



# The eating culture of the Sundanese: Does the traditional salad (*Lalapan*) improve vegetable intake and blood $\beta$ -carotene concentration?

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## Data of the article

First received: 11 April 2019 | Last revision received: 06 August 2019

Accepted: 11 August 2019 | Published online: 12 September 2019

DOI: 10.17170/kobra-20190709593

## Keywords

$\beta$ -carotene, consumer perception, eating culture, *Lalapan*, skin quality

## Abstract

This study explores how consumption of the traditional salad *Lalapan*, central to the eating culture of the Sundanese, is associated with skin quality perception, daily  $\beta$ -carotene intake and blood  $\beta$ -carotene concentrations. This cross-sectional study was conducted in Gunung Malang Village and Leuweung Kolot Village, Bogor District, West Java. 60 healthy Sundanese women, aged 30-49 years, were selected using simple random sampling. Their body weight and height were measured, and they were interviewed about the eating culture of *Lalapan*, skin quality perceptions after consumption of *Lalapan*, and consumption habits of *Lalapan* using a semi-quantitative month-long food frequency questionnaire (SQ-FFQ). The blood  $\beta$ -carotene concentrations of about 25% of the subjects were analysed and Chi-square used to evaluate the association between variables. The results show that about 60% and 51.7% subjects had a good eating culture of *Lalapan* and good skin quality perceptions respectively. The eating culture of *Lalapan* had a positive association with skin quality perception ( $p=0.000$ ),  $\beta$ -carotene intake from *Lalapan* ( $p=0.008$ ), daily  $\beta$ -carotene intake ( $p=0.035$ ), and blood  $\beta$ -carotene concentrations ( $p=0.031$ ). The consumption of *Lalapan* is a wisdom culture in Sundanese society that serves to improve vegetable consumption at the community level. In particular, it increases nutrient intake, especially  $\beta$ -carotene that is beneficial to health. Given that vegetable consumption is low in the community, maintenance of the good eating culture of *Lalapan* should be an urgent policy priority to ensure the nutrition and health of the community.

## Introduction

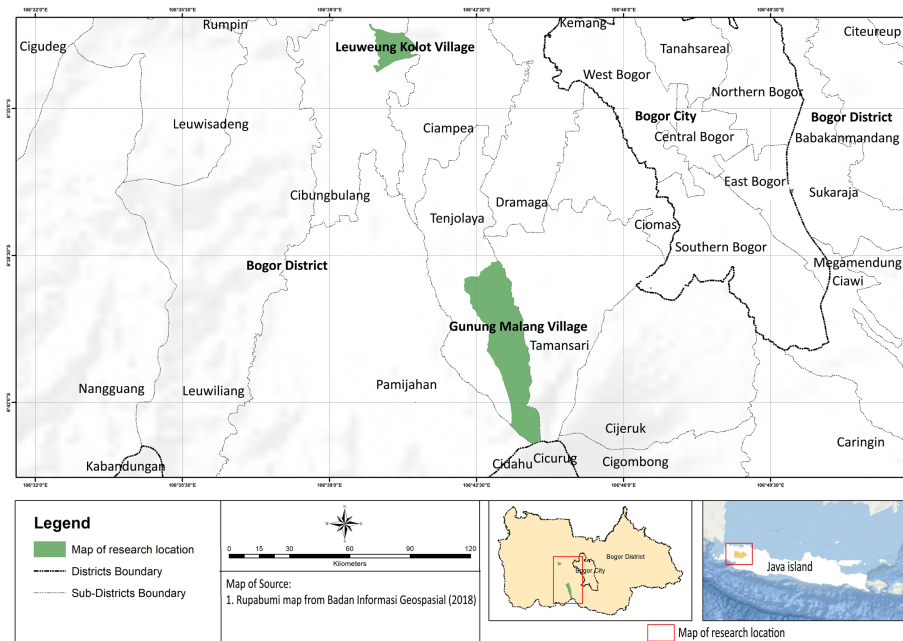
Vegetable consumption in Indonesia is very low, i.e. 107g/capita/day (BPS, 2017), less than half of that recommended by the World Health Organisation, i.e. 250g/capita/day (WHO, 2015). The low rate of consumption is puzzling because Indonesia is a tropical country with an abundance of fruits and vegetables. Community perception of positive habits is one way to improve consumption of vegetables. One good example of local, indigenous wisdom is the Sundanese people's age-old eating culture of *Lalapan* (Hendariningrum, 2018). Other eating cultures that are believed to provide health benefits include torbangun leaves (*Coleus amboinicus* Lour) (Da-

manik, 2009), jamu (Paryono, 2014), and tambelo, snail, and clam (Hardinsyah et al., 2006).

The Sundanese, who originate from West Java, are the second largest ethnic group in Indonesia (15.5%) (BPS, 2010). The Sundanese traditional salad or *Lalapan* consists of fresh tender coloured leaves, cucumber, and stinky beans that are consumed with sambal (chilli sauce) (KBBI, 2018). Always consumed fresh, other varieties of *Lalapan* include basil leaves, poh-pohan leaves, gandaria leaves, lettuce, long beans, leunca, takokak, and cabbage. The Sundanese believe that the eating culture of

Citation (APA):

Amrinanto, A. H., Hardinsyah, H., Palupi, E. (2019). The eating culture of the Sundanese: Does the traditional salad (*Lalapan*) improve vegetable intake and blood  $\beta$ -carotene concentration?, *Future of Food: Future of Food: Journal on Food, Agriculture and Society*, 104.



**Figure 1:** Map of research location: Leuweung Kolot Village to south and Gunung Malang Village to north, Bogor district, West Java, Indonesia

*Lalapan* provides bodily health benefits and makes their skin smoother and brighter (Hendariningrum, 2018).

Many of the components in fresh vegetables could affect skin quality such as nutrients and phytochemical compounds including amino acids (N-Acetylcysteine), carotenoids ( $\beta$ -carotene, lutein, zeaxanthin, and lycopene), fatty acids (Linoleic acid, Eicosapentaenoic acid, and Docosahexaenoic acid), vitamins (vitamin C, vitamin E, and vitamin B3), minerals (copper, selenium, and zinc), and polyphenols (Souyoul et al., 2018; Zouboulis et al., 2019). Some components are useful as antioxidants, skin pigmentation cofactors, to protect skin from damage, increase skin safety and heal wounds. The indicator of skin quality that is easiest to observe is the brightness of the skin. Among the components in vegetables, carotenoids affect skin colour the most.

The consumption of vegetables could brighten skin colour because vegetables contain high levels of carotenoid compounds (Whitehead et al., 2012). The carotenoids consumed from food are absorbed through the intestine and then transported through the bloodstream to various target tissues including the skin layer (Mayne et al., 2010), brightening skin colour. The sampling of blood carotenoid concentrations enables an evaluation of the effect of vegetable consumption on the level of blood  $\beta$ -carotene (Pezdiric et al., 2016).

$\beta$ -carotene is one of the most abundant carotenoid groups contained in vegetables, blood, and human tis-

sue (Rodriguez-Amaya et al., 2008; Britton et al., 2008; Schagen et al., 2012). The main role of  $\beta$ -carotene is its activation of provitamin A.  $\beta$ -carotene also plays a role as an antioxidant in the human body and regulates skin quality (Grune et al., 2010; Schagen et al., 2012). Stahl et al. (1998) show that the blood carotenoid concentration (including  $\beta$ -carotene) is related to skin carotenoid concentration. Meinke et al. (2010) found that increasing carotenoid intake increases blood and skin carotenoid concentration. This research is perhaps the first to explore the eating culture of the Sundanese traditional salad (*Lalapan*) and its association with skin quality perception,  $\beta$ -carotene intake, and blood  $\beta$ -carotene concentration.

## Methods

### Design, location, and time

This cross-sectional study was conducted in Gunung Malang Village and Leuweung Kolot Village, Bogor District, West Java from November 2018 to February 2019. Ethical clearance was obtained from the ethical clearance committee of Bogor Agricultural University, Bogor, Indonesia (No:117/IT3.KEPMSM-IPB/SK/2018). The study location was chosen purposively by considering differences in location and sample characteristics. Gunung Malang Village is a village located in the Tenjolaya sub-district near Mount Salak and far from urban areas. By contrast, Leuweung Kolot village is located in Cibungbulang sub-district, close to urban areas (Figure 1).



**Sample size and technique**

60 healthy Sundanese women, aged 30-49 years, were recruited and their body weight and height measured. The minimum sample at each of the two locations was 30, so that the total number of subjects became 60 (Gay & Diehl, 1992). The women were interviewed about their consumption habits of *Lalapan* and their skin quality perceptions after consumption of *Lalapan*. After that, a sub-sample of about 25% of the subjects was taken to analyse blood  $\beta$ -carotene concentrations, using the following criteria: BMI <35 kg/m<sup>2</sup>, non smokers, not taking  $\beta$ -carotene supplements, not alcoholics, and absence of needle allergy. A BMI less than 35 kg/m<sup>2</sup> is necessary to avoid the influence of body fat storage on  $\beta$ -carotene levels. The subjects'  $\beta$ -carotene intake were assessed. Finally, the blood  $\beta$ -carotene concentration levels of 14 subjects with the highest and lowest  $\beta$ -carotene intake from *Lalapan* were evaluated.

**Types and modes of data collection**

The variables in this study are the eating culture of *Lalapan*, skin quality perception, and consumption habits of *Lalapan*. Eating culture of *Lalapan* and skin quality perception data was collected through interview. Eating habits of *Lalapan* were assessed using a month-long semi-quantitative food frequency questionnaire (SQ-FFQ), that had already been tested for validity and reliability (Cronbach- $\alpha$ =0.6). Blood  $\beta$ -carotene concentrations were analysed using High Performance Liquid Chromatography (HPLC) at SEAMEO RECFON laboratory, Jakarta.

**Model specification**

The model specification of this study was determined based on its objectives, i.e. to find out the association between variables (independent and dependent variables) (Ingranti et al., 2012). The independent variable was eating culture, while the dependent variables were skin quality perception, intake of  $\beta$ -carotene, and blood  $\beta$ -concentration. The equation for this analysis is as follows:

$$Y_1 = a + bX_1 \dots\dots\dots (1)$$

$$Y_2 = a + bX_1 \dots\dots\dots (2)$$

$$Y_3 = a + bX_1 \dots\dots\dots (3)$$

Where  $X_1$  is the independent variable (eating culture),  $a$  is a constant,  $b$  is the slope of the line, and  $Y_1$ ,  $Y_2$ , and  $Y_3$  are dependent variables (skin quality perception, intake of  $\beta$ -carotene, and blood  $\beta$ -concentration).

**Processing and analysis of data**

Eating culture of *Lalapan* and skin quality perception were assessed in the questionnaire before being analysed. The five indicators to assess the eating culture of

*Lalapan* were 1) *Lalapan* habit passed on from the parent, 2) *Lalapan* habit passed on to the children, 3) *Lalapan* consumed for the past 20 years, 4) *Lalapan* usually consumed at least three times a week, 5) *Lalapan* consumed with other foods (rice, side dishes, and sambal (chilli sauce)). The indicators for assessing skin quality perception were those perceived by the respondents, namely perception of skin appearance (smoothness and brightness) and perception of skin moisture. The indicators were measured using a value that ranged from 5 (yes/100%) to 0.  $\beta$ -carotene levels in food were obtained from the Indonesian Food Composition Table 2018, ASEAN Food Composition Database, USDA National Nutrition Database for Standard Reference 2018, and other scientific journals. If there was no data on  $\beta$ -carotene levels for a food item consumed by the subject, it was estimated by using data on  $\beta$ -carotene levels for a similar food item. If this was not possible,  $\beta$ -carotene levels were estimated by calculating conversion from vitamin A, with Retinol Activity Equivalents (RAE  $\mu$ g) = 12  $\mu$ g  $\beta$ -carotene. The association between eating culture of *Lalapan*, skin quality perceptions,  $\beta$ -carotene intake from *Lalapan*, daily  $\beta$ -carotene intake, and blood  $\beta$ -carotene concentrations were analysed using Chi-square.

**Results and discussion**

Most of the Sundanese subjects were between 30-39 years old (63.3%) and most of them were housewives (96.7%) (Table 1). The majority had studied only to elementary level (81.7%) and about 46.7% had a monthly income of between IDR 1,000,000 and IDR 2,000,000, equal to approx. USD 70-140 per month.

*Lalapan* has been defined as fresh tender coloured leaves, cucumber, and stinky beans that are consumed with sambal (chilli sauce) (KBBI, 2018). Based on the results of this study, the Sundanese themselves define *Lalapan* not only as vegetables that are consumed in fresh condition (raw), but also as vegetables that are processed by briefly boiling them (blanching) with or without the addition of salt.

The top ten leaves and fruits consumed by subjects as *Lalapan* are given in Table 2. The leaves and fruit most consumed in fresh and processed condition are cabbage (71.7%) and cassava leaves (76.7%), and cucumber (96.7%) and string beans (33.3%) respectively. In addition, other ingredients in *Lalapan* often consumed by the subjects were chayote, carrots, banana bud, and several others. The food issues that influence consumers include educating others, exerting their choice as consumers, or growing their own food (Gray, 2017). *Lalapan* consumed in fresh (raw) conditions or slightly processed



**Table 1:** Subjects' characteristics

Characteristics	Total subjects* n (%)
<b>Age (years)</b>	
30-39	38 (63.3)
40-49	22 (36.7)
<b>Occupation</b>	
Housewife	58 (96.7)
Others	2 (3.3)
<b>Education level</b>	
Elementary school	49 (81.7)
Junior high school	3 (5.0)
Senior high school	7 (11.7)
College	1 (1.7)
<b>Income (IDR/month)</b>	
<1,000,000 (<\$ 70)	17 (28.3)
1,000,000-2,000,000 (\$ 70-140)	28 (46.7)
>2,000,000 (>\$ 140)	15 (25.0)
<b>Nutritional Status</b>	
Normal	37 (61.7)
Overweight	15 (25.0)
Obesity	8 (13.3)

Note: \*n=60 subjects; 1 IDR=0.000075 USD

has several advantages, such as preventing a decrease of nutrients, especially heat-sensitive nutrients such as vitamins A and C, preventing enzyme damage in vegetables (Link & Potter, 2004), reducing potential of Maillard reactions that can change colour and taste (O'Brien & Morrissey, 1989), preventing a decrease of folate and fibre content (McKillop, 2002; Fabbri & Crosby 2016), and containing higher levels of polyphenols and total antioxidants than cooked vegetables (Sengül et al., 2014). In addition, consumption of *Lalapan* for a sustained period has several health benefits, such as reducing risk of cancer (Link & Potter, 2004), decreasing blood LDL and triglycerides concentrations (Koebnick et al., 2005), and increasing blood  $\beta$ -carotene,  $\alpha$ -carotene, and lycopene concentration levels (Garcia et al., 2007). Even so, consumption of *Lalapan* in fresh (raw) conditions also has several disadvantages, such as having residual and bacterial potential that can endanger health (Schattenberg

et al., 1996), lower bioavailability of nutrients compared to cooked vegetables (Link & Potter, 2004), and enabling the presence of non-nutritive components in vegetables (Fabbri & Crosby, 2016).

Based on the results of the study, the subjects were divided into two groups (of 30 subjects each) according to their  $\beta$ -carotene intake from *Lalapan* ( $\mu\text{g}/\text{day}$ ). Table 3 shows that about 63.3% of subjects' parents had passed to them the habit of consuming *Lalapan*, while 71.7% passed the habit on to their children. These results indicate that parents have an important role in teaching the eating culture of *Lalapan* to their children. Parents choose foods to be included in the family diet, and thus act as models for their children and encourage their children to learn and adapt eating patterns and behaviours that are appropriate within their culture (Savage et al., 2007). Stajcic (2013, p.6) says that "culture is created,


**Table 2:** Type of *Lalapan* mostly consumed by subjects

Type of <i>Lalapan</i>	Scientific name	Local name	n (%)
<b>Leaves</b>			
<b>Fresh <i>Lalapan</i></b>			
Cabbage	<i>Brassica oleracea</i>	Kubis/kol/engkol	43 (71.7)
Poh-pohan	<i>Pilea melastomoides</i>	Poh-pohan	41 (68.3)
Basil	<i>Ocimum basilicum</i>	Kemangi/surawung	34 (56.7)
Lettuce	<i>Lactuca sativa</i>	Selada/salada	17 (28.3)
Rane	<i>Selaginella doederleinii</i>	Rane/cakar ayam	12 (20.0)
Gandaria	<i>Bouea macrophylla</i>	Gandaria/jatake	11 (18.3)
Jotang	<i>Spilanthus ibadicensis</i>	Jotang/getang	10 (16.7)
<b>Processed <i>Lalapan</i></b>			
Cassava	<i>Manihot esculenta</i>	Singkong/sampeu	46 (76.7)
Papaya	<i>Carica papaya</i>	Pepaya/gedang	38 (63.3)
Mustard green	<i>Brassica juncea</i>	Sawi	11 (18.3)
<b>Fruits</b>			
<b>Fresh <i>Lalapan</i></b>			
Cucumber	<i>Cucumis sativus</i>	Ketimun/bonteng	58 (96.7)
Long beans	<i>Vigna unguiculata</i>	Kacang panjang	47 (78.3)
Stinky beans	<i>Parkia speciosa</i>	Petai/peteuy	41 (68.3)
Tomato	<i>Lycopersicon esculentum</i>	Tomat	38 (63.3)
Leunca	<i>Solanum americanum</i>	Leunca	37 (61.7)
Green eggplant	<i>Solanum melongena</i>	Terong hijau/hejo	22 (36.7)
Gandaria	<i>Bouea macrophylla</i>	Gandaria/jatake	16 (26.7)
Takokak	<i>Solanum torvum</i>	Takokak/tekokak	13 (21.7)
<b>Processed <i>Lalapan</i></b>			
String beans	<i>Phaseolus vulgaris</i>	Buncis	20 (33.3)
Dogfruit	<i>Archidendron Jiringa</i>	Jengkol	11 (18.3)

Note: \*n=60 subjects

formed, delivered, and obtained through the communication". Parents are teachers for children in the family and their interactions create an understanding of the eating culture, including the eating culture of *Lalapan*. Food that has been introduced since childhood will have a connection with culture and if it continues to be managed, it can create strong bonds with lifelong eating habits (Wansink et al., 2003). Childhood experiences about food are very important in shaping preferences and eating habits for the future (Wansink, 2002). Food as a culture is not formed rapidly, but through a long process. The eating culture of *Lalapan* has been around since the 10th century AD and is referred to in the Taji Inscriptions of 901 AD (Hendariningrum, 2018). The results show that 70.0% of subjects had consumed *Lalapan* for

the past 20 years. This shows that the eating culture of *Lalapan* is not new.

Eating culture is also formed because it is often done repeatedly, so that it becomes habitual and carried out routinely. One concept of habits and routines is that these actions are carried out repeatedly and have been shared across whole communities or social groups (Southerton, 2012). According to the results of this study, about 60.0% of subjects consume *Lalapan* at least three times a week. Several factors could affect habits and frequency of *Lalapan* consumption, such as environment, accessibility, and availability (Dean & Sparkey, 2011). Table 3 shows that all subjects consumed *Lalapan* alongside other dishes (rice, side dishes, and chilli sauce). According to



**Table 3:** Eating culture of *Lalapan* and skin quality perception indicators

Indicators	High intake of $\beta$ -carotene n** (%)	Low intake of $\beta$ -carotene n** (%)	Total n (%)	p*
Eating culture of <i>Lalapan</i> indicators				
Passed from parent	23 (76.7)	15 (50.0)	38 (63.3)	0.032
Passed to children	26 (86.7)	17 (73.3)	43 (71.7)	0.011
Consumed since 20 years	32 (76.7)	20 (66.7)	43 (71.7)	0.394
Consumed three times a week	24 (80.0)	12 (40.0)	36 (60.0)	0.002
Complemented by other dishes	30 (100.0)	30 (100.0)	60 (100.0)	>0.05
Eating culture of <i>Lalapan</i> categories				
Good (score $\geq 20$ )	23 (76.7)	13 (43.3)	36 (60.0)	0.009
Less (score $< 20$ )	7 (23.3)	17 (56.7)	24 (40.0)	
Perception of benefits on the skin				
Brighter	8 (26.7)	2 (6.7)	10 (16.7)	0.039
Smoother	12 (40.0)	6 (20.0)	18 (30.0)	0.094
More moist	5 (16.7)	6 (20.0)	11 (18.3)	0.741
No effect	10 (33.3)	19 (63.3)	29 (48.3)	0.021
Skin quality perception categories				
Good (score $\geq 5$ )	20 (66.7)	11 (36.7)	31 (51.7)	0.021
Less (score $< 5$ )	10 (33.3)	19 (63.3)	29 (48.3)	

Note: \*Mann Whitney test, significant at  $p < 0.05$ ; \*\*n=30 subjects for each groups

Hendariningrum (2018), *Lalapan* and chilli sauce is the food menu that must be present every mealtime. *Lalapan* consumption complemented by other dishes, especially foods that contain enough oil or fat, can increase the absorption of nutrients in *Lalapan* such as  $\beta$ -carotene (Gopper et al., 2009).

Table 3 shows that 51.7% of subjects feel that eating *Lalapan* is beneficial to their skin. Previous studies have shown that vegetable consumption habits can improve skin quality, brighten skin tone, and increase facial attractiveness (Tan et al., 2015; Appleton et al., 2018). Vegetable consumption including *Lalapan* can improve skin quality because vegetables contain high levels of carotenoids (Whitehead et al., 2012). Therefore maintaining this good eating culture of *Lalapan* seems nec-

essary to increase the nutrition and health of the community. Community perception plays an essential role in social-ecological arrangements. For example, public perception of water quality is seen as a necessary condition for the development of a more integrated system to sustain ecology in Mashavera River Basin, Georgia (Withanachchi et al., 2018). Modern media could be used to highlight and strengthen the eating culture of *Lalapan*.

There are also significant differences between the eating culture of *Lalapan* and skin quality perception by high and low intake groups of  $\beta$ -carotene ( $p=0.009$  and  $p=0.021$ ) (Table 3). The result shows that the high intake group of  $\beta$ -carotene had a higher score of eating culture of *Lalapan* and skin quality perception compared to the lower group.



Cultural context and practices are one of the important factors that can influence food choices (Roudsari et al., 2017; Preedy et al., 2011). Culture, especially food eating culture might play an important role in human nutrition intake, and food beliefs might give beneficial or detrimental effects on human health status (Reddy & Anitha, 2015). Table 4 shows that the eating culture of *Lalapan* has a positive association with skin quality perception ( $p=0.000$ ). The eating culture of *Lalapan* influences the food choice of subjects, increasing the consumption of vegetables and having a positive effect on the health of the body including skin quality. Table 4 also shows that consumption of *Lalapan* has a positive association with vegetables consumption ( $p=0.025$ ), which indicates that the eating culture of *Lalapan* could increase vegetable consumption. Urbanization, evolution of agriculture, environmental characteristics of food, income, availability of food, and access to food all influence vegetable consumption including consumption of *Lalapan* (Caspi et al., 2012).

One type of carotenoid that is widely found in vegetables, blood, and human tissue is  $\beta$ -carotene (Rodriguez-Amaya et al., 2008; Schagen et al., 2012).  $\beta$ -carotene has a role in regulating skin quality (Schagen et al., 2012).  $\beta$ -carotene consumed from *Lalapan* and other resources is absorbed through the intestine and then transported through the bloodstream to various target tissues (Mayne et al., 2010).  $\beta$ -carotene concentration in the blood could reflect the amount of food consumed from  $\beta$ -carotene sources such as fruit and vegetables, including fresh vegetables (Block et al., 2001). The results of this study show that the eating culture of *Lalapan* has a positive association with  $\beta$ -carotene intake from *Lalapan* ( $p=0.008$ ), daily intake of  $\beta$ -carotene ( $p=0.035$ ), and blood  $\beta$ -carotene concentrations ( $p=0.031$ ).

*Lalapan* consumption increases daily intake of  $\beta$ -carotene and blood  $\beta$ -carotene concentrations, which in turn are thought to cause subjects to feel skin quality benefits. Previous research has shown that  $\beta$ -carotene can increase the brightness of skin colour (Whitehead et al., 2012; Pezdirc et al., 2016), prevent skin damage caused by sun light (Köpcke & Krutmann, 2008), reduce erythema caused by UV exposure (Stahl et al., 2000), reduce mitochondrial damage to fibroblasts in the skin layer after UV exposure (Eicker et al., 2003), and prevent ageing (Cho et al., 2010). In addition, long-term consumption of raw vegetables could increase levels of  $\beta$ -carotene (Garcia et al., 2007). The limitation of this study is that eating culture is only measured using five indicators, even though there are many other influencing factors such as availability, environment, and motivation to consume *Lalapan*.

## Conclusion

The eating culture of *Lalapan*, which contains nutrients including  $\beta$ -carotene which is beneficial for health and skin, likely increases vegetable consumption and the perception of good skin quality. In turn this positive perception seems to spur an increase in *Lalapan* intake. This is reflected in the high level of blood  $\beta$ -carotene concentrations, which is very important to support and protect human health. This positive community perception on skin quality and vegetable consumption suggests a potential communication media for improving people's eating quality and health at the community level. Maintaining the good eating culture of *Lalapan*, therefore, should be an urgent priority by all interested in increasing the nutrition and health of the community.

## Acknowledgements

We thank Anne Christopherson for proofreading the manuscript. The authors are grateful to anonymous reviewers for their valuable comments on an early version of the manuscript.

## Conflict of Interests

The authors hereby declare that there is no conflict of interest.

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