

## Risks factors for diarrhea among travellers visiting Bali

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### ABSTRACT

**Background and purpose:** The number of foreign travellers visiting Bali continues to increase and diarrhea often occur among them. The purpose of this study is to determine the risk factors for the incidence of diarrhea in foreign travellers.

**Methods:** A case-control study was conducted in foreign travellers visiting the international clinic at the Port Health Office at Ngurah Rai International Airport in Denpasar during the period from May to October 2018. Cases were foreign travellers visiting the clinic with diarrhea symptoms. Controls were non-diarrhea foreign travellers visiting the clinic for other purposes. The number of cases and controls was 87 people each and were matched by gender and citizenship. Data collected were age, travel plans, type of food and beverage consumption, hand washing habits and type of food providers (roadside food sellers, restaurants, hotel restaurants and food stalls). Multivariate analysis was performed using logistic regression to determine the adjusted odds ratio (AOR) of each risk factor.

**Results:** Characteristics of cases and controls do not differ in terms of gender and citizenship. Multivariate analysis shows that significant risk factors associated with diarrhea in foreign travellers are a history of consuming street food with AOR=3.94 (95%CI: 1.19-12.97) and a history of traditional barbequed pork consumption (called *babi guling*) with AOR=6.24 (95%CI: 2.09-18.64). Other risk factors, namely consumptions of Indonesian food, traditional mixed chopped meat and vegetables (called *lawar*), mixed rice and drinks with ice cubes, are not found to be associated with the incidence of diarrhea in foreign travellers.

**Conclusion:** Consumptions of street food and traditional barbequed pork were found to be associated with the incidence of diarrhea in foreign travellers during a visit to Bali. Street food hygiene, education for food vendors and information provision to foreign travellers on choosing food types need to be improved

**Keywords:** traveller's diarrhea, street food, travel health, Bali

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### INTRODUCTION

Globally, 8% of 50 million travellers take medication after travelling.<sup>1</sup> Health problems frequently experienced by travellers visiting developing countries include diarrhea, respiratory infections and skin disorders.<sup>1</sup> Acute diarrhea is the most frequent health issue in foreign travellers visiting developing countries including Indonesia.<sup>2,3</sup> World Health Organization (WHO) defines diarrhea as defecation with a consistency of liquid three times or more in 24 hours.<sup>4</sup> The reported incidence of acute and chronic diarrhea in travellers was as many as 335 of the 1000 people who returned from travelling.<sup>1</sup> Diarrhea in foreign travellers is associated with lack of food sanitation when travelling to developing countries.<sup>5-7</sup>

Bali is a major foreign traveller destination in Indonesia with the number of foreign travellers visiting Bali continues to increase. During 2017 the number of flights from I Gusti Ngurah Rai Airport was 31,982 with a total of 5,317,800 foreign travellers.<sup>8</sup> The number of diarrhea cases in travellers who were treated at the Port Health Office clinic for one month (January 2018) was reported as many as 36 people out of 177 patients.<sup>9</sup>

Outbreaks related to food experienced by travellers often occur in Bali and in some outbreaks, *Escherichia coli* (*E.coli*) contamination found on food samples.<sup>7,10</sup> Reports from the main referral hospital of the Port of Health Office in Denpasar showed that the number of diarrhea cases in travellers was as many as 1,571 cases (42.5%) of the total 3,698 cases of diarrhea managed at the hospital during 2016, both outpatient and inpatient.<sup>9</sup>

As a traveller destination, various types of food are found in Bali sold by many forms of vendors such as restaurants and roadside stalls. Street food is well-liked by foreign travellers, especially in the beach area which is a popular place to congregate in Bali.<sup>7</sup> In addition, local Balinese food is also much loved by travellers. The results of a study in Bali showed that 66.7% of travellers said that they really liked the local and traditional Balinese food. One type of Balinese food that is favored by travellers is the pork cooked in a traditional barbeque style which usually consists of skin and pork, fried pork meat, roasted pork sausage, pork soup (potatoes, carrots, beans and pork) and is usually

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supplemented with vegetables (beans, papaya and coconut) and Balinese seasoning.<sup>11</sup>

A study conducted in exploring the association of diarrhea with the type of food found that there is no association between the type of food and diarrhea.<sup>12</sup> Studies on the association between food sanitation and hygiene with the incidence of diarrhea in Bali remain limited. In a previous study conducted in Bali on risk factors for diarrhea in foreign travellers, it was found that the age of foreign travellers, length of stay and handwashing behavior were risk factors for diarrhea and there was no association between the type of food with the incidence of diarrhea.<sup>13</sup> This study was conducted to determine the type of food and place of food sellers as the risk factors for diarrhea among foreign travellers visiting Bali.

## METHODS

The case control study was conducted on 87 foreign travellers with diarrhea as cases and 87 foreign travellers who did not have diarrhea as controls (1:1). Cases were foreign travellers visiting Bali from May to July 2018 who returned to their country and stayed for a maximum of 2 weeks and visited the International Clinic of the Port Health Office in Denpasar with symptoms of diarrhea. Controls were non-diarrhea foreign travellers visiting Bali from May to July 2018 who returned to their country and stayed for a maximum of 2 weeks visiting the International Clinic at the Port Health Office and were not family members of the cases. Cases and controls were matched by gender and citizenships. The sample size was calculated with a significance level of 95%, power of 80% and an estimated OR of 3.0. Risk factors collected were types of food and food sellers, types of beverages, types of traveller visit and handwashing behavior among foreign travellers.

Data collection was carried out by interview at the International Clinic in the Port Health Office in Denpasar by the attending physician who had been trained for using a questionnaire in English. For the respondents who did not speak English the interviewer was assisted by an interpreter from the airline used by the respondents. Multivariate analysis was performed using logistic regression with the Stepwise Backward LR Method to determine the adjusted odds ratio (AOR) of each risk factor. This study has been approved by the Ethics Committee of the Faculty of Medicine, Udayana University/Sanglah Hospital on October 8, 2018.

## RESULTS

Table 1 presents the characteristics of cases and controls based on several variables and it was found that there is no significant difference ( $p > 0.05$ ) between cases and controls by gender, citizenship, health insurance ownership, types of visit, destination of visit, length of stay, accommodation and the frequency of visits to Bali.

Table 2 presents the crude odds ratio for variables considered to be risk factors for diarrhea in foreign travellers. It appears that a number of variables significantly associated with the incidence of diarrhea, namely age, types of travel, consumption of Balinese food, Indonesian food, salads, *lawar*, pork satay, rice, traditional barbecued pork, fried rice, mixed rice, chicken satay, bottled water, drinks with ice cubes, as well as hand washing habits, hand washing using a hand sanitizer, history of eating at roadside food sellers, hotel restaurants and food stalls.

**Table 1** Characteristics of foreign travellers visiting the international clinic at Denpasar Port Health Office

Variable	Cases		Controls		p
	n	%	n	%	
<b>Gender</b>					1.00
Male	49	56.3	49	56.3	
Female	38	43.7	38	43.7	
<b>Citizenship</b>					1.00
Australian	24	28.0	24	28.0	
European	32	35.4	32	35.4	
Asian	22	26.3	22	26.3	
American	9	10.3	9	10.3	
<b>Travel insurance</b>					0.76
No	35	40.2	33	37.9	
Yes	52	59.8	54	62.1	
<b>Visit type</b>					0.25
Group	12	13.8	18	20.7	
Family	30	34.5	22	25.3	
Individual	45	51.7	47	54.0	
<b>Purpose of visit</b>					0.25
Visiting family/friends	13	14.9	8	9.2	
Holiday	74	85.1	79	90.8	
<b>Length of stay (days)</b>					0.40
1-7	65	74.7	60	69.0	
>7	22	25.3	27	31.0	
<b>Accommodation</b>					0.22
Hotel	70	80.5	76	87.4	
Lodgings	17	19.5	11	12.6	
<b>Frequency of visits to Bali</b>					0.61
First time	65	74.7	62	71.3	
More than once	22	23.5	25	28.7	

**Table 2** Crude OR of risk factors for travellers' diarrhea

Variable	Cases		Controls		Crude OR	95%CI	p
	n	%	n	%			
<b>Age (years)</b>					2.1	1.09-3.89	0.03
≤24	37	42.5	23	26.4			
≥25	50	57.5	64	73.6			
<b>Type of travel</b>					2.7	1.47-5.09	<0.01
Independent	48	55.2	27	31.0			
Package tour	39	44.8	60	69.0			
<b>Balinese food</b>					14.2	6.79-29.64	<0.01
Yes	72	82.8	22	25.3			
No	15	17.2	65	74.7			
<b>Indonesian food</b>					26.1	7.67-89.05	<0.01
Yes	84	96.6	45	51.8			
No	3	3.4	42	48.3			
<b>Western food</b>					0.9	0.44-1.95	0.85
Yes	69	79.3	70	80.5			
No	18	20.7	17	19.5			
<b>Chinese food</b>					0.8	0.35-1.74	0.54
Yes	13	14.9	16	18.4			
No	74	85.1	71	81.6			
<b>Salad</b>					3.3	1.47-7.33	<0.01
Yes	26	29.9	10	11.5			
No	61	70.1	77	88.5			
<b>Lawar</b>					8.5	3.50-20.43	<0.01
Yes	37	42.5	7	8.0			
No	50	57.5	80	92.0			
<b>Pork satay</b>					4.7	2.42-9.21	<0.01
Yes	48	55.2	18	20.7			
No	39	44.8	69	79.3			
<b>Street stall rice</b>					8.4	2.77-25.28	<0.01
Yes	25	28.7	4	4.6			
No	62	71.3	83	95.4			
<b>Vegetables</b>					2.0	1.74-2.35	0.16
Yes	2	2.3	0	0			
No	85	97.7	87	100.0			
<b>Traditional barbequed pork</b>					14.7	6.84-31.45	<0.01
Yes	61	70.1	12	13.8			
No	26	29.9	75	86.2			
<b>Fried rice</b>					7.5	3.83-14.87	<0.01
Yes	59	67.8	19	21.8			
No	28	32.2	68	78.2			
<b>Rice and side dishes</b>					7.5	3.83-14.87	<0.01
Yes	60	69	19	21.8			
No	28	31	68	78.2			

Table 2 Continue

Variable	Cases		Controls		Crude OR	95%CI	p
	n	%	n	%			
<b>Chicken satay</b>					5.4	1.75-16.75	<0.01
Yes	18	20.7	4	4.6			
No	69	79.3	83	95.4			
<b>Bottled water</b>					0.1	0.10-0.64	<0.01
Yes	76	87.4	86	98.9			
No	11	12.6	1	1.1			
<b>Drinks with ice</b>					10.7	4.75-23.96	<0.01
Yes	48	55.2	9	10.3			
No	39	44.8	78	89.7			
<b>Regular handwashing</b>					3.7	1.95-7.02	<0.01
Not always	61	71.8	35	40.7			
Always	24	28.2	51	59.3			
<b>Hands washed with water</b>					1.1	0.58-2.18	0.73
Yes	64	73.6	62	71.3			
No	22	26.4	25	28.7			
<b>Hands washed with soap</b>					1.2	0.51-2.88	0.66
Yes	13	14.9	11	12.6			
No	74	85.1	76	87.4			
<b>Hands washed with handsanitizer</b>					0.1	0.05-0.34	<0.01
Yes	6	6.9	31	35.6			
No	81	93.1	56	64.4			
<b>Roadside food sellers</b>					11.7	4.85-28.2	<0.01
Yes	44	50.6	7	8.0			
No	43	49.4	80	92.0			
<b>Restaurant</b>					0.9	0.44-1.62	0.62
Yes	59	67.8	62	71.3			
No	28	32.2	26	28.7			
<b>Hotel restaurant</b>					0.2	0.07-0.73	<0.01
Yes	72	82.8	83	95.4			
No	15	17.2	4	4.6			
<b>Food stalls</b>					1.9	1.06-3.61	0.03
Yes	43	49.4	29	33.3			
No	44	50.6	58	66.7			

Table 3 AOR of risk factors for traveller's diarrhea

Consumption of food and drinks and hand washing habits	AOR	95% CI	p
<b>Indonesian food</b>			
No	1 (Ref)		
Yes	4.28	0.94-19.50	0.06
<b>Lawar</b>			
No	1 (Ref)		
Yes	2.88	0.80-10.30	0.11

Table 3 Continue

Consumption of food and drinks and hand washing habits	AOR	95% CI	p
<b>Traditional barbequed pork</b>			
No	1 (Ref)		
Yes	6.24	2.09-18.64	<0.01
<b>Fried rice</b>			
No	1 (Ref)		
Yes	0.32	0.12-0.86	0.02
<b>Rice and side dishes</b>			
No	1 (Ref)		
Yes	0.42	0.16-1.13	0.09
<b>Drinks with ice</b>			
No	1 (Ref)		
Yes	0.35	0.12-1.05	0.06
<b>Hands washed with handsanitizer</b>			
No	1 (Ref)		
Yes	0.20	0.04-0.71	0.16
<b>Roadside food sellers</b>			
No	1 (Ref)		
Yes	3.94	1.19-12.97	0.02

In the multivariate analysis with logistic regression all variables are included in the model. Table 3 presents adjusted odds ratios for risk factors that significantly associated with diarrhea in foreign travellers, namely consumption of traditional barbequed pork (AOR=6.24; 95%CI: 2.09-18.64) and food consumption at roadside food sellers (AOR=3.94; 95%CI: 1.19-12.97).

## DISCUSSION

We found that in the bivariate analysis, risk factors that associated with diarrhea in foreign travellers visiting Bali are age, travel independently and consumption of Balinese and Indonesian foods, salads, *lawar*, pork satay, rice, traditional barbequed pork, fried rice, rice with side dishes, chicken satay, bottled water, drinks with ice cubes, as well as hand washing habits, washing hands using a handsanitizer and purchasing food from roadside sellers. However, in the multivariate analysis, only two variables were found to increase the risk of diarrhea in foreign travellers visiting Bali, namely consumption of traditional barbequed pork and roadside food sellers. This is likely because respondents who answered “yes” to the consumption of traditional barbequed pork also answered “yes” to consuming Balinese and Indonesian foods. In our study, 75% of foreign travellers who had diarrhea were first-time travellers visiting Bali and also first time consuming Balinese food including traditional

barbequed pork. This food is cooked with a variety of Bali typical spices<sup>14</sup> and it is possible that foreign travellers experience intolerance or malabsorption of these spices so as to cause diarrhea in foreign travellers.<sup>14-16</sup>

Apart from intolerance and malabsorption, another possibility is due to contamination of microorganisms and bacteria that most often causes diarrhea is *Enterotoxigenic E.coli* (ETEC).<sup>17-19</sup> A study that was conducted in Bali shows that the occurrence of diarrhea in foreign travellers is associated with contamination by *E.coli* in Balinese type *lawar* food in Kuta area.<sup>7</sup> Another study reported that diarrhea can be caused by contamination by *Salmonella* and *Campylobacter* in pork that is not cooked properly.<sup>20</sup> However, traditional barbequed pork in Bali is commonly cooked thoroughly at high temperatures, so allergic factors and malabsorption are more likely to be associated with diarrhea in foreign travellers than due to contamination by microorganisms, but further studies are needed to confirm this assumption.

Our study also indicates that the risk of diarrhea in foreign travellers is higher in travellers who buy food from roadside sellers. This is likely related to food sanitation and hygiene that is sold alongside roads that have not received much supervision from the government. There is no regulations that require roadside food sellers to have good sanitation service permits for food and sanitation hygiene, such as large restaurants and hotels that have been required

according with the Indonesia Ministry of Health Act No. 1096/MENKES/per/2011.<sup>21</sup> Further studies on the hygiene of food and beverages sold along the side of the road are necessary to be conducted which can be used as a reference or an evidence for making regulations or included in a guidebook for travellers as conducted in Thailand.<sup>22</sup> In addition, ongoing supervision of food and beverage hygiene for both licensed and unlicensed sellers is required, because those who are licensed do not necessarily have good food and beverage hygiene. A study in Bali reported that ownership of a food service license and food hygiene certificate did not reduce the risk of diarrhea in foreign travellers.<sup>13</sup>

Cases and controls in this study were selected for travellers who came to the international clinic at the Port Health Office at Ngurah Rai Airport so that they did not represent cases and controls among foreign travellers visiting Bali in general. In addition, information bias may occur because the data was collected during departure time of the respondents thus some respondents may provide information in a short available time.

## CONCLUSION

Consumption of traditional barbequed pork and street food are found to be associated with diarrhea in foreign travellers visiting Bali. This is probably due to food intolerance or malabsorption and inadequate food and beverage hygiene. Information for travellers, regulation and continuous supervision on food and drinks are required to reduce the risk of diarrhea among foreign travellers visiting Bali and also to maintain Bali's image as a global destination.

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