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Utilization of Mengalo as an alternative carbohydrate source and dietary consumption patterns among the Sakai Tribe

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ABSTRACT

The Sakai Tribe is an indigenous community that traditionally consumes Mengalo. However, the consumption of fruits and protein-rich foods remains limited. This study aimed to describe food consumption patterns and the utilization of Mengalo as an alternative carbohydrate source among the Sakai Tribe. A descriptive cross-sectional survey was conducted involving 72 Sakai households. The sample size was determined using the Slovin formula with a 90% confidence level. Nutrient intake data were collected through face-to-face interviews using a food recall form. Household dietary diversity was assessed using the Household Dietary Diversity Score (HDDS), while the utilization of Mengalo was measured using a structured questionnaire. Data were analyzed descriptively and presented as percentages. The findings indicated that 43.1% of households had normal energy intake and 58.3% had normal carbohydrate intake. In contrast, protein intake was predominantly classified as a severe deficit in 38.9% of households. The average household dietary diversity was categorized as high (63.9%), although the intake of fruits and protein sources remained relatively low. Regarding local food utilization, 48.6% of households demonstrated a moderate level of Mengalo utilization as an alternative carbohydrate source. In conclusion, Mengalo continues to play an important role in supporting carbohydrate intake among the Sakai Tribe. Nevertheless, efforts are needed to improve the consumption of fruits and protein-rich foods to enhance overall diet quality. Preserving the cultural practice of Mengalo consumption through intergenerational knowledge transfer and exploring more modern processing techniques may contribute to sustaining local food utilization and improving dietary diversity among indigenous communities.

Keywords: *Alternative Carbohydrate Sources, Dietary Patterns, Indigenous Community, Mengalo*

1. Introduction

Dietary patterns describe the types and amounts of food consumed daily by individuals and reflect the characteristics of a particular population group (Leech et al., 2015). A healthy dietary pattern is recommended to higher in plant-based foods (e.g., vegetables, fruits, legumes, seeds, nuts, whole grains) (Nelson et al., 2016). Defined dietary patterns as the regulation of food types and quantities aimed at maintaining health, nutritional status, and preventing as well as treating diseases (Cena & Calder, 2020). Food quantity refers to portion size, while food type indicates the variety of foods consumed to form a balanced diet (Nurzakiah et al., 2021).

At the national level, Indonesian dietary patterns remain highly dependent on rice as the primary carbohydrate source. There is a common perception that a meal is considered incomplete without rice, positioning rice as the main provider of energy(Saliem et al., 2019). According to data from Statistics Indonesia, national rice consumption increased by 0.3% in 2014 compared to the previous year, while rice production decreased by 0.6% in the same period (BPS, 2014). This imbalance between rice demand and

availability has encouraged the government to promote rice self-sufficiency and dietary diversification through adherence to balanced nutrition guidelines.

Dietary patterns are influenced by several factors, including income, ethnicity, beliefs, knowledge, and environmental conditions (Fernández-Gómez et al., 2020). Ethnicity plays an important role in shaping food consumption habits, as each cultural group possesses distinct traditional dietary practices. Indonesia is a multicultural country with 1,340 ethnic groups, one of which is the Sakai Tribe, predominantly residing in Bathin Solapan Subdistrict, Bengkalis Regency, Riau Province (Bakar & Ghofur, 2017).

The Sakai Tribe traditionally consumes *Mengalo*, a local cassava-based food, as an alternative to rice. Mengalo has long been utilized as a household carbohydrate source, particularly during periods of rice crop failure or while awaiting harvest, and it has a relatively long shelf life. However, preliminary observations indicate limited consumption of fruits and protein-rich foods and a gradual shift toward rice-based diets. Therefore, this study aimed to describe the dietary patterns of the Sakai Tribe and the utilization of Mengalo as an alternative carbohydrate source.

2. Methods

This study was conducted in Desa Petani, Bathin Solapan District, Bengkalis Regency, Riau Province. The study area was selected because it is one of the settlements of the Sakai Tribe that still preserves the consumption of Mengalo as a traditional local food. The study population consisted of all Sakai households residing in the study area who consumed Mengalo, with a total population of 266 households.

The sample size was determined using the Slovin formula with a confidence level of 90%. Based on this calculation, a total of 72 Sakai households were included in the study. Households were selected based on inclusion criteria, namely Sakai families that consumed Mengalo and had a housewife who was willing to participate as the main respondent.

This study employed a descriptive survey with a cross-sectional design. Data were collected through face-to-face interviews with housewives, considering their role in managing household food preparation and consumption. The research instruments consisted of a structured questionnaire to obtain data on respondents' characteristics and the utilization of Mengalo, as well as a 24-hour food recall form to assess food consumption and nutrient intake.

The 24-hour food recall was conducted twice on non-consecutive days to obtain a more representative description of usual dietary intake. Nutrient intake data were manually processed to calculate energy, carbohydrate, and protein intake, which were then categorized according to levels of nutrient adequacy. Household dietary diversity was assessed using the Household Dietary Diversity Score (HDDS) based on the number of food groups consumed. The utilization of Mengalo as an alternative carbohydrate source was assessed based on the contribution of carbohydrate from Mengalo to the total household carbohydrate intake. All collected data were analyzed using univariate analysis and presented as frequency distributions and percentages.

3. Results

The results section summarizes the distribution of household characteristics, adequacy of energy, carbohydrate, and protein intake, household dietary diversity levels, and categories of Mengalo utilization among Sakai Tribe households.

Table 1. Distribution of Household Characteristics among the Sakai Tribe

Household Characteristics	n	%
Age of Housewife		
20-29 Years	20	27,8
30-39 Years	25	34,7
40-49 Years	15	20,8
>50 Years	12	16,7
Educational Level of Housewife		
No Formal Education	35	48,6
Elementary School	12	16,7
Junior High School	7	9,7
Senior High School	17	23,6
Higher Education	1	1,4

(to be continued)

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Table 1. Distribution of Household Characteristics among the Sakai Tribe (*continued*)

Household Characteristics	n	%
Number of Family Members		
< 5 Persons	54	75,0
≥ 5 Persons	18	25,0
Occupation of Household Head		
Laborer	15	20,8
Fishermen	36	50,0
Contruction Worker	10	13,9
Tader	2	2,8
Private Employee	5	6,9
Contract Employee	2	2,8
Others	2	2,8
Household Income		
< 1.000.000	11	15,3
1.000.000-2.000.000	50	69,4
> 2.000.000	11	15,3
Total	72	100

Table 1 shows that most housewives in Sakai Tribe households were aged 30–39 years, accounting for 25 respondents (34.7%). The educational level of housewives was predominantly no formal education, reported by 35 respondents (48.6%). Most Sakai households consisted of fewer than five family members, with 54 households (75.0%) and an average household size of four persons. Regarding the occupation of household heads, fishing was the most common livelihood, reported by 36 respondents (50.0%). The majority of households had a monthly income ranging from IDR 1,000,000 to 2,000,000, totaling 50 households (69.4%), with an average household income of approximately IDR 1,500,000.

Energy intake adequacy among Sakai Tribe households was predominantly classified as normal, with 31 households (43.1%). In line with energy intake, carbohydrate intake adequacy was also mainly categorized as normal, accounting for 42 households (58.3%). In contrast to energy and carbohydrate intake, protein intake adequacy among Sakai Tribe households was largely classified as a severe deficit, with 28 households (38.9%), as presented in Table 2.

Table 2. Distribution of Nutrient Intake Adequacy among Sakai Tribe Households

Nutrient Intake Adequacy	n	%
Energy Intake Adequacy		
Excess	0	0
Normal	31	43,1
Mild Deficit	21	29,2
Moderate Deficit	14	19,4
Severe Deficit	6	8,3
Carbohydrate Intake Adequacy		
Excess	3	4,2
Normal	42	58,3
Mild Deficit	13	18,1
Moderate Deficit	9	12,5
Severe Deficit	5	6,9
Protein Intake Adequacy		
Excess	0	0
Normal	10	13,9
Mild Deficit	12	16,7
Moderate Deficit	22	30,6
Severe Deficit	28	38,9
Total	72	100

Table 3 presents the levels of household dietary diversity among Sakai Tribe households, which are classified into three categories: low, moderate, and high. The results indicate that the majority of households had a high level of dietary diversity, accounting for 46 households (63.9%), followed by a moderate level in 26 households (36.1%). No households were classified in the low dietary diversity category.

Table 3. Distribution of Household Dietary Diversity Levels among Sakai Tribe Households

Household Dietary Diversity Level	n	%
Low	0	0
Moderate	26	36,1
High	46	63,9
Total	72	100

Furthermore, Table 4 describes the distribution of food groups consumed and not consumed by Sakai Tribe households. The food groups most frequently not consumed were fruits (83.3%), meat and meat products (98.6%), legumes (86.1%), and milk and dairy products, which were not consumed by all households (100%). In contrast, staple food groups such as cereals, tubers, fish, oils, and other complementary foods were consumed by the majority of households.

Table 4. Distribution of Food Groups Consumed by Sakai Tribe Households

Food Group	Consumed		Not Consumed		Total	
	n	%	n	%	N	%
Cereals	72	100	0	0	72	100
Tubers	67	93,1	5	6,9	72	100
Vegetables	57	79,2	15	20,8	72	100
Fruits	12	16,7	60	83,8	72	100
Meats	1	1,4	71	98,6	72	100
Eggs	31	43,1	41	56,9	72	100
Fish	67	93,1	5	6,9	72	100
Legumes	10	13,9	62	86,1	72	100
Milk	0	0	72	100	72	100
Oils	66	91,7	6	8,3	72	100
Sugar	52	72,2	20	27,8	72	100
Others	66	91,7	6	8,3	72	100

The utilization of Mengalo among Sakai Tribe households was predominantly classified as moderate, accounting for 35 households (48.6%), as presented in Table 5. Meanwhile, 23 households (31.9%) were categorized as having high utilization, and 14 households (19.4%) were classified as having low utilization.

Table 5. Distribution of Mengalo Utilization among Sakai Tribe Households

Mengalo Utilization	n	%
Low	14	19,4
Moderate	35	48,6
High	23	31,9
Total	72	100

Based on the mode of Mengalo consumption, as shown in Table 6, most Sakai Tribe households consumed Mengalo in combination with rice and side dishes, as well as with side dishes only, each reported by 31 households (43.1%). In contrast, only 10 households (13.9%) consumed Mengalo as a snack.

Table 6. Distribution of Mengalo Consumption Methods among Sakai Tribe Households

Mengalo Consumption Method	n	%
Consumption with rice and side dishes	31	43,1
Consumption with side dishes	31	43,1
Snack consumption	10	13,9
Total	72	100

4. Discussion

The characteristics of Sakai Tribe households in this study were examined based on the age of the housewife, education level, household size, occupation of the household head, and household income. The results showed that most housewives were within the productive age range. This condition potentially supports household management, including food consumption regulation and the utilization of local food resources (Surijati et al., 2021). In terms of education level, most housewives in Sakai Tribe households did not attend formal education. This low level of education is influenced by limited access to educational facilities in the past, as educational infrastructure in Sakai residential areas has only developed in recent years. Jayarni & Sumarmi (2018) reported that low levels of formal and informal education among housewives contribute to limited knowledge regarding the role of nutrients within the household. This condition may affect dietary diversity and housewives' understanding of the importance of balanced nutrient intake.

Based on household size, most Sakai Tribe households consisted of fewer than five members, with an average of four household members. Household size is an important factor in meeting household food needs, as a larger number of family members requires greater food availability (Wahyuni & Sukarniati, 2018). A relatively small household size may facilitate food consumption management and food distribution within the household, thereby supporting better nutrient intake and sustainable utilization of local food such as Mengalo.

The primary occupation of Sakai Tribe household heads was fishing, relying on river resources as the main source of livelihood. This condition influences household dietary patterns, particularly in the selection of animal protein sources, which are predominantly fish-based. Household income among Sakai Tribe families is generally earned on a daily basis and remains relatively limited. Income is a crucial factor in shaping household dietary patterns (Habib et al., 2021), as increased income enhances a household's ability to access food in adequate quantity and quality. Limited income and market access result in household food consumption being highly dependent on food resources available in the surrounding environment.

Energy and carbohydrate intake adequacy among Sakai Tribe households was mostly classified as normal. This condition is influenced by dietary patterns dominated by staple carbohydrate sources such as rice, as well as local tuber-based foods, particularly cassava processed into Mengalo. In contrast, protein intake adequacy among most households was classified as a severe deficit. This condition is attributed to limited variation in protein sources, as protein consumption was dominated by fish, while other protein sources such as meat, eggs, milk, and legumes were rarely consumed. These findings are consistent with the study by Anastasia & Angkasa (2013), which reported that protein consumption levels in rural communities in West Java were lower compared to urban areas.

The level of household dietary diversity among Sakai Tribe households, based on the HDDS, was predominantly categorized as high. Nevertheless, this level of diversity does not fully reflect optimal dietary quality, as several important food groups were rarely or not consumed, particularly fruits, meat and meat products, legumes, as well as milk and dairy products. Low fruit consumption aligns with the findings of Hermina & Prihatini S (2016), which indicated that fruit consumption in rural communities remains relatively low. This condition suggests that a high dietary diversity score does not necessarily correspond to adequate micronutrient intake.

The utilization of Mengalo as an alternative carbohydrate source among Sakai Tribe households was mostly categorized as moderate, with Mengalo contributing 20–50% of total household carbohydrate intake. This finding indicates that Mengalo continues to play an important role in household dietary patterns, although it has not fully replaced rice as the primary staple food. This condition is consistent with the findings of Adha & Suseno (2020), which reported that households in Sukadamai Village, Dramaga District, remain highly dependent on rice as the main energy source, while other local staple foods serve as complementary energy sources.

Most Sakai Tribe households consumed Mengalo together with rice and side dishes, reflecting a shift in the function of Mengalo from a primary staple food in the past to a complementary food in daily meals. However, some households continued to consume Mengalo as a substitute for rice, primarily due to cultural factors and economic constraints. In addition to being consumed as a staple or complementary food, a small proportion of Sakai Tribe households utilized Mengalo as a snack. This variation in consumption patterns demonstrates the flexibility of Mengalo as a local food with potential for further development. This consumption pattern aligns with the findings of (Rembulan, 2019), who reported that 31.7% of panelists consumed tiwul (a traditional cassava-based food) as a snack. The similarity in raw materials and consumption patterns between Mengalo and tiwul indicates that cassava-based local foods have the potential to be accepted not only as staple foods but also as snack foods.

Overall, the findings of this study indicate that the utilization of Mengalo as an alternative carbohydrate source aligns with the fourth message of the Balanced Nutrition Guidelines, which encourages the consumption

of diverse staple foods. Mengalo, which is made from cassava, has the potential to support food diversification, household food security, and the preservation of local wisdom.

5. Conclusion

This study concludes that Sakai Tribe households predominantly exhibit normal energy and carbohydrate intake, supported by the consumption of rice and the local cassava-based food Mengalo. However, protein intake remains insufficient due to limited variation in protein sources that are largely dominated by fish. Household dietary diversity is generally categorized as high, although the consumption of fruits and several protein-rich food groups remains low. The utilization of Mengalo as an alternative carbohydrate source is mostly moderate, indicating that Mengalo continues to play a significant role in household food consumption as a complementary staple rather than a complete substitute for rice. Mengalo therefore has the potential to support dietary diversification, household food security, and the preservation of local food culture among the Sakai Tribe.

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