the availability of foods from this vendor greatly influences people's food choices." (Woman from Ledokombo district)*

Convenience

The time involved in food preparation is another consideration. Lack of time to cook at home was a concern for some participants, who would prefer to do so if they had the time.

> *"…But all this time I have been attending class. So, since I needed to go with husband, I had to wake up at 5 and prepare quick meals… Yes, practical ones, but we rarely buy, so at night we would prepare the ingredients so we just need to cook them in the morning… it's quicker to cook, quicker to prepare…" (WD, lowlands).*

Health and safety concerns

Health is another factor, particularly for children. People are familiar with the slogan "4 Healthy and 5 Perfect" which refers to foods from the healthy eating pyramid.

> *"Healthy food is 4 healthy 5 perfect. Rice, dish, vegetable, fruits, and milk if any. Healthy foods are available in this neighborhood. It's just the money to buy fruits. I usually buy banana." (Participant from Puger)*

Instant noodles and egg (Food diaries participants)

There is concern that some bought foods have been contaminated with food additives and pesticides.

> *"Healthy food is food that has been processed by ourselves without food preservative and other food additives. Healthy foods are occasionally available in my neighborhood because the foods still use food additives such as MSG." (Woman from Tanggul)*

> *"My kids are still young… so I choose better, more beneficial food… because they will still listen…" (Participant, coastal area)*

Culture

The reliance on a few foods is also related to habits and local cuisine. For example, the consumption of white rice as the main staple is a deeply rooted practice. Cost is also a factor driving this narrow choice, particularly for the staple, rice.

> *"I still eat white rice as staple food. I feel like I haven't eaten if I don't eat white rice." (woman Ledokombo)*

Products made from soybean are also very popular, such as tempeh and sauce made from peanuts (satay). These habits can result in a narrow range of foods being consumed from the main food groups, as revealed by the narrow species diversity in the main food groups discussed above.

> *"For food… I normally choose one liked by the whole family, so I only need to cook once…" (participant, coastal area)*

Children consume a lot of foods containing artificial colourings and MSG and this can be related to food culture amongst school children.

> *"Children who eat instant noodles feel they are more 'hip' or more modern than people who eat traditional foods" (Teachers Association).*

Knowledge of food preparation methods

Several focus group discussion and interview participants mentioned that people do not know how to cook some green leafy vegetables, which may account for their low consumption rates. The types of green leafy vegetables that people consume most are the wild vegetables. Sometimes people buy some vegetables that they cannot find in their neighbourhood.

Consumption of white processed rice illustrates several of these factors. It is consumed in preference to the more nutritious red rice because of availability, cost, taste and preference.

> *"The highest consumed cereal is bought white rice. The other rice is not really popular because they are not easy to acquire, more expensive and are considered tasteless while white rice is cheaper, easy to acquire and delicious. The community understands the benefits of consuming red rice but they don't want to consume it." (Puger respondent)*

5. RECOMMENDATIONS

Towards a healthier diet

For adults and children in Jember to meet the dietary diversity target, they need to consume a wider range of nutrient-rich foods, particularly vitamin A-rich fruits and vegetables, eggs, pulses and nuts and seeds, whilst reducing unhealthy choices such as ultra-processed foods, oils, fats and sweets.

The good news is that there is a large diversity of foods available in the region, and much potential to improve diets by using these foods more in local cuisine.

Children especially need high quality diets during growth and development and this is a crucial time to optimise diets for health. Therefore, efforts should emphasise actions to improve children's diets. This includes ensuring healthy food is available in and around schools, and developing a whole-family approach to providing healthy foods at home. Healthy cooking using the wealth of local food diversity needs to be supported by policies in those areas along with improvements to the food culture in schools and the workplace.

Local projects, such as the 'Child Friendly Region' initiative in Jember and the 'Healthy Canteen' initiative, are good examples of ways to promote healthy diets. Child-friendly public places that limit the distribution of ultra-processed foods are important. Local food plans can help co-ordination between local and national initiatives while also linking to the Sustainable Development Goals.[4]

There is a need for improved regulation of commercial food processing, and better implementation of local dietary guidelines. Policies should aim to increase the diversity of foods sold by market vendors and improve the availability of and access to local, healthy, seasonal food in these markets.

In general, there needs to be a closer alignment between dietary needs and agricultural policy to ensure that food production meets nutritional requirements. Farmers need to be supported to practise sustainable agriculture, avoid the use of potentially harming agro-chemicals and increase agricultural diversification. National policy to support this push to agro-biodiversity should include a re-think of subsidies that currently solely focus on the production of staple crops. Homestead food production of fresh foods could be encouraged through community initiatives; the reasons why this is so limited currently should be further explored.

Towards a more integrated methodology

Despite the urgent need to address the triple burden of under-nutrition, overweight and obesity, and micronutrient deficiency, there is a lack of suitable methods and indicators. A more holistic approach to assessing diets and food systems is required, including indicators and assessment methods that can map, understand and address the triple burden of malnutrition in an integrated way.

Researchers need straightforward, ready-to-use participatory dietary assessment methods that cover all age groups and genders. It is important to be able to separately assess school-age children, for example, as well as adolescents and men, rather than the almost exclusive focus on infants and young children and women of reproductive age. This needs to change, from a human rights-based approach to nutrition. A new easy-to-use dietary indicator that accounts for both healthy and unhealthy foods would be also useful for future research — perhaps including negative scoring for unhealthy foods.

It is also important to gather information on within-food group diversity. This would make it easier to understand and compare the diets of all demographic groups and help us link diets with agro-biodiversity and sustainable food systems. The dietary species richness score is a promising new indicator that can potentially link sustainable agriculture practices, agro-biodiversity and diets. For example, it could help explore whether agro-biodiversity improves dietary species richness and whether this has nutritional implications. With correct training respondents could easily record more detailed information (e.g. 'mackerel' instead of simply 'fish').

4 For more information visit https://sustainablediets4all.org/where-we-work/indonesia.

Cooking competition (New Generation Indonesian Cooking)

Self-administered food diaries are a step forward from the expert-driven approach to research, offering a method that allows people to collect their own dietary data, while saving some time and effort. However, recording meals over a week resulted in an enormous data set which is complex and unwieldy to analyse. As there was little day-to-day variability in dietary diversity scores a shorter recording time period might be suitable. Combining food diaries with accessible electronic recording methods (for example a specially programmed app for a mobile phone) would ensure they are still participatory, while sophisticated software would enable semi-automated analysis, saving time and money and encouraging more data collection. This would help to build a fuller picture of diets in different contexts for use in policies and programmes to tackle the urgent problem of the triple burden of malnutrition.

ANNEXES

Annex 1. An example of a completed diary page

MOTHER'S MENU				
	6th day	Picture	7th day	Picture
Breakfast	White rice Omelette Crispy chicken		White rice Boiled noodle Little tuna Chili condiment	
Morning snack	-	-	-	-
Lunch	White rice Omelette Tofu with soy sauce Fried little tuna		Fried rice Cracker	
Afternoon snack	Compressed rice cake Soupy meatballs Crispy fried rice		-	-
Dinner	White rice Fried little tuna Sauteed soupy cabbage		White rice Fried tofu Boiled noodle Chili condiment	
Evening snack	-	-	-	-

REFERENCES

Development Initiatives (2018). Global Nutrition Report. https://globalnutritionreport.org/reports/global-nutrition-report-2018/

FAO. (2014). "Food-based dietary guidelines — Indonesia http://www.fao.org/nutrition/education/food-dietary-guidelines/regions/countries/indonesia/en/" Retrieved 25/10/19.

FAO (2016). "Compendium of indicators for nutrition-sensitive agriculture http://www.fao.org/3/a-i6275e.pdf."

FAO (2018). Asia and Pacific Regional Overview of Food Security and Nutrition: accelerating progress towards the SDGs http://www.fao.org/3/CA0950EN/CA0950EN.pdf

FAO and FANTA (2016). Minimum Dietary Diversity for Women: a guide to measurement http://www.fao.org/3/a-i5486e.pdf

Food and Agriculture Organisation (2018). Dietary Assessment: a resource guide to method selection and application in low resource settings www.fao.org/3/i9940en/I9940EN.pdf

Herforth, A. and A. Rezpa (2019). "Defining and measuring diet quality worldwide: ." https://news.gallup.com/opinion/gallup/199436/defining-measuring-diet-quality-worldwide.aspx

House, C. (2019). Healthy diets from sustainable production: Indonesia. https://hoffmanncentre.chathamhouse.org/article/healthy-diets-from-sustainable-production-indonesia/

INDDEX Project. (2018). "Data4Diets: Building Blocks for Diet-related Food Security Analysis. Accessed on 19 September 2019." from https://inddex.nutrition.tufts.edu/data4diets.

Islam, S. (2019). Poor diets damaging children's health worldwide, warns UNICEF. https://www.unicef.org/eap/press-releases/poor-diets-damaging-childrens-health-worldwide-warns-unicef

Kazmi, Z., I. Fatima, S. Perveen and S. Malik (2017). "Monosodium glutamate: Review on clinical reports." International Journal of Food Properties.

Lachat, C., J. E. Raneri, K. W. Smith, P. Kolsteren, P. Van Damme, K. Verzelen, D. Penafiel, W. Vanhove, G. Kennedy, D. Hunter, F. O. Odhiambo, G. Ntandou-Bouzitou, B. De Baets, D. Ratnasekera,

H. T. Ky, R. Remans and C. Termote (2018). "Dietary species richness as a measure of food biodiversity and nutritional quality of diets https://www.pnas.org/content/115/1/127." Proceedings of the National Academy of Sciences 115(1): 127–132.

Lipoeto, N. I., K. G. Lin and I. Angeles-Agdeppa (2012). "Food consumption patterns and nutrition transition in SE Asia." Public Health Nutrition 16(9): 1637–1643.

McAuliffe, A. (2016). "Double burden: childhood stunting and obesity in Indonesia." https://blogs.unicef.org/east-asia-pacific/double-crisis-the-dual-burden-of-stunting-and-obesity-in-indonesia/

Monteiro, C. A., G. Cannon, M. Lawrence, M. L. Costa Louzada and P. Pereira Machado (2019). Ultra-processed foods, diet quality, and health using the NOVA classification system. Rome, FAO. http://www.fao.org/3/ca5644en/ca5644en.pdf

National Population and Family Planning Board, Statistics Indonesia and Ministry of Health (2017). Indonesia Demographic and Health Survey https://datacatalog.worldbank.org/dataset/indonesia-demographic-and-health-survey-2017 B. BKKBN, Kemenkes, and ICF.

Pinstrup-Andersen, P. and D. Watson II (2011). Food Policy for Developing Countries.

SCN-CREST and TANOKER (2017). Assesment Report: Healthy Food Stakeholder Analysis Kecamatan Ledokombo Kabupaten Jember (Desa Ledokombo, Sumber Salak, Sumber Lesung).

WFP (2017). The Cost of the Diet Study in Indonesia https://www.wfp.org/publications/indonesia-cost-diet-study

WHO (2010). Indicators for assessing infant and young child feeding practices. Part 2: measurement https://www.who.int/nutrition/publications/infantfeeding/9789241599290/en/

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