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**Traveler's Diarrhea Risk Factors on Foreign Tourists in Denpasar Bali-Indonesia
May and August 2013**

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Background: Traveler's diarrhea is the most common disease of tourists who pay a visit to developing country. Bali is one of island located in Indonesia where the number of tourists visit from various countries continue to increase. This study aimed to evaluate risk factors of traveler's diarrhea incidence on foreign tourists in Bali. **Methods:** A case control study performed on 137 foreign tourists who visit Bali through Ngurah Rai International Airport, Denpasar, Bali. Case and control group selected with convenience method, 35 samples and 102 samples for case and control group, respectively. Traveler's diarrhea incidence determined based on interview. All data analyzed descriptively and analytically with univariate and multivariate analysis. **Results:** Risk factors of traveler's diarrhea on foreign tourists in Bali were tourist's age, length of stay, and hand washing behavior. **Conclusions:** The incidence rate of traveler's diarrhea is related with environment sanitation, so it may be advisable to health authority, especially Puskesmas (primary health services), to encourage environmental sanitation monitoring program on public areas such as markets, stalls, inns, and hotels.

Keywords: traveler's diarrhea, case control, risk factors, tourists.

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INTRODUCTION

Traveler's diarrhea is the most common disease of tourists who visit developing countries, including Indonesia. The prevalence of diarrhea on tourists in Peru reported as 24% and as many as 9,836 people from 7,937,654 tourists suffer from diarrhea.¹ While data of traveler's diarrhea on tourists of Indonesia has not much been published. Bali is one of island in Indonesia and a favorite tourist destination especially for international tourists. Bali tourism office reported that the number of foreign tourists who visit Indonesia and Bali in 2009 was 6.323 and 2.229 million people, respectively, and this trend continue to increase as much as 23% until the end of 2011.²

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The increase in tourist visits also accompanied with the increase incidence of

infectious diseases including the incidence of traveler's diarrhea on tourists. According to preliminary survey on hospital as the sample, the incidence of traveler's diarrhea on tourists who visit hospitals in Bali was 5% from 2429 cases of diarrhea. There is still a probability in which the incidence of traveler's diarrhea increases if the survey was performed on all clinics in Bali. High incidence of traveler's diarrhea in foreign tourists will affect to the amount of international tourist's visits and indirectly affect on the economy of Bali communities for the field of tourism is one source of income in Bali.

The government, in this case is Health Department, has implemented prevention efforts through the implementation of infectious diseases prevention program and sanitary supervision of public areas including restaurants and hotels, but the results were not optimal. The programs only able to suppress the incidence of diarrhea by 50.7%.³ There are several factors that affect traveler's diarrhea incidence that is environmental factors, host, and agent. Environmental condition for international tourists, especially in hotel and restaurants, are reported clean but not in several places in Bali.

Tourists also tend to consume foods in unhygienic areas so it is likely to be infected with bacteria. Host factors that affect the incidence of diarrhea are age, eating and drinking habits, socioeconomic, country of origin, areas visited, prophylactic history or other preparation before visit. According to survey, the average age of international tourists who visit Bali was 30 years old. The incidence in female was higher than male which is 51.2% and 4.8%, respectively. The incidence of traveler's diarrhea mostly from Europe with 37.6%, Australia 31.9%, Asia 22.6%, and American continent 2.8%.²

This study aimed to determine risk factors of traveler's diarrhea on foreign tourists in Bali.

METHODS

This study used case control design. The study population was foreign tourists who visit through Ngurah Rai International Airport Denpasar Bali on May and August 2013. Sample in this study was foreign tourist in departure immigration section of Ngurah Rai International Airport. 137 travelers selected with convenience method as sample. Case group was foreign tourist with traveler's diarrhea (n=35) while control group was foreign tourists without traveler's diarrhea (n=102). Variables of occupation was divided into risk and not at risk, based on the samples' mobility, risk occupation for high mobility. Variable of income classified as \leq average and $>$ average based on the mean of annual income. Country of origin defines as country which they come from, divided into developed and

developing countries. Hand washing behavior define as hand washing before consume particular foods.

Data about characteristics of tourist and the incidence of diarrhea collected with structured interview and analyzed with univariate and bivariate analysis.

RESULT

The Incidence of Traveler's Diarrhea

The incidence of diarrhea on foreign tourists during traveled in Bali was 25.5% (table 1). This number obtained from interview regarding frequency of loose stools more than three times during traveled in Bali.

Table 1. Prevalence of Traveler's Diarrhea on Foreign Tourists in Bali

Variable	N	%	
Diarrhea	Yes	35	25.5
	No	102	74.5
Total	137	100.0	

The Trend of Traveler's Diarrhea on Foreign Tourists in Bali

Traveler's diarrhea on foreign tourists in Bali tend to occur on tourists with a young age, high income, comes from developed countries, duration of stay more than a week, dining at inn, western type of food, and regular hand washing. Detailed information presented in table 2.

Table 2. The Trend of Traveler's Diarrhea on Foreign Tourists in Bali

Variables		Traveler's diarrhea				Total	
		Yes		No		N	%
		N	%	N	%		
Age	\leq average	29	32.2	61	67.8	90	100.0
	$>$ average	6	12.8	41	87.2	47	100.0
Occupation	Risk	10	22.7	34	77.3	44	100.0
	Not at risk	18	26.9	49	73.1	67	100.0
Income	\leq average	29	23.4	95	76.6	124	100.0
	$>$ average	6	46.2	7	53.8	13	100.0
Country of origin	Developing	3	5.1	56	94.9	59	100.0
	Developed	32	41.0	46	59.0	78	100.0
Length of stay	$<$ 8 days	19	20.7	73	79.3	92	100.0
	\geq 8 days	16	35.6	29	64.4	45	100.0
Dining location	Inn	28	24.6	86	75.4	114	100.0
	Outside of inn	7	30.4	16	69.6	23	100.0
Type of food	Western Food	6	35.3	11	64.7	17	100.0
	Asian food	11	16.9	54	83.1	65	100.0
	Mixed	18	32.7	37	67.3	55	100.0
Hand washing behavior	Yes	25	71.4	10	28.6	35	100.0
	No	10	9.8	92	90.2	102	100.0

Table 3. Chi-square Test Analysis of Traveler's Diarrhea Risk Factors on Foreign Tourist in Bali

Variables	Traveler's diarrhea				X ²	P	
	Yes		No				
	N	%	N	%			
Age	≤ average	29	32.2	61	67.8	6.145	0.013
	> average	6	12.8	41	87.2		
Country of origin	Developing	3	5.1	56	94.9	22.813	0.000
	Developed	32	41.0	46	59.0		
Occupation	Risk	10	22.7	34	77.3	0.241	0.662
	Not at risk	18	26.9	49	73.1		
Dining location	Inn	28	24.6	86	75.4	0.508	0.594
	Outside of inn	7	30.4	16	69.6		
Type of food	Western Food	6	35.3	11	64.7	4.881	0.087
	Asian Food	11	16.9	54	83.1		
	Mixed	18	32.7	37	67.3		
Income	≤ average	29	23.4	95	76.6	3.206	0.095
	> average	6	46.2	7	53.8		
Length of stay	< 8 days	19	20.6	73	79.4	3.529	0.049
	≥ 8 days	16	35.5	29	64.5		
Hand washing behavior	Yes	25	71.4	10	28.6	6.223	0.027
	No	10	9.8	92	90.2		

Traveler's Diarrhea Risk Factors on Foreign Tourists in Bali

Based on chi-square test analysis found that traveler's diarrhea risk factors on foreign tourists in Bali were age of tourists, country of origin, length of stay in Bali, also hand washing behavior before eating with P value for each variables < 0.05. The result of chi-square test analysis on all variables was presented in table 3.

Risk of Suffering Traveler's Diarrhea on Foreign Tourists in Bali

Multivariate analysis found that only variables of age, length of stay, and hand washing behavior were traveler's diarrhea risk factors on foreign tourists in Bali. The highest risk that affect the incidence of traveler's diarrhea was age with OR 3.249 and P value 0.000 (<0.05). All the data presented in table 4.

Table 4. Multivariate Analysis of Traveler's Diarrhea Risk Factors on Foreign Tourists in Bali

Variables	OR	CI		P
		Lower	Upper	
Age	3.249	1.239	8.519	0.000
Country of origin	0.077	0.022	0.268	0.105
Length of stay	0.472	0.214	1.042	0.000
Hand washing	0.306	0.117	0.801	0.000

DISCUSSION

The incidence of traveler's diarrhea on foreign tourist in Bali was 25.5%. This result is in accordance with the range of traveler's diarrhea incidence in other developing countries, which is 20-90%. Developing countries are at high risk with the incidence of diarrhea 20-90% per 2 weeks' length of stay. While low risk is region with the incidence <8% per 2 weeks' length of stay. Region with the incidence >8% and <20% considered as moderate risk. United states, Canada, Australia, New Zealand, Japan, and countries in north and west Europe are the examples of countries with low risk. Countries with moderate risk are East Europe countries, South Africa, and several Caribbean island. Countries with high risk include most countries in Asia, middle East, Africa, Mexico, and Central and South America.³

Other researcher reported the incidence of traveler's diarrhea was 60%.⁴ Traveler's diarrhea on foreign tourist tend to occur in age, permanent work, high income, countries of origin from developing countries, female, length of stay more than 8 days, dining location at the inn, and western type of food. Other researcher relates the incidence rate of traveler's diarrhea with the destination country that visited by tourists. Tourists from developed countries are at more risk suffered from traveler's diarrhea when visiting developing countries.⁵ It connected with host's immunity towards infection. Sanitation and environment in developing countries are relatively worse than developed countries. Foreign tourists from developed countries rarely exposed to bacteria that caused infection so they do

not have immunity towards infectious disease, including diarrhea, during vacation.

Bali is one of the islands in Indonesia, included in Asia countries, where the risk of traveler's diarrhea was reported in high risk category. But the result of this research found that the incidence rate of traveler's diarrhea was lower than result reported by other researcher.² On the other hand, there are only few report regarding the incidence of traveler's diarrhea on foreign tourists in Bali, so it is difficult to evaluate the incidence of traveler's diarrhea annually.

Risk factors for traveler's diarrhea on foreign tourists at Bali in this research were age, country of origin, length of stay in Bali, and hand washing behavior before eating. Other researcher found that age, behavior, nationality, genetic, environment (tourist destination and hotel) had important role on the incidence of traveler's diarrhea.⁶ Other factor that associated with traveler's diarrhea is season. Season has little relevance toward traveler's diarrhea, 16-18% on May until July and 20-23% on August until October.⁷ Furthermore, the risk of traveler's diarrhea in winter is lower. In Mexico, traveler's diarrhea risk increases with warmer temperature and greater rainfall.⁸ The unexpected result is hotel associated with the incidence of traveler's diarrhea, where the incidence rate of traveler's diarrhea in five stars' hotels is slightly higher compared with three or four stars' hotels with the incidence rate of 0-33% from 18 hotels which visited by approximately 40 clients each week.

There is significant difference in the incidence of diarrhea for different risk category. One of the important factor is the hotel which they choose to stay. As shown in Jamaica, the incidence of traveler's diarrhea in tourists from 18 hotels which visited by approximately 40 clients each week is 0-33%. The incidence rate of traveler's diarrhea is the reflection of hygiene in the places visited. The duration of exposure also relevant. It has been proven that 5 of five stars' hotel, where the research conducted, have higher traveler's diarrhea incidence compared with three and four stars' hotel. This finding is make sense, given the food was made by using hand. Type of trip also important, where beach has lower incidence (28%), 31% for group tourists and 32% for individual tourist, 34% for escapade tourists, and combination tourists were higher related with higher consumption of alcohol.⁴

Tourists with younger age are at more risk for traveler's diarrhea since they tend to more active and more often exposed to bacteria-contained objects that cause traveler's diarrhea. This is in accordance with other researcher which found that tourists with young age is a risk factor for traveler's diarrhea.⁴ Infants, toddlers, and young adults with age between 15-30 years old are most vulnerable to suffer from traveler's diarrhea. Children are at more risk since their fingers often carelessly touch unhygienic

things such as floors and contaminated items, even lick their fingers. While in young adults, higher risk of traveler's diarrhea related with huge appetite and consuming food that unconsciously contaminated with pathogenic bacteria that cause traveler's diarrhea.

Country of origin is also a variable that related with the risk of suffering from traveler's diarrhea. Other researcher found that tourists who visit developing countries more often suffered from traveler's diarrhea compared with tourists from developing countries who visit developed countries.^{5,9,10} *Enterotoxigenic Escherichia coli* (EAEC), bacteria that cause diarrhea, associated with diarrhea in tourists from Spain or Spanish ethnicity that visits developing countries. The expected dose for *E. coli* strains is high, which is in the level of one million bacteria or higher.¹¹ Similar things also reported by Steffen et al.⁷ They found that more than 60% of tourists from developed countries who visit developing countries are suffered with traveler's diarrhea.

The origin of tourists is the most relevant host factor. It has long been known that people from developed countries have very low incidence of diarrhea (2-8%) when visit other developed countries. This phenomenon has been proved in delegation for convention and students, military population. Tourists who just visit tropical region have lower diarrhea incidence possibly as a result of immune development.^{7,12,13}

Evidence on hand washing behavior to prevent traveler's diarrhea is uncertain. Theoretically, this behavior helped in preventing infection by pathogens at low inoculum doses. Noroviruses or *Shigella* strains are considered as the most contagious pathogens since they only need low inoculum doses and their stability in the environment. Hand washing behavior or use of alcohol-based hand sanitizers have an impact if this behavior pursued both by the persons who prepares the food and the tourists who consume it.¹¹ It is likely not have an impact if done only by the tourists who consumes the food.

One strategy to prevent traveler's diarrhea is the use of prophylaxis. Tourists who came to developing countries are often counseled on preventive risk behavior, but despite all of counseling and their best attention, it still lacks the evidence of protective effect of this precaution.¹⁴ Primary prevention strategies such as bismuth subsalicylates (BSS), probiotics, and antibiotics are considered. Bismuth subsalicylates have moderate effectiveness. It could be considered for tourists with no contraindications and can adhere to frequent dosing requirements. While probiotics, prebiotics, and synbiotics for prevention of traveler's diarrhea are not recommended. Antibiotic chemoprophylaxis may be considered for short term use in high risk individual. It has moderate to good effectiveness.¹¹

CONCLUSION

Traveler's diarrhea found on foreign tourists in Bali with high socio economy, comes from developed countries, female, length of stay < 8 days, consuming western food, and hand washing behavior. While traveler's diarrhea risk factors in foreign tourists who visit Bali were age, length of stay, and hand washing behavior.

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