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ETHNOMATHEMATICAL EXPLORATION OF *TUMBU'* BUGIS FOOD

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ABSTRACT

Culture-based education holds significant value as a tool and strategy for individuals and society in the information and technology age. Consequently, the researchers aim to explore ethnomathematics in typical Bugis food called Tumbu' Bugis. This study employed a qualitative method, utilizing an ethnographic approach and involving local communities familiar with the research study, specifically the Bugis tribe. Through observation and interviews, it was found that the typical food of Tumbu' Bugis contains the concept of geometry on the leaves used as Tumbu' wrappers and on the shape of Tumbu'. The concept of 3D shapes was also found, especially tubes (cylinders). In addition, there is also an algebraic concept in Tumbu' regarding the number of leaves needed to make Tumbu' and the number of Tumbu wrappers produced in one banana leaf. Tumbu' can be used as a medium for learning mathematics in plane geometry, including the properties and area of circumference and rectangular shapes. Comparison materials may also involve Tumbu' Bugis specialties. In conclusion, the typical food of Tumbu' Bugis encapsulates mathematical concepts, facilitating the teaching and learning process for teachers and students, ultimately aiding in achieving learning goals.

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INTRODUCTION

Education and culture have a significant and intrinsic relationship. Education plays a pivotal role in shaping individuals with cultural awareness, and in turn, culture guides people to live by life's principles. The objective of ethnomathematics research on Bugis tumbu' is to comprehend and analyze the role of mathematics within Bugis culture, particularly in the context of tumbu (Janan, 2022). Learning mathematics in alignment with its conceptual framework has positive impacts on learners. It enables the development and application of solutions in daily life situations. Consequently, educators' effective teaching of mathematics is essential, ensuring that students can comprehend and apply mathematical concepts proficiently in their daily activities (Kuswidi et al., 2021).

Mathematics studies have been integrated into various aspects of people's lives, including culture, customs, and others. Mathematics cannot be separated from the culture in society (Aulia et al., 2023; Zuliana, 2012). A culture-based learning approach focuses on activities and skills involving diverse cultural backgrounds. This model integrates the cultural aspects into the learning process in a particular subject and the assessment of learning outcomes using various assessment methods (Astanti & Fitroh, n.d.).

Culture-based education is valuable as a tool and strategy for individuals and society in the information and technology age. In addition, this education also plays a role in the early stages of identity awareness, the process of filtering, assimilation, and acculturation in cultural development. As it is said, "Maintaining the good old culture and adopting the new better culture." This reflects the characteristics of the formation of a dynamic culture. In this context, the role of humans is paramount in supporting cultural development through its relation to learning, including in mathematics learning (Fitriani & Azmidar, 2023).

The novelty in this research lies in the role of mathematics in Bugis tumbu' and its impact on the everyday lives of the Bugis community. The exploration concerns the potential application of mathematical knowledge in Bugis tumbu within a modern context, such as in mathematics education or other practical applications. Thus, the ethnomathematics research on Bugis tumbu aims to comprehend and analyze the role of mathematics in Bugis culture, particularly within the context of tumbu. This research also seeks to document the traditional mathematical knowledge embedded in Bugis tumbu practices. Therefore, this research aims to investigate the relationship between Bugis culture and mathematics.

In this context, the terms education and culture are related to ethnomathematics, which refers to the application of mathematics among certain cultural groups. Mathematics is observed and applied in various cultural contexts, such as tribal communities, social groups, children in certain age groups, and other classes (Hadija & Yuniarti, 2022). In 1977, D'Ambrosio, a mathematician from Brazil, introduced the concept of ethnomathematics. Ethnomathematics etymologically combines three basic words from Greek: *ethno*, which refers to natural or sociocultural groups; *mathema*, which relates to understanding and learning; and *this*, which relates to means, arts, and techniques (Rura et al., 2022).

Ethnomathematics-based learning is inherently connected to local culture and wisdom, offering an opportunity for comprehensive development in learning (Kuswidi et al., 2021). Intertwining cultural elements with mathematical principles can enhance learning methods. Ethnomathematics encompasses various mathematical concepts, including activities, calculations, measurements, and design. The overarching goal of ethnomathematics is to explore and study mathematics within the context of culture. Thus, it makes it easier for students to understand the inherent value of mathematical concepts when integrated with cultural concepts (Hanik & Nurtamam, 2017; Budiyono & Rahtwo, 2022). t has the potential to optimize students' cognitive development.

In principle, the Bugis are the largest ethnic group in Indonesia, where local culture has a significant role and is inseparable from their social life. This stems from the Bugis people's deep appreciation for cultural values, leading to earnest efforts to preserve the cultural heritage that has endured since ancient times (Alatas, 2015). Consequently, it is imperative for every culture, not only from the Bugis tribe but also from other tribes, to undergo revitalization or revival; this ensures the continued development of culture so that it remains well-known to future generations (Pathuddin & Raehana, 2019).

Traditional food is one of the characteristics of the famous Bugis cultural heritage. The presence of food has always been an inseparable part of various events and celebrations in the Bugis community, for example, during the Eid celebration. The close relationship between traditional Bugis food and various communities makes it well-known and familiar (Pathuddin & Raehana, 2019). This is evidenced by the number of people who like these specialties because of their distinctive forms, which have hardly changed since ancient times. Hence, it is essential

to preserve this traditional food, ensuring its recognition by future generations (Fitriani & Azmidar, 2023).

Traditional food shapes contain geometric concepts (Sianturi, 2019; Vinet & Zhedanov, 2011). This can be seen from its shape, which provides links with learning in mathematics. Therefore, it is important to explore more deeply the geometric concepts in traditional Bugis food. This is so that the concept can be used as a source of mathematics learning relevant to students' daily lives (Wanke & Santarcangelo, 2021). Therefore, a study linked each shape of traditional Bugis food called Tumbu' with mathematical concepts. This encourages interest in exploring the ethnomathematics in the context of traditional Bugis food, especially Tumbu' Bugis, a typical dish of the Bugis tribe during Eid and certain occasions (Diena Frentika & Heru Tri Novi Rizki, 2020; Fitriani & Azmidar, 2023).

METHOD

This research applied a descriptive qualitative research method to describe, explain, and explore a phenomenon and represent the situation under study. This research used a descriptive qualitative approach to explore and obtain comprehensive and in-depth information (Siregar, 2014; Sugiyono, 2015). The approach used was ethnographic, theoretical and empirical, to obtain description information and analyze as a whole mathematical element related to Bugis food known as Tumbu' (Rare'). Therefore, through an ethnographic approach, researchers can explore community culture and the ability to expose research data (Isnaningrum & Wahab, 2023).

Data collection techniques in this study are literature studies and observations on Bugis food, namely tumbu' (rare'). Data in this study were obtained from primary and secondary data sources (Hamdani, 2013; Siregar, 2016). Primary data were collected through observation and interviews with indigenous people who were community members at the study site. Meanwhile, secondary data were obtained through documents and literature studies related to geometric concepts in typical Bugis food, namely Tumbu' (Langka'). Data analysis techniques included data reduction, data presentation, and concluding. Therefore, this data analysis technique is suitable for research on ethnomathematics in typical Bugis food, namely *Tumbu* (Bien, 2020).

RESULT AND DISCUSSION

The following is the excerpt from an interview conducted by researchers with a resource person named Mrs. Siti Zaenab (2023), a native of Sanglar Village, Reteh District, Indragiri

Hilir Regency. The data was obtained from the interviews conducted, providing knowledge about the Bugis traditional food known as *Tumbu'.*

Researcher : What do you know about Bugis food, especially *Tumbu'* Bugis?

Informant : *Tumbu'* is a common.

Researcher : Why?

Informant : *Tumbu'* is one of the most popular traditional foods, as evidenced by the many Bugis who make this food when facing big events such as Eid al-Fitr, Eid al-Adha, and various other events. It is commonly packed as a lunch for long-distance travel.

Researcher : Is the process of making *Tumbu'* not complicated so that many Bugis people make it to various events?

Informant : It is certainly not difficult for those who often make it. The ingredients are easy to find, consisting of black or white glutinous rice (*pulut*), coconut milk, and salt, which is enough to create a delicious taste.

Based on the interview results, it is stated that the Bugis people consider Tumbu as a traditional dish. Tumbu' is consistently served during significant occasions such as Eid al-Adha and Eid al-Fitr and is often packed as provisions for long journeys. Making Tumbu' involves readily available ingredients such as glutinous rice *pulut* (black or white), coconut milk, and salt, resulting in a delectable taste.

Tumbu is a substitute for rice and is synonymous with this dish. It is a staple during Eid, typically accompanied by *opor ayam* (coconut gravy chicken), eggplant chili sauce, anchovy sauce, or other condiments. *Pulut* is utilized to craft Tumbu', which is then wrapped in banana leaves. Additionally, circular separators made from banana leaves are provided to prevent Tumbu's circles from sticking together, facilitating easier separation when presented. Furthermore, approximately 30 cm-long raffia ropes are supplied to tie together late additions of Tumbu', securing them within the leaves. The following interview provides insights into the process of making Tumbu', featuring Mrs. Zaenab (2023).

Researcher : What do you need to prepare?

Informant : All we need to prepare is banana leaves.

Researcher : Are there things that must be considered when selecting banana leaves?

Informant : Of course, Choose young and fresh banana leaves. After the leaves are collected, dry them first (cleaned). Next, cut the leaves into pieces.

Researcher : What is the size of the cut leaves?

Informant : The leaf size is about one inch for the inner leaf and two inches for the outer leaf. However, it also depends on the size you want.

Researcher : What characterizes this food?

Informant : A characteristic feature of this food is made in molds, then in hand mash to make it solid in molds and wrapped in leaves.

From the explanation of the size of the leaves used as Tumbu wrappers, we found the number of wrappers or small pieces produced in one banana leaf. Suppose we know *x* as the length of a banana leaf separated from its palm, y as the length of one side cut into pieces, and n as the desired number of leaf wrappers. In this case, we can use *2x* when the separated leaves on the palm are divided into two parts. In the conversation below, there is a geometric concept of similarity, where although the size of the outer and inner leaves is different, they have the same shape.

Researcher : As far as I know, leaves are also needed as an inner layer, aren't they?

Informant : Yes, that's right, but the size differs between the inner and outer layers

Researcher : What is the size of the leaves on the inner layer of Bu?

Informant : The size of the Tumbu' depends on the maker, but certainly, the size is smaller than the size of the outer leaf. Although the size of the leaves in the two layers of Tumbu's wrapper is different, they both have the same shape, which is rectangular.

Figure 1. Leaves to wrap *Tumbu'*s inner and outer leaves when stacked

Furthermore, the interview excerpt below explains the process of making *Tumbu'*. In this interview, a comparative concept is used in making *Tumbu'*.

Researcher : After finishing the wrapping part, what are the next steps?

Informant : Next, we will enter the stage of making Tumbu'. For the first step, prepare the ingredients needed, such as glutinous rice (*pulut)*. You can choose between black or white glutinous rice (*pulut putih or hitam)*. In making Tumbu', we will need *pulut*, coconut milk, and salt. If you use 1 kilogram of *pulut*, it takes 4 ounces of coconut milk and a pinch of salt. As a wrapper, usually used 16 outer leaves and 8 inner leaves.

Researcher : Then how manyTumbu' are produced with 1kg of glutinous rice?

Informant : Generally, the number of Tumbu' made is around eight or more, depending on the desired size, whether the Tumbu' will be made in large or small sizes.

From the interview results above, the problem arises about how many leaves are needed if two kilograms of rice are to make Tumbu'. The problem can be solved using the following comparison formula.

$$\frac{x1}{y1} = \frac{x2}{y2}$$

If we consider x as the amount of rice in kilograms used and y as the number of banana leaves needed, then to solve the problem, we can use the following approach.

Given that:

$x1$ = 1Kg

$y1$ = 24 Sheets

Asked:

$y2 = \cdots$

Completing the calculation using the previous formula.

$$\frac{1}{24} = \frac{2}{y}$$

$$y = 2\ (24)$$

Thus, if two kilograms of glutinous rice are used to make Tumbu', then 48 banana leaves are needed. The following are the steps in making Tumbu' Bugis: wash well and soak for 2-3 hours, re-wash it thoroughly, drain, and then set aside.

1. Steam glutinous rice until cooked. Remove and set aside in a baking dish; let it cool.

2. Cook thick coconut milk and add salt. Stir well to boil. Taste correction and turn off the heat.
3. Pour the coconut milk gradually over the cold glutinous rice until all the coconut milk is used. Stir thoroughly until the mixture is well combined and absorbed by the glutinous rice. Allow it to cool initially. One of the objectives is to let it cool first, preventing easy spoilage and ensuring it can last for 3-4 days at room temperature.

Figure 2. Coconut milk mixed into sticky rice

4. Take enough dough. Insert in a round mold with a diameter of 5 cm and a height of 2 cm (the mold can be adjusted to the desired size). Do this step until the glutinous rice dough runs out.

Figure 3. The dough is put into round molds

5. Take one dough, layer with banana leaves that have been formed round following the shape of the dough. Add more dough on top. Layer back with plantain leaves. Do this three times.

Figure 4. Layers of *Tumbu'*

6. After finishing the coating process, roll the mixture and wrap it with young banana leaves, securing both ends. Next, encase it again with banana leaves and secure both ends.

Figure 5. Combination *Tumbu'* bugis

7. Tie the dough that has been wrapped in banana leaves.
8. Continue tying until all surfaces are neatly and tightly bonded.
9. Store in a saucepan. Add water to taste. and cook until cooked for 2-3 hours. Add water if the water has decreased. When it is cooked, remove and drain. When you want to serve, open the leaves first.

Figure 6. *Tumbu'* that has been wrapped and will be cooked

10. Once cooked, it is ready to serve and enjoy together by opening the Tumbu' from the leaf dressing and arranging it on a plate as desired. Figure 8 displays Tumbu' made of white glutinous rice (*pulut*).

Figure 7. *Tumbu'* (black and white *pulut*) is ready to serve and enjoy together

Plane Geometry

Rectangle

This ethnomathematical research is focused on the production process of Tumbu' by the Bugis community. The shape and size of the leaves used to wrap Tumbu' has to do with learning mathematics, especially in the context of rectangles. There are two leaf sizes with the same shape, which reflects a geometric concept called “similarity” (Sianturi, 2019).

Figure 8. Leaves to wrap *Tumbu'* Bugis

The leaves used as Tumbu wrappers have two sizes with the same shape. Let's assume there are two rectangles: ABCD with a larger size and PQRS with a smaller size. To give you a

clearer picture, Figure 10 visually represents the rectangles on the leaves used to wrap food *Tumbu'*.

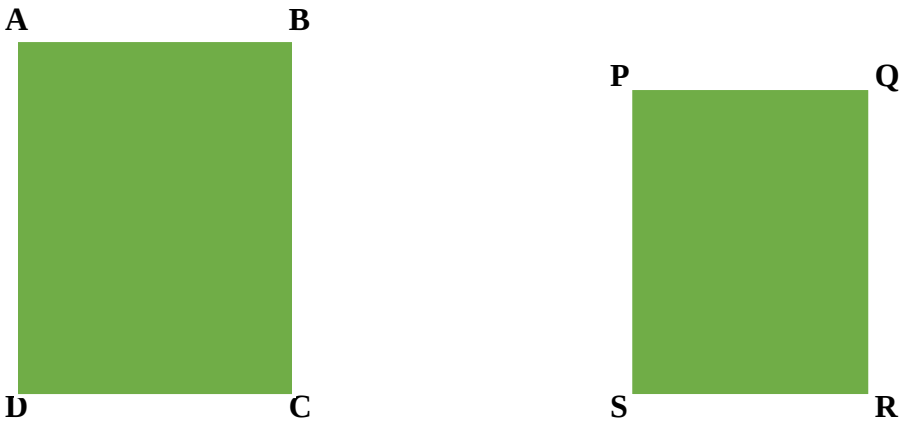

Figure 9**.** Rectangle as a representation of a banana leaf

From a geometric perspective, two leaves with identical shapes but varying sizes introduce the mathematical concept of congruence. The concept of congruence posits that two or more objects are deemed congruent if their corners and sides are of equal dimensions. In this context, the interconnected angles of both rectangles are right angles, each measuring 90° (Nugraha et al., 2022).

The corresponding angles of the two squares are $\angle A = \angle P$, $\angle B = \angle Q$, $\angle C = \angle R$, $\angle$*and* $D = \angle S$. As a result, the sides of the ABCD and PQRS rectangles have the same ratio, and the angles are equal, namely: $AB = PQ$, $CD = RS$, $AC = PR$, $BD = QS$.

Circle

Next, ethnomathematics is reviewed from small circular leaves as a barrier between Tumbu and one another. For more details, see Figure 11.

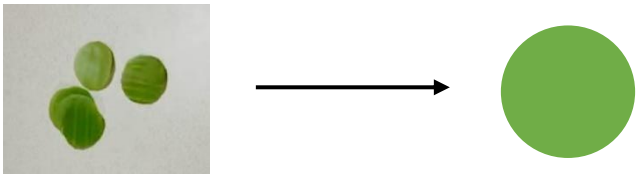

Figure 10. Circle as a representation of the delimiter Tumbu' Bugis

A circle is a set of points located on curved lines with equal distances from a certain central point. This center point is referred to as the center of the circle. After understanding the concept of a circle, you can proceed to study the elements of a circle to calculate the circumference and area of the circle (Wanke & Santarcangelo, 2021). Figure 12 provides an overview.

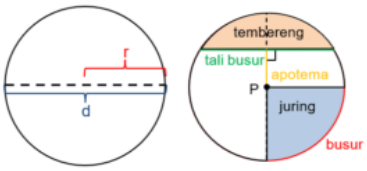

Figure 11. Illustration of the elements of a circle *(source:akupintar.id)*

The following is the formula for the circumference of a circle.

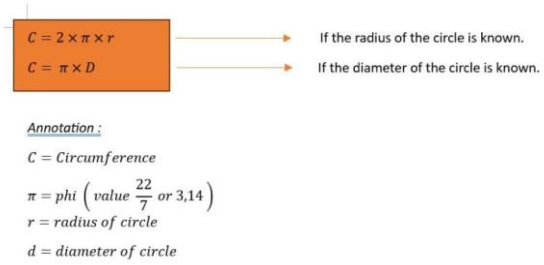

Figure 12. Illustration of the formula for the circumference of a circle *(source:akupintar.id)*

In addition, you can also use the following formula (Figure 14), if you want to determine the circle's radius using the circle's circumference (Hadija & Yuniarti, 2022).

$$r = \frac{K}{2\pi}$$

Figure 13**.** The Formula of the Radius of a Circle with the Circumference of a Circle

The formula in Figure 14 indicates that if, knowa circle's diameter is in a problemn, it is necessary to convert the diameter to radius. The following are the steps to do the conversion (Figure 15).

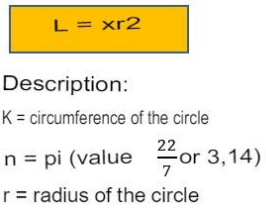

Figure 14. The formula of Circle Area

If you want to find the radius of a circle based on the area of the circle, you can use the following formula (Figure 16).

$$r = \sqrt{\frac{L}{\pi}}$$

Figure 15. Formula of Radius with Circle Area

3-D Shapes

Tube (Cylinder)

In principle, a shape resembling a glass or milk can is referred to as a tube. A tube constitutes a space formed by two parallel and congruent circles, enclosed by a rectangle that surrounds the circumference of the two circles. The tube is characterized by three sides, with two circular and the third rectangular, accompanied by two edges (M. Nur, 2006; Wahyuni & Pertiwi, 2017). Figure 17 presents the Tumbu mold associated with the tube (cylinder).

Figure 16. Tumbu' Bugis Mold

Figure 17. Tumbu' Bugis is ready to serve

Figure 18 resembles an upright cylindrical chamber, as illustrated in Figure 19.

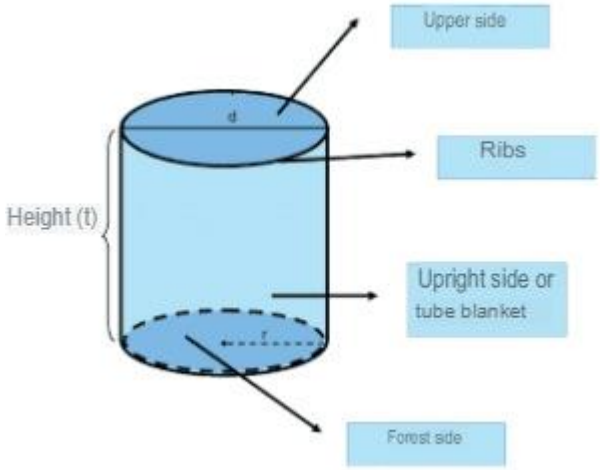

Figure 18. Elements of a Cylinder *(source: akupintar.id)*

The formula of a cylinder surface area is as follows.

$L = \pi \times r^2 + \pi \times r^2 + 2 \times \pi \times r \times t$

$L = 2 \pi r (r+t)$

The formula of a cylinder volume is as follows.

$V = \pi \times r^2 \times t$

CONCLUSION

Based on the study results, it was observed that the traditional Bugis food, Tumbu', embodies the concept of geometry. This concept is evident in the leaves used as Tumbu wrappers and the overall shape of the Tumbu'. Specifically, the geometric concept found in Tumbu refers to the concept of 3D shapes, particularly cylinders. Moreover, algebraic concepts are present in Tumbu', particularly in discussions about the number of leaves required to make Tumbu' and the number of Tumbu' wrappers produced from a single banana leaf. Tumbu serves as an effective medium for teaching various mathematical concepts of 3D shapes, encompassing properties, circumference, and rectangular area. Additionally, it can be utilized for teaching comparison concepts and formulas to determine unknown values. However, it is important to note that this research is confined to exploring algebra and geometry concepts in Tumbu'. Subsequent studies could investigate further to uncover additional mathematical concepts inherent in Tumbu' Bugis.

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