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Transforming of Indigenous Knowledge into Scientific Knowledge: An Ethnoscientific Study of Cascara Tea in Kerinci

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Abstract: The indigenous biological knowledge of ethnic communities such as Kerinci has the potential to be a scientific source in biology learning through an ethnoscience approach. This study aims to reconstruct the local knowledge of the Kerinci community about the processing of coffee skin waste into cascara tea, transform it into scientific knowledge, and explore its potential as a medium for biology learning. The method used is descriptive qualitative, the research informants are cascara tea UMKM actors consisting of 2 people. Data were obtained through interviews, observations, and documentation, then analyzed into scientific concepts. The results show that the cascara processing process consists of sorting, roasting, grinding, packaging, serving, and flavor variations. This study proves that indigenous knowledge can be developed into contextual biological concepts and integrated into biology learning to improve students' scientific literacy and strengthen the relationship between culture, science, and the environment.

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Introduction

Ethnoscience, derived from the Greek word ethos meaning 'nation' and Latin scientia meaning knowledge, is defined as a system of community knowledge (native science) obtained through interaction with nature and becomes part of its culture (Mukti et al., 2022). This approach combines cultural heritage and scientific concepts to create meaningful educational experiences, by systematically designing learning processes through the integration of local culture, such as the use of food and beverage products in learning (Eka Maryam et al., 2022). In addition to preserving national culture, the ethnoscience approach also aims to increase knowledge and study natural phenomena and symptoms that occur (Silla et al., 2023). By involving the community in the development of learning media, this approach becomes more democratic and responsive to local needs. Education that pays attention to culture is very important for students because it helps foster a sense of love for culture, national character, and love for the homeland (Ghufroni et al., 2020). Through ethnoscience, students can recognize the potential of their region and preserve cultural heritage from generation to generation by transforming the community's native knowledge into scientific knowledge

Kerinci, located in Jambi Province, is known for its natural beauty, such as Mount Kerinci and Kerinci Seblat National Park. This area is inhabited by the Kerinci Tribe, who still maintain traditions and customs through their clans. Kerinci Regency is one of the areas that is actively cultivating coffee plants (Lamefa et al., 2020) . Drinking coffee is an activity that has been a culture among Indonesian people for a long time (Djami, 2020) . Coffee can be made into food such as coffee cakes and also as a drink (Suma & Ulfa, 2023). From post-harvest coffee processing, 65% of coffee beans and 35% of coffee skin waste are obtained (Syaiful et al., 2022). So that there is an increase in the population of coffee fruit skin waste. In line with (Nafisah, et al., 2018) stating the large amount of coffee production that exists, then coffee processing will produce a lot of coffee fruit skin waste, coffee waste is a big note in the coffee industry, however, this can be utilized by the Kerinci community, namely in Kemantan Agung village, where they produce tea from coffee fruit skin, in line with research (Nalurita et al., 2023) stating that coffee skin waste can be utilized into cascara herbal tea bags, The coffee fruit skin has the scientific name Cascara (Garis et al., 2019).

Coffee (Coffea sp.) belongs to the Rubiceae family and consists of several important species such as Coffea arabica, Coffea canephora (robusta), Coffea liberica, and Coffea excelsa (Rahardjo, 2012; Subandi, 2011). The fruit structure includes the exocarp (skin), mesocarp (flesh), and endocarp (parchment), with the exocarp,

commonly known as cascara, often being considered agricultural waste. However, this byproduct holds significant potential for use in various applications, one of which is making cascara tea.

Cascara tea drink is a drink made from dried coffee skin waste from the coffee fruit peeling process (Rahayu et al., 2020) . The management of this waste has great potential because the raw material is free and reduces the accumulation of waste in the environment (Setiyono et al., 2023). The manufacturing process involves drying the coffee fruit skin after the beans are harvested. This fruit skin is then brewed like tea, producing a drink with a unique taste that is mixed or added with cinnamon bark, and also ginger. Cascara also provides many benefits for the body. One of them is the antioxidant content which is useful for maintaining the body's immune system (Bahri, et al., 2024)

Thus, the use of cascara in the context of ethnoscience can enhance students' understanding of the relationship between science, culture, and the environment. According to (Rikizaputra et al., 2021) enhance the purpose of education is not only focused on knowledge but also on attitudes and character. Through ethnoscience, students can understand how positive attitudes and characters can be learned from the surrounding environment. Therefore, it is important to emphasize the use of environmental and cultural concepts, especially local culture, as sources of learning.

Through a culture-based learning approach, students will be involved in direct observation activities at the cascara tea production site, allowing them to ask scientific questions, describe phenomena scientifically, and conclude relationships with natural conditions and the impact of human activities on them. Involving students directly in direct observation in the home industry or cascara tea production site can provide them with direct experience which is a real application of biological concepts. To support the achievement of learning objectives, one of the things that teachers must do is how ethnoscience can be applied in learning and can be connected to local culture or wisdom. This study raises the indigenous knowledge of the Kerinci ethnic group, particularly from the Kemantan Agung Village community, regarding the processing of cascara tea from coffee fruit skin and reconstructs it into scientific knowledge that can be used as a medium for learning biology. This integration provides a new approach to students' scientific literacy, by connecting local culture, science, and the environment. Unlike previous studies that focused more on the chemical aspects or benefits of cascara in general (for example, Garis et al., 2019; Rahayu et al., 2020), this study not only describes the cascara processing process but also explores its benefits in the context of biology education. Therefore, this study aims to explore the indigenous knowledge of cascara processing by the Kerinci tribe, and reconstruct indigenous knowledge into scientific knowledge (biological concepts) as teaching materials for biology learning.

Method

This study uses a qualitative phenomenological approach to explore community knowledge and local wisdom related to natural phenomena and events observed in the Kerinci area, especially in the management of coffee skin waste. (Creswell, 2021). This approach was chosen because it allows researchers to explore the meaning and deep understanding of individual subjective experiences in their social and cultural contexts, as well as how the Kerinci community gives meaning to environmental phenomena and preserves their indigenous knowledge.

This study uses a purposive sampling method, which is a deliberate sampling technique by selecting informants who have in-depth experience in the topic being studied (Sugiyono, 2017). In this study, there were 2 informants, namely cascara tea UMKM actors in Kemantan Agung Village, Air Hangat Timur District, Kerinci Regency, Jambi Province. The selection of these informants aims to gain in-depth insight into the potential for cassava processing in the village.

The data in this study were obtained through three methods, namely semi-structured interviews, documentation, and observation. Interviews were conducted with young cascara entrepreneurs and their mothers to obtain in-depth information. Documentation was used to collect written data related to the production process, while observations were conducted directly in the field to study the daily activities of cascara entrepreneurs in Kemantan Agung Village.

The instruments in this study consisted of several tools used to collect data systematically, namely interview guidelines, observation sheets, and documentation. Interviews were conducted in an unstructured and open manner(Denzin, & Lincoln, .2009). where researchers prepared a list of main questions but there was still further discussion development according to the answers given by the informants. The main questions in this interview included things like: "How did you start a cascara processing business?, What are the ingredients used in the process of processing cascara into tea?, Can you explain in detail the stages in cascara processing?". The purpose of this interview was to obtain in-depth information related to the cascara processing process and its impacts. In addition, observation sheets were used to record the processes and interactions that occurred in the field, such as the daily activities of business actors, while documentation was used to take pictures that documented cascara production activities.

Data analysis in this study was carried out by transforming indigenous knowledge about cascara tea processing by the Kerinci Tribe in Kemantan Agung Village into scientific knowledge. This transformation is interpreted as the process of changing indigenous knowledge into scientific knowledge through the steps of interpreting and classifying information from interviews, observations, and documentation. The information obtained is analyzed based on biological concepts, resulting in scientific knowledge that is sourced from local wisdom. This knowledge is then integrated into high school Biology learning based on the Independent Curriculum to support contextual and meaningful learning.

Results

Based on the results of interviews with cascara tea entrepreneurs, it is known that the type of coffee used is Arabica coffee. The stages in processing cascara tea are (1) sorting, (2) roasting, (3) grinding, (4) Packaging is divided into 2, namely packaging tea powder into tea bags and then packaging tea into boxes. and (5) serving. The following is some research documentation.

Figure 1. Sorting, separating the remaining coffee beans or dirt from coffee fruit skin waste using a sorting machine

Figure 2. manual roasting process using a frying pan (roasting)

Figure 3. The process of grinding coffee fruit skin using a machine.

Figure 4.1. the process of filling tea powder into tea bags using a machine

Figure 4.2. Tea packaging into boxes

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Figure 5. Serving cinnamon skin variant tea

Discussion

Based on research conducted through observation and interviews with the Kerinci community, the processing of Cascara *(* coffee skin) into tea consists of several stages, namely starting with the sorting stage of the coffee fruit, washing coffee beans, Fermentation of coffee fruit skin, Steaming of coffee fruit skin, Drying of coffee fruit skin, *Cascara* Grinding (Coffee fruit skin), cascara tea packaging (Indrayani et al., 2022). This is slightly different compared to the way *Cascara tea is processed* in Kerinci, precisely in Kemantan Agung Village, namely there are 6 stages: Collecting coffee fruit skins, Sorting (separating coffee fruit skins), Roasting (roasting using manual tools such as cauldrons), Grinding (refining coffee skins into tea powder using a grinding machine), packaging and continued with serving.

Based on the results of interviews with the community, it is known that the Kerinci community has utilized coffee skin optimally, and knows the many benefits of coffee skin including protecting the stomach, preventing cancer, preventing heart disease, preventing premature aging, and can tighten the skin. then it is also safe for consumption, because the caffeine content can relieve fatigue, hunger, drowsiness, and can increase concentration and strengthen heart contractions(Mierza et al., 2023).

After trying Robusta coffee (Coffea canephora), Arabica coffee (Coffea arabica), and liberka (Coffea liberica), the best type of coffee to make cascara tea is Arabica coffee because the skin is thick (Lilmutawakkil et al., 2023). The type of coffee that is suitable for processing as cascara tea according to the Kerinci Community is Arabica coffee, this is related to the caffeine content in Arabica coffee. (Aryadi et al., 2020)stated that the highest caffeine content comes from Robusta coffee at 2.15%, second from Arabica at 1.77% and third from Liberica at 1.32%. The caffeine content in Arabica coffee is categorized as moderate, so it is more tolerant for long-term consumption.

The process of processing cascara (coffee skin) into tea is as follows: The initial stage of the process of collecting coffee fruit skins that have been dried at the coffee production site in Kerinci, where there are several types of coffee cultivated in Kerinci, namely Arabica, Robusta, and Liberka, so that the production of coffee fruit skin materials received by *Cascara Tea* Kerinci production does not undergo further drying, because during drying the air content in Arabica coffee skin is ± 15%, drying of coffee fruit skin waste must reach a water content of ± 15% to prevent the growth of microorganisms. In line with research (Edowai & Tahoba, 2018)) on coffee beans, that the process of drying coffee beans is carried out until the water content reaches 10-13%. With the aim that the coffee beans stored before being roasted are not easily attacked by disease.

The first stage of coffee fruit skin processing in Kemantan Agung is the Sorting stage **.** Sorting stage namely the activity carried out to separate the remaining coffee beans or dirt from coffee fruit skin waste **,** the sorting carried out in Kemantan Agung village has used a sorting tool (dry coffee peeling machine) where this sorting is carried out with the aim of separating the coffee skin from the coffee beans that are still attached to the skin. In line with research (Ariyanto et al., 2022)that in the process of making coffee fruit skin tea (cascara) must go through procedures including cleaning the coffee fruit skin from dirt that may stick at harvest time.

The second stage of roasting, the skin of the Arabica coffee fruit obtained with an air content of ± 15% is then roasted manually using a cauldron (Roasting), where roasting is a cooking process without using oil and water with the aim of reducing the air content which was originally 15% to below 12% to be stored in tea bags for a period of 1 year with an air content below 12%, based on research (Garis et al., 2019)revealed that the standard air content contained in tea bags or dry tea in packaging set by SNI 01-3836-2000 is a maximum of 8.00%. Then with the roasting process it will provide a specific taste and aroma of coffee (Nofrian Utama putra, 2023)

The third stage of grinding, at the grinding stage carried out on coffee skin that has gone through the roasting stage aims to smooth it into powder. The purpose of grinding is so that cascara tea will be easier to pack in tea bags and easier to extract when brewed with hot water (Indrayani et al., 2022)in addition, the purpose of grinding is to activate the secondary metabolite content found in coffee fruit skin, research also shows that the smaller the particle size, the surface area of the substance will increase, so that the solubility of a substance. (Rondang Tambun et al., 2017)A reduction in the particle size of raw materials can affect the physical and chemical characteristics of the final product, such as texture, taste, and aroma. Thus, refining or making cascara tea into powder has a strong scientific basis in improving the quality of the resulting tea drink, both in terms of taste, aroma, and uniformity.

The fourth stage includes 2 packaging. The first packaging, tea powder into tea bags, then packaging tea into boxes. The ground tea powder is put into the tea bag filling and packaging machine, each package contains 2 grams of tea powder. At the packing stage, the coffee skin powder is separated into three flavor variants, namely original, cinnamon *(Cinnamomum burmanni)* , and red ginger (*Zingiber officinale)* . The addition of

flavor variants is adjusted to the cinnamon content, and red ginger with the coffee bean skin content. Cinnamon contains vitamin D in line with research by Wijayanti et al., (2021) Vitamin D plays a role in lowering blood glucose levels in people with Diabetes mellitus. so that it can control blood sugar levels so that diabetics are suitable for consuming cinnamon flavor variants, because the use of cinnamon skin powder can lower blood glucose levels in the elderly with diabetes mellitus (Kurniawati et al., 2022). This is suitable to be combined with the caffeine found in coffee bean skin so that it gives a different tea taste. In addition, the reason for combining cinnamon with cascara tea is because Kerinci is the largest cinnamon producer in Indonesia and cinnamon can provide a warm sensation to tea drinks, so it can add to the taste of the cascara tea produced, while the addition of red ginger (*Zingiber officinale*) to cascara tea is because the content of red ginger can be used as a traditional medicine. Red ginger has properties to cure asthma, coughs, and heart disease (Nur et al., 2020).

the fourth stage, the second packaging, namely the tea powder that has been put into the tea bag is then put back into a box-shaped packaging consisting of 15 tea bags, each consisting of 2 grams, so for one box of cascara tea weighing 30 grams and has received a halal certificate from the MUI. The function of Tea packaging in boxes can extend the shelf life or expiration of tea and help prevent or protect the product inside because there are several factors that affect product stability. One of the main factors is protection against external factors that can accelerate the degradation of active substances in tea, such as moisture, light, and air.

The fifth stage is serving tea, namely by inserting the tea bag into the cup, then pouring boiling water at 90^{o} C for $\pm$ 4 minutes, remove and dip several times to obtain the desired concentration, you can also add honey, milk, lemon or according to taste.

The results of the study show that in the process of processing coffee skin into cascara tea starting from sorting, roasting (drying), grinding, packaging to serving, there is a lot of knowledge owned by local communities *(indigenous knowledge*) that can be connected with scientific knowledge (*science*). This offers the potential to be used as a learning medium in the context of biology, especially in waste and pollution management materials. The process of reconstructing local community knowledge (*indigenous science*) into scientific knowledge (*science*) can enrich biology learning as seen in table 1.

Table 1. Stages of Reconstruction of Community Knowledge into Scientific Knowledge

Cascara processing stages	Community Knowledge	Scientific Knowledge
Sorting	The public understands that sorting is done to separate the remaining coffee beans or dirt that is still attached to the coffee skin. This activity aims to ensure the cleanliness of the raw materials before further processing.	In biology, sorting is part of a physical process summary aimed at improving the quality of raw materials (Edowai & Tahoba, 2018). Sorting is also important to reduce microorganism contamination that can affect the final product results. Sorting is redefined as a step to maintain the cleanliness and quality of raw materials according to food safety standards, making it relevant in a biological context through the study of microbiology and the quality of food materials.
to bake	The roasting process is carried out using manual tools such as a frying pan to reduce the air content and increase the distinctive aroma of the coffee skin.	Roasting is a thermal process that causes chemical changes in organic materials. Roasting aims to reduce air content to below 12%, prevent the growth of microorganisms, and improve the taste of the product (Sudantha et al., 2019). This stage is reconstructed into a biology learning involving concepts such as erosion, degradation of organic compounds, and aroma modification through Maillard reactions, which are relevant in the study of biochemistry and food technology.
Milling	The aim is to grind it into powder	Milling in science aims to reduce particle size to increase surface area, so that the extraction of active substances is more optimal. In this context, secondary metabolite compounds such as antioxidants are more easily extracted in hot water (Fibrianto & Ramanda, 2018). This stage is included in biology learning through simple experiments on the effect of particle size on extraction speed, connecting biology with physics (mechanics) and chemistry.
Packaging	Packaging is done using tea bags with various flavors such as original, cinnamon, and red ginger, then packaged in a box labeled halal.	In biology and food technology, packaging serves to extend the shelf life of products by protecting them from moisture, oxygen, and microorganism contamination. The addition of cinnamon and ginger also increases nutritional value and adds health benefits (Kurniawati et al., 2022). This stage can be reconstructed into biology learning materials about biotechnology and food preservation, with simple experiments on the effect of packaging types on product quality.
presentation	People serve cascara tea by pressing the tea in hot water, often adding honey or lemon for flavor.	The brewing process is related to the diffusion of active substances from the coffee skin into hot water. The addition of honey or lemon increases the vitamin content and health benefits (Wijayanti et al., 2021). This stage is incorporated into biology learning with experiments on the optimal temperature for the extraction of active substances, pH solutions, or the interaction of bioactive compounds with additional ingredients such as honey and lemon.

From the table above, there are various applied science activities such as sorting, roasting, grinding, packaging, and extraction of active substances from natural materials that can be integrated as Biology learning that is relevant to phases E and F in the independent curriculum.

Table 2. Learning Achievements

Aktivitas Sains	Capaian Pembelajaran	Konteks
Sorting of food ingredients	Biotechnology innovation, food microbiology	Simple biotechnology
Roasting	Biochemistry (Maillard reaction, metabolism)	Food chemistry and enzymes
Grinding	Interaction of biology, physics, chemistry	Diffusion and surface area experiments
Packaging	Biotechnology and food preservation	Product protection and nutrition
Presentation (extraction of active substances)	Biochemistry, environmental chemistry, nutrition	Extraction and interaction experiments of compounds

Conclusion

This study successfully reconstructed the indigenous knowledge of the Kerinci community in processing coffee skin waste into cascara tea and transformed it into scientific knowledge relevant to biological concepts. These findings contribute to the development of contextual learning resources based on local wisdom, especially in the topics of waste recycling and bioactive compounds. The results of this study can be applied in biology learning in schools to improve students' scientific literacy and encourage integration between culture, environment, and education. Further research is recommended to develop teaching tools based on these findings and test their effectiveness in the classroom.

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