

Designing the Tender Coconut Punching Tools

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Abstract: Coconuts play an imperative role in Indian culture, tradition and economy. Coconut water vending is one of common street vending business. Cutting a tender coconut is considered as messy, unsafe and has high risk of injuries. Therefore there is need for designing tender coconut punching tools. A market survey was conducted to explore the availability of different manually operated tender coconut punching tools available in local and online markets. By studying the available tools three tools for punching tender coconuts were designed. Among the three tools one tool was designed to operate by hand. This hand operated tool was named as “manual tender coco opener”. The other two tools were with same type of design one is battery operated and the other work on electrical power. The battery operated tool is named as “tender coco punching tool” and the electrical power operated tool is named as “tender coco drill machine”. The three tools along with the existing two mechanisms and conventional method were assessed by a local tender coconut vendor by means of RULA. The results showed that punching tender coconut by using tender coco punching tool was found comfortable.

Index Terms: Tender coconut opener, RULA, manual tender coco opener, tender coco punching tool, tender coco drill machine.

I. INTRODUCTION

Coconut is a symbol of righteousness, politeness, productiveness and lucky thing. It is a common practice to break open a coconut during religious procedures, and starting of new goings-on. Apart from this coconut plays a major role in the health of people. Tender coconut water is beneficial to human health, it is a thirst quenching liquid and also contains the minerals (Poduval et al., 1998). Tender coconut water is recommended to patients in many instances. Tender coconut water contains major electrolytes (Priya and Ramaswamy, 2014), glucose, vitamins, hormones and minerals (Yong et al., 2009). Coconut water has

anti carcinogenic properties (Sylanco et al., 1992) and helps in rise of human metabolism, boost human immune system, detoxification, controlling diabetes, flu, herpes and AIDS (Poduval et al., 1998). Tender coconut water could lower total cholesterol (TC), low-density lipoprotein (LDL) and triglycerides (TG) levels and decrease height-density lipoprotein (HDL) (Tkachenko and Kurhalyuk, 2011).

Tender coconut vending is one of the common street vending businesses. It is at its peak especially in summer season. The method of punching coconut is tough and strenuous. The common traditional tool used for making a hole for tender coconut is a hand sickle. This method is unsafe, messy and has high risk of injuries. This conventional method cannot be done by everyone as it requires special skill. The time required for cutting the top portion of the tender coconut demands use of force and more time. One should have expertise in cutting the coconut. Roshini et. al. (2009) stated that the major problem the tender coconut vendors faced in developing countries like India was punching and splitting of tender coconut. The vendor has to use high force which may affect the nerves, blood vessels or tissues inside the hands.

Anil et. al. (2016) opined that the traditional method of dealing out tender coconut is very tedious and chances of causing the accidents are more. Balachandar et. al. (2018) stated that the existing traditional tools used are unsafe, messy, need skill and training and the risk of injury is also too high. This method has high risk of injury. The traditional technique of cutting and punching tender coconut demands effort of 300 N and 150 N for cutting and punching respectively (Anil et al., 2016). The vendor has to use high force which may affect the nerves, blood vessels or tissues inside the hands. Injuries to the hand are a common cause of pain and other types of discomfort, particularly in people who regularly use heavy equipment.

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As on date there were no suitable manually operated tender coconut punching tool available in the market. This is one of the major reasons that the vendors still continue the strenuous operation. Tender coconut punching is a labour intensive work which involves a lot of repetition and force application.

Both conventional method and existing machines require a lot of force. Therefore there is need for careful study of the existing tools for designing a new coconut punching tool for wellbeing and to reduce effort in cutting a tender coconut that can also be utilized by common consumer and commercial vendor. Therefore, the study was undertaken with the following objectives:

1. To explore the various markets and identify the available tender coconut punching tools.
2. To propose design changes and redesign the tender coconut punching tool that is economical and efficient.
3. To conduct Rapid Upper Limb Assessment (RULA) for conventional method of tender coconut cutting, existing tools and designed tender coconut punching tools.

II. MATERIALS AND METHODS

Market survey is an investigation into the state of the market for a particular product or service (Oxford dictionary). A market survey was conducted to explore the availability of different manually operated tender coconut punching tools available in local and online markets. Hence, exploratory research method was selected for conducting the market survey. Guntur and Vijayawada cities were selected to conduct the market survey. Local markets dealing with agricultural inputs were visited. The online markets were explored through internet search.

By studying the mechanism of the existing tools new tender coconut punching tools are designed.


The designed tools along with existing tools and traditional method of tender coconut cutting are assessed by means of RULA by a local tender coconut vendor.








III. RESULTS AND DISCUSSION

A. Market survey

Market survey was done in local markets of Guntur and Vijayawada. The information obtained through market survey was tabulated and presented below.

Table 1. Available manually operated tender coconut tools in the online markets

S.No	Description	Picture
1	Name: Punch cum splitter Brand name: Eazyhom products Available website: Eazyhom Price: 7,000 Remarks: Available	

2	Name: Tender Coconut Cutting Machine Brand name: KCI Available website: Ali express Price: 8,500 Remarks: To be purchased in bulk.	
3	Name: Cocotap Brand name: Cocotap Available website: Cocotap Price: 2,500 Remarks: Foreign website takes time to procure	
4	Name: Green coconut opener Brand name: Zftopa Available website: Ali express Price: 4,200 Remarks: To be purchased in bulk.	
5	Name: Brazilian coconut opener Brand name: Kitchy Available website: Amazon Price: 870-1,300 Remarks: Foreign website takes time to purchase	
6	Name: Tender coconut opener Brand name: Easy homes Available website: Eazyhom Price: 310 Remarks: Not available at the time of enquiry	
7	Name: Household tender coconut opener Brand name: Eleenar Available website: Amazon Price: 200 Remarks: Available	
8	Name: Household tender coconut opener Brand name: Baskety, Cocodrill, Deziine. Available website: Price: Amazon, flipkart. Remarks: Not available at the time of enquiry	
9	Name: Tender coconut punch Brand name: ITMU of Central Plantation Crop Research Institute Available website: ITMU of CPCRI Price: 15,000 Remarks: Not responded	

In the local market no machine or tool was available at the time of market survey. When explored online market a total of nine tender coconut punching machines/tools were available for purchase through online marketing. Out of this nine, punch cum splitter machine, tender coconut cutting machine, green coconut opener and tender coconut punch machines were with same type of mechanism. These machines operate on the lever mechanism. The blades for punching and cutting were made with stainless steel. A plastic holder having adjustments for two different heights was provided below the punching tube to hold the coconut. Two rods in the shape of 'V' and two semi circular shaped rods were attached at the front and sides act as coconut holders while splitting.



Fig. 1(a)coconut punch and splitter, (b)tender coconut opener

The rest of the tools cocotap, Brazilian coconut opener, tender coconut opener with single handle, tender coconut opener with 'T' shaped handle and tender coconut opener with unequal 'T' shaped handles were with similar mechanism. These tools were meant for punching the coconut with bare hands. These tools consisted of a hollow tube with sharp edge at one side and a handle attached to it on other side. The handles were made up of plastic or stainless steel. Cylindrical hollow tubes were made up of stainless steel with pointed or highly sharp edges. The handles were mainly three different types: one was long cylindrical above the blade, other was a 'T' shaped handle with the blade attached at centre and other type of handle was a 'T' shaped but the blade was attached to one side of the handle.

Though there were nine machines/tools available online depending on the mechanism and availability for ready purchase, coconut punch and splitter and tender coconut opener tool were selected for the study.

B. Designing tender coconut punching tools

As a whole there are only two mechanisms for cutting tender coconut open one from each mechanism is selected. The tools selected for studying and redesigning were the coconut punch and splitter from the Eazyhom products and Elaneer household tender coconut opener with T- shaped handle.

The two tools were given to one of the local tender coconut vendor available and asked to work with it for at a minimum of 5 minutes and give his inputs. The vendor expressed that the conventional method of cutting the tender coconut cutting is better than the given coconut punch and splitter and tender coconut opener. As the selected tools require more force and strenuous shoulder and hand movements.

It was observed that though the coconut punch and splitter needed less force compared to the tender coconut opener and hand sickle it requires a lot of awkward postures, raising of shoulder due to the lever positioning and bending and twisting of trunk.

Tender coconut have simple mechanism and needed a lot of force in comparison with hand sickle and coconut punch and splitter. The operation is simple with top removed. Without layer. The mechanism is highly safe compared to other tools.

Though the traditional method scored superior to the tools used

in the study, the vendors expressed that skill is required to punch the tender coconut. The vendors also reported that the chances of cutting the fingers are very high in this method. According to the vendors that were one of the obstacles that keep away many people entering in to the business.

According to the vendors the tender coconut opener is safe in operation.

Therefore, it was thought that instead of hand operated tender coconut opener, battery or electrical operated tender coconut opener can satisfy the requirements of tender coconut vendors. This type of machine can be useful for consumers also.Hence the following machines were designed.

Three tools for punching tender coconuts were designed. Among the three tools one tool was designed to operate by hand. This hand operated tool was named as "manual tender coco opener". The design of the tool is based on gear mechanism.

The other two tools were with same type of design one is battery operated and the other work on electrical power. The battery operated tool is named as "tender coco punching tool" and the electrical power operated tool is named as "tender coco drill machine".

1) Manual tender coco opener

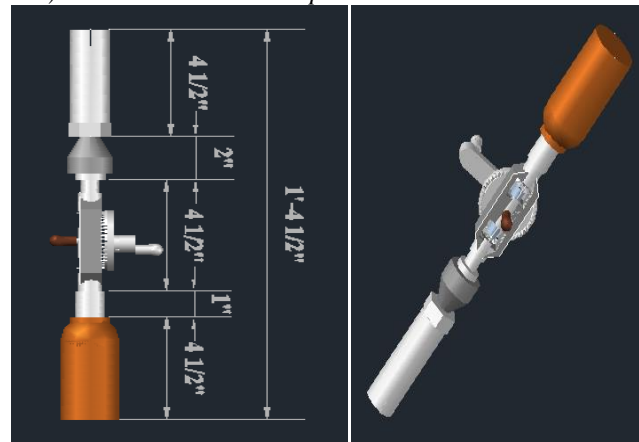


Fig. 2(a) Side view and (b) Perspective view of Manual tender coco opener AUTOCAD Drawing

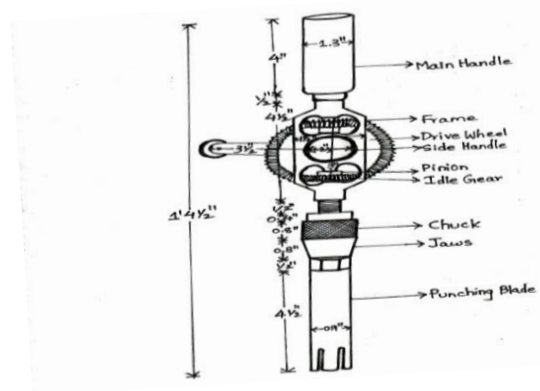


Fig. 3 Line diagram of designed Manual tender coco opener

The manual tender coco opener consisted of 1) main handle, 2) frame, 3) side handle, 4) pinion, 5) idle gear, 6) drive wheel 7)

The manual tender coco opener consisted of 1) main handle, 2) frame, 3) side handle, 4) pinion, 5) idle gear, 6) drive wheel 7) chuck with jaws and 8) punching blade. The length of the hollow cylindrical blade provided for punching was 4.5 inches with a width of 0.9 inches.

2) Tender coco punching tool

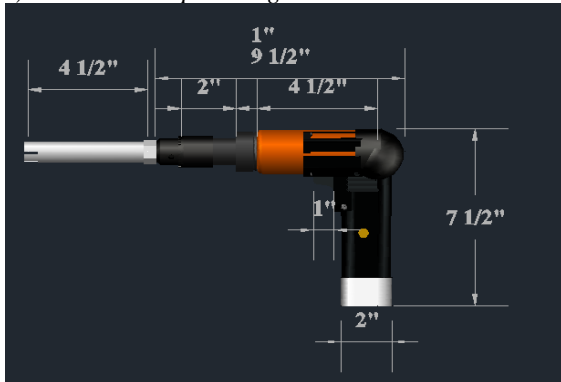


Fig. 4 Side view of Tender coco punching tool AUTOCAD Drawing

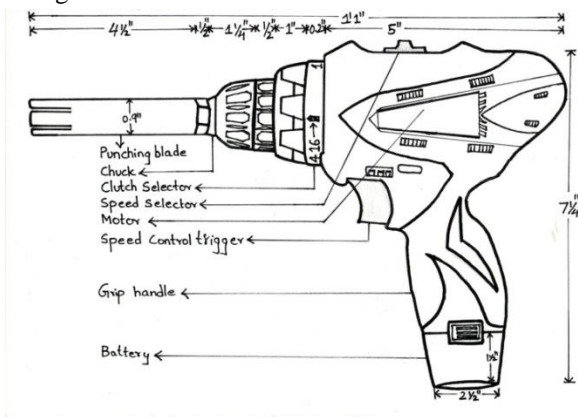


Fig. 5 Line diagram of designed Tender coco punching tool

The tender coco punching tool consisted of 1) battery, 2) grip handle, 3) motor, 4) speed selector, 5) clutch selector, 6) speed control trigger, 7) chuck and 8) punching blade. The hollow cylindrical blade provided for punching was 4.5 inches long with a diameter of 0.9 inch.

3) Tender coco drill machine

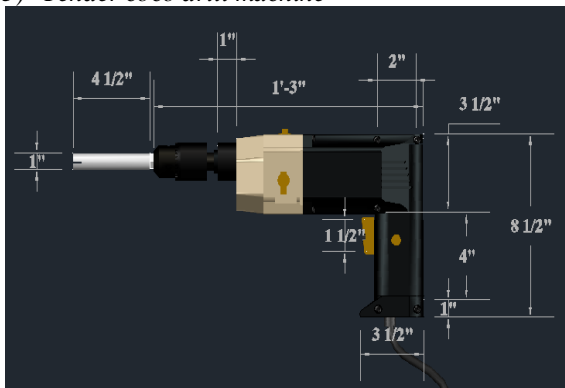


Fig. 6 Side view of Tender coco drill machine AUTOCAD

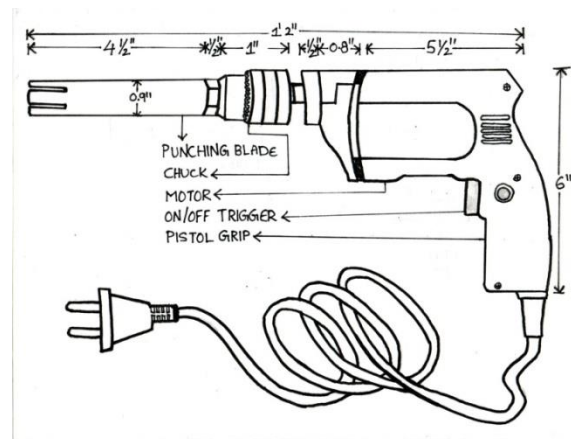


Fig. 7 Line diagram of designed Tender coco drill machine

Tender coco drill machine consisted of 1) pistol grip, 2) motor, 3) on/off trigger, 4) chuck and 5) punching blade. The punching blade is 4.5 inches long and has 0.9 inch diameter.

C. Rapid Upper Limb Assessment (RULA) for tender coconut punching tools.

The designed tools along with the hand sickle, coconut punch and splitter and tender coconut opener were assessed by means of RULA with a local tender coconut vendor.



Fig. 8 Tender coconut punching with (a) Conventional method and (b) Coconut punch cum splitter.



Fig. 9 Tender coconut punching with (a) Tender coconut opener and (b) Manual tender coco opener.



Fig. 10 Tender coconut punching with (a) Tender coco punching tool and (b) Tender coco drill machine.

The assessment showed that the tender coconut punching with hand sickle (conventional method), coconut punch cum splitter and tender coconut opener have overall score of 7, which indicate that the tools need to be investigated and change should be made immediately as the posture are highly risky.

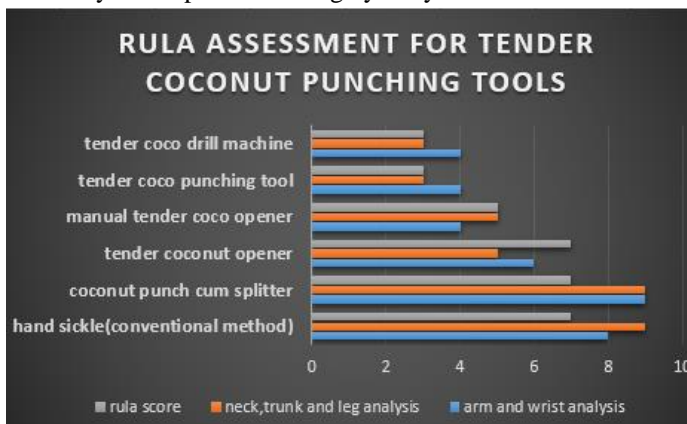


Fig. 11 RULA assessment for tender coconut punching tools.

In the figure 11. It was observed that all the designed tools in the study have less RULA score compared to the conventional method and existing tools. And tender cocodrill machine and tender coco punching too have a RULA score of 3 indicating that they have better posture and have less risk prone compared to other coconut punching tools

CONCLUSION

The study shows that though there are few tender coconut punching tools available in the market they are not utilized by the vendors as they are also need a lot of force and extreme moments, awkward postures and repetition. The designed tools have better usability and are less prone to occupational risks. Especially the vendor expressed satisfaction with tender coco punching tool.

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