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Analysis of *Pemangku* and *Pengayah* Blood Glucose Levels at Besakih Temple

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Abstract

Background: *Every year on Sasih Kedasa, Besakih Temple holds a series of ceremonies called Ida Bhatara Turun Kabeh. The ceremony was held annually for approximately one and a half months. The workload of Pemangku and Pengayah during the ceremony, with a long duration and repetitiveness, is considered to cause physical fatigue, which leads to increased stress and an increased tendency to eat poorly. Pemangku and Pengayah are also vulnerable to sunburn, coffee, sleep loss, and dehydration while on duty. These factors trigger diabetes and spikes in blood glucose levels (BGL).* ***Aims:*** *To analyze the BGL of Pemangkuand Pengayah in Besakih temple.* ***Methods:*** *It is observational research with a cross-sectional approach. Data collection was done by Point of Care Testing (POCT), supported by interviews with 66 respondents to determine individual conditions.* ***Results:*** *One of the adult female respondents shows low BGL (48 mg/dl). High BGL (335,2 mg/dl on average) was obtained from five respondents: adult women, older women, and three older men. The rest of the respondents show normal BGL, which is 125,6 mg/dl on average.* ***Conclusions:*** *As many as 1,5% had low, 7,6% had high, and 90,9 % had normal BGL of 66 Pemangku and Pengayah at Besakih Temple.*

Keywords*: Blood Glucose Level, Pemangku, Pengayah, Besakih Temple*

1. Introduction

Considered the religious center of Balinese Hindus, every year on Sasih Kedasa (according to the Balinese lunar year), a ceremony called Ida Bhatara Turun Kabeh is performed at Besakih Temple. Balinese Hindus perform this ceremony to show their gratitude to God and pray for the welfare and salvation of the universe. In 2023, the Ida Bhatara Turun Kabeh ceremony was held for approximately one and a half months, from March 11 to April 29 (1).

In this ceremony, Pemangku - the Balinese Hindu holy man, and Pengayah - a man who serves sincerely without material reward at the temple, are busy handling everything for the ceremony. The workload involved in long duration and repetitiveness is considered to cause fatigue, increased stress, and a greater tendency toward an unbalanced and poor diet.

An unbalanced diet and poor stress management are known as risk factors that can trigger diabetes (2–4). In addition,

Pemangku and Pengayah was are also vulnerable to exposure to several things that, according to the CDC (5) could trigger blood sugar spikes, such as Sunburn, Coffee, Losing sleep, and Dehydration during their duty.

Diabetes is a chronic metabolic disorder characterized by excessive blood glucose levels (BGL). Diabetes mellitus is classified into two types: type 1 diabetes is characterized by insufficient insulin levels, and type 2 diabetes is due to the body's failure to utilize insulin (6).

Diabetes is the leading cause of premature death worldwide, as well as the leading cause of blindness, heart disease, and kidney failure. According to the International Diabetes Federation (IDF), in 2019, at least 463 million people aged 20 to 79 worldwide had diabetes, representing 9.3% of the total population at those age levels. Within the top ten countries with the highest number of people with diabetes, Indonesia was ranked as the seventh country with 10.7 million people with diabetes (7).

Due to this description, this study aims to analyze the BGL of Pemangku and Pengayah at Ida Betara Turun Kabeh ceremonies in Besakih Temple, which is suspected to be exposed by factors related to the elevation of BGL. The results of this study are expected to contribute to the early detection of diabetes in the prevention and control of DM in Indonesia.

2. Research Methods

This research method is an observational study with a cross-sectional approach. This research was conducted at Bale Pewaregan, in Jaba (outer side) of Penataran Agung Area of Besakih Temple, which is located in Besakih Village, Rendang District, Karangasem Regency, Bali, in April 2023. Using the purposive sampling technique, 67 respondents were willing to do the BGL examination. However, one of them was categorized into exclusion criteria. Therefore, the sample size of this study was 66 respondents. The inclusion criteria are Pemangku orPengayah at Ida Betara Turun Kabeh 2023 ceremony who are willing to become respondents, age range of adolescents 12-25 years, adults 26-45 years, and elderly ≥46 years. The age range is adjusted to the criteria of the Indonesian Ministry of Health (8). Exclusion criteria are taking drugs for Diabetes Mellitus therapy. Data was collected by examining BGL using the point-of-care testing (POCT) method and interviewing the respondents to determine their circumstances. Equipment used in this study were a glucometer (Easy Touch® GCU), blood glucose strips (Easy Touch®), a lancet, and an autoclick lancing device. The sample used was capillary blood.

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3. Results and Discussions

The BGL examination was conducted on 66 Pemangku and Pengayah who fulfilled the inclusion criteria. Sixty-six participants were 45% (30 people) male and 55% (37 people) female, with an age range of 28 to 85 years. The distribution of participant information according to age and gender is presented in Table 1.

Table 1. Respondents Characteristics

Characteristics	Number (people)	Percentage (%)
Gender		
Men	30	45,5
Women	36	54,5
Total	66	100
Age Criteria		
Teens	0	0
Adults	29	43,9
Elderly	37	56,1
Total	66	100

Source: Primary data, 2023

This study found that BGL varied with an average 140 mg/dl value. The lowest BGL obtained was 48 mg/dl, and the highest was 412 mg/dl.

Referring to the consensus of the Indonesian Endocrinology Society (PERKENI), which adopts the American Diabetes Association (ADA) criteria, diabetes is confirmed when BGL ≥ 200 mg/dl with symptoms of frequent hunger and thirst, frequent urination in large quantities, weight loss (7). According to the my-Cleveland clinic-org page (9), for most people with diabetes, hypoglycemia occurs when blood sugar levels are below 70 mg/dl. Meanwhile, for most people without diabetes, hypoglycemia occurs when blood sugar levels are below 55 mg/dl.

Based on these criteria, interpretations of the BGL test results were categorized into three groups, which are Low (< 55 mg/dl), Normal (56 - 199 mg/dl), and High (≥ 200 mg/dl), as described in Table 2.

Table 2. Blood Glucose Levels of Pemangku and Pengayah at Besakih Temple

Blood Glucose Levels	Number (people)	Percentage (%)	Average Value (mg/dl)
Low	1	1,5	48,0
Normal	60	90,9	125,6
High	5	7,6	335,2
Total	66	100	140,3

Source: Primary data, 2023

Table 2 shows that there was one person (1.5%) with low BGL at 48.0 mg/dl, five people (7.6%) with high BGL with an average value of 335.2 mg/dl, and 60 of them (90.9%) had normal BGL with an average value of 125.6 mg/dl. Out of the five respondents who were found to have high BGL, two respondents stated that they already had a history of high blood glucose, meanwhile the other one just found out that they had high BGL during the current study. BGL results were also grouped by respondent characteristics, including gender and age (Table 3). These characteristics are also known as factors that are indirectly associated with BGL.

Table 3. Blood Glucose Level of Pemangku dan Pengayah at Besakih Temple According to Respondent Characteristic

Characteristic	Low		Normal		High		Total		Average Value (mg/dl)	SD
	N	%	N	%	N	%	N	%		
Gender										
Men	0	0	27	90,0%	3	10,0	30	45,5	149,1	74,7
Women	1	2,8	33	91,7%	2	5,6	36	54,5	133,3	54,0
Age Criteria										
Teens	0	0	0	0	0	0	0	0	0	0
Adults	1	3,4	27	93,1	1	3,4	29	43,9	122,2	28,5
Elderly	0	0,0	33	89,2	4	10,8	37	56,1	154,4	79,2

Source: Primary data, 2023

able 3 shows that the mean value of BGL in men was higher than in women, 149.1 mg/dl versus 133.3 mg/dl. Similarly, the percentage of respondents with high BGL in men was higher than that of respondents with high BGL in women, 10% versus 5.6%. Some people believe that women might be more vulnerable to getting type 2 diabetes because women have higher cholesterol than men, and there is a difference in their daily activities and lifestyles (10). However, Boku (11) stated that gender does not affect the increase or decrease of BGL in patients with type 2 diabetes, as both males and females have the same risk of developing diabetes.

This statement is supported by research by Putra et al. (12), which showed no significant difference in BGL between men and women. Moreover, research by Susilawati and Rahmawati (13), also showed no relationship between gender and the incidence of type 2 diabetes. Thus, the difference in average BGL values and the percentage of high BGL in the two groups may be caused by other factors.

Based on the characteristics of the age group in Table 3, it shows that the average value of BGL in the adult age group is higher than the average value of BGL in the adult age group: 154.4 mg/dl versus 122.2 mg/dl, as well as the percentage of high BGL in the elderly group, is higher than the percentage of high BGL in adulthood: 10.8% versus 3.4%. The data shows an increase in average BGL with age.

The American Diabetes Association states that the risk of type 2 diabetes increases with age. Increasing type 2 of diabetes with age is due to an increase in body fat composition that accumulates in the abdomen, thus triggering central obesity. Central obesity then triggers insulin resistance, which is the initial process of type 2 diabetes mellitus. WHO also states that after a person reaches the age of 40 years, BGL increases by 1-2 mg% per year during fasting and will

increase by around 5.6 - 13 mg% 2 hours after eating (14).

This statement aligns with the research results by Komariah and Rahayu (15), which showed that age had a significant relationship with fasting BGL (p value = 0.004). In addition, increasing age affects a person's BGL, also evidenced in the results of research by Ugahari et al. (16), which shows that respondents who experience hyperglycemia tend to be more at the age of 41-60 years compared to respondents under the age of 40 years.

The Data from national health survey by the Ministry of Health (Riskesdas) shows an increase in the prevalence of DM along with the increasing age of the patient, which peaks at 55-64 years and decreases after passing this age range. This pattern of increase occurred in Riskesdas 2013 and 2018, indicating that the higher the age, the greater the risk of developing diabetes (7). This pattern is also evident in the results of this study, where high BGL were experienced more by elderly respondents compared to adult respondents.

Table 3 also shows that one respondent with low BGL came from the adult female group. This result is in line with the pattern that shows an increase in glucose in the elderly, especially men, so a decrease in glucose occurs in the opposite group, adult women. However, the author did not find any reference that mentioned that adult age group with female gender is related to the incidence of low blood glucose.

On the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) website (17), several conditions that increase the tendency of low BGL include type 1 diabetes, taking insulin or other diabetes medications, being 65 years old or older, or having other health problems such as kidney disease, heart disease, or cognitive impairment.

Based on the interview, the respondents did not have those conditions. The low BGL obtained in the results of this study may be due to various other factors, including the sampling and physiological conditions of respondents.

According to Irawan & Helviola (18), sampling conditions such as stabbing done before the alcohol on the finger is dry and improper finger massage techniques can cause dilution of the sample, giving false low results. In addition, the busyness of the participants during the ceremony activities disrupted the meal schedule and the patient's physiological condition, such as a history of low blood glucose, which could also affect the results of the BGL examination in these respondents.

The interviews also found that the respondents were served in shifts during the ceremony. Those assigned to tasks at night until early morning will suffer from sleep

loss, which is one of the factors influencing BGL.

Spiegel et al. (19) stated that Chronic sleep insufficiency, associated with sleep behaviors or disorders, could be a new risk factor for weight gain, insulin resistance, and type 2 diabetes. Healthy young adults treated with repeated partial sleep restriction show visible changes in glucose metabolism, including decreased glucose tolerance and insulin sensitivity. Neuroendocrine regulation of the appetite is also affected as the levels of the anorexigenic hormone leptin decrease, whereas the levels of the orexigenic factor ghrelin increase. These neuroendocrine disorders correlate with increased hunger and appetite, which may lead to overeating and weight gain.

Respondents also stated that in the daytime, they work in quite hot situations as the ceremony is held during the dry season, and the worship area is an outdoor area exposed to direct sunlight. Working in these conditions without adequate drinking led the respondents to have a risk of dehydration.

Outdoor sunlight shows a favorable association with insulin resistance. Bright sunlight may be associated with improved insulin sensitivity (20). A literature review published by Lorenti et al. (21) also stated moderate evidence supporting the role of sun exposure in reducing the likelihood of type 2 diabetes.

However, overexposure to excessive ultraviolet (UV) light, which commonly causes redness, pain, and burning on the skin, known as sunburn, can trigger physical stress that involved to increasing blood sugar levels (5). When stressed, the cortisol hormone increases, and insulin sensitivity decreases, which causes high glucose levels (22). If the respondents are also dehydrated, it enhances the possibility of high blood glucose test results because dehydration increases blood concentration, so the measured blood sugar level in this condition becomes higher (5).

Most respondents mentioned having tea or coffee almost daily while volunteering. This condition also can affect blood glucose levels. A systematic review by Reis et al. (23) suggests that consumption of caffeinated coffee may cause acute unfavorable effects; however, improved glucose metabolism was found at long-term follow-up.

Based on the references obtained, several conditions encountered by respondents are suspected to contribute to the results of measuring BGL obtained. However, the limitation of this study is that it only measures blood sugar levels without measuring stress levels, sun exposure, coffee consumption, sleep duration, and dehydration. Therefore, no conclusion can be drawn on the relationship between these risk factors and the blood sugar levels of

Pemangku and Pengayah during Ida Betara Turun Kabeh ceremony at Besakih Temple.

4. Conclusions

Examination of BGL carried out on *Pemangku* and *Pengayah* during the Betara Turun Kabeh Ceremony at Besakih Temple showed that as many as 1,5% had low, 7,6% had high, and 90,9 % had normal BGL of 66 respondents. For further research, it is necessary to measure the stress levels, sun exposure, coffee consumption, and sleep duration of *Pemangku* and *Pengayah* during Ida Betara Turun Kabeh Ceremony at Besakih Temple so that the influence of these factors on BGL can be determined.

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