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DEVELOPMENT & EVALUATION OF JACK OPERATED HERBAL JUICE/OIL EXTRACTOR FOR AYURVEDIC MEDICINE PREPARATION

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ABSTRACT: Sri Lanka has a rich indigenous system of traditional medicine known as Ayurveda, which combines Sinhala traditional medicine, Indian Ayurveda and Siddha systems, Greek Unani medicine through Arab influence, and the unique Desheeya Chikitsa. The objectives of this research were to identify the essential practices for equipment development in the Ayurvedic sector, to examine the scientific principles underlying traditional practices, and to design Ayurvedic machinery. To achieve these goals, a needs identification survey was conducted involving over 10 institutes in Sri Lanka and more than 300 indigenous doctors across the country. Data were collected from 120 of these doctors to ascertain the specific requirements of the sector. In Ayurvedic preparations, herbal juice extraction is done manually, and 'Pehe' is used to extract oil from hard materials like "mee" and to extract the remaining oil from Kalka, making the process time-consuming and labour-intensive. To address this challenge, a hydraulically operated juice/oil extractor was designed to fulfil one of their requirements. This machine operates at low temperatures, which helps to preserve the nutrients and flavour of the juice/oil. It is operated using 4-ton hydraulic jack. Extracted juice percentages (wet basis) were 65% and 60% for Gotukola and Neeramulliya leaves respectively. Extracted oil/juice % (wet basis) were 36%, 48.89%, 19.8%, 20.4%, 68.52% and 52% for Mee (without steaming), Mee (steamed), Sesame (black), Sesame (normal), Nelli (without seeds) and Nelli (with seeds) respectively. Results revealed that using this method juice/oil can be extracted efficiently using this extractor than traditional methods. An extractor is a portable device which can be operated by a single person. Since the raw material contaminating machine components of the extractor are made of food-grade stainless steel, the hygienic extraction process is secured. The extractor has a capacity of approximately 3 kg of crushed leaves or 1 kg of crushed seeds per batch. Over 100 machines have been distributed to small and medium-scale Ayurvedic practitioners involved in medicine preparation.

Keywords: Gotukola, hydraulic jack operated, juice/oil extractor, Mee, traditional medicine

1. INTRODUCTION

The history of indigenous medicine in Sri Lanka is deeply intertwined with the origins of the Sinhalese nation. This medical practice, rooted in traditional knowledge, has been influenced by Ayurveda from Northern India, Siddha from Southern India, and Unani from the Arabic region (Weragoda, 1980; Perera PK, 2012). During the Colonial era, indigenous medical practices faced significant suppression, while Western medicine gained prominence as the dominant national health system throughout the island (Perera PK, 2012).

Currently, over twenty thousand traditional Ayurvedic doctors are practicing in Sri Lanka. These practitioners face numerous challenges in preparing specialized Ayurvedic medicines, primarily due to a lack of suitable small-scale equipment (Perera PK, 2012). Consequently, the development of appropriate equipment and processes is crucial for efficiently producing medicines needed by both Ayurveda and traditional Ayurvedic practitioners (Hapugahakotuwa, 2024).

To address this issue, a needs identification survey was conducted to ascertain the specific requirements of the Ayurvedic sector. Various methods were employed to gather information from different stakeholders.

2. METHODOLOGY

For the needs analysis, we visited several key institutes, including the Ayurveda Research Institute in Navinna, Ayurveda Hospital in Borella, Sri Lanka Ayurvedic Drug Corporation, Gampaha Wickramarachchi Institute, Gampaha Wickramarachchi Ayurveda Hospital, and the Department of Indigenous Medicine at Colombo Municipal Council (Dematagoda). Further, we collected

information from participants at two workshops organized by the Ministry of Indigenous Medicine and the NERD Centre. Based on the preferences of participants and other relevant stakeholders, the following requirements were identified:

1. Development of machinery for the Ayurvedic sector, including small-scale machinery for the preparation of 'Guli'; Equipment for producing uniform fine powder; Methods for minimizing powder wastage during preparation; A cutter for processing hard medicinal woods; An oil expeller for extracting juice/oil from leaves and seeds.
2. Investigation of the temperature profile of traditional Puta furnaces used in the preparation of Ayurvedic metallic ash (Bhasma).

Among these, we selected the development of a juice/oil extractor, which was named the Jack Operated Juice/Oil Extractor. Initially, we explored indigenous methods, including the scientific principles behind the 'Pehe' and 'Sekkuwa' techniques. Based on these principles, the design and fabrication processes were initiated. In addition, the need of a crusher machine for crushing hard seeds and dried herbs into powder and fresh herbs into smaller size prior to extracting squeezing process of juice/oil.

Having understood the significance of these two major requirements, two essential machines were successfully designed and developed: a crusher for seeds, dried herbs, and fresh herbal leaves, along with a hydraulic jack-operated herbal juice/oil extractor for simultaneous juice and oil extraction. These two machines were designed as simple devices with reliable and durable machine elements considering the operational feasibility in the aspect of ergonomics.

At first, herbal leaves were crushed into smaller size using the crusher before feeding into the hydraulic jack operated juice/oil extractor for extracting juice. Likewise, the seeds to be tested are also got crushed using the same crusher before feeding into the same juice/oil extractor for extracting oil for verity of seeds. Results of juice and oil extraction processes carried out for two verities of herbal leaves and four verities of seeds at different test conditions are listed in the Table 1 and Table 2.

3. RESULTS AND DISCUSSION

Fig. 1 and Fig. 2 illustrate the main components of the two fabricated machines, while Table 1 and Table 2 present the results of the field trials. During the trials, wastage was minimised (5g<) and considered negligible. All trials were conducted in collaboration with respective Ayurvedic doctors. This method is simple and requires less human effort compared to traditional methods, making it easy and efficient for a single operator to manage.

Specifications of the Crusher Used for Herbal Leaves & Seeds

Power Requirement - 1.5 hp, Single Phase
Capacity - 15-20 kg of leaves/hr (approximately) or 35-40kg of seeds/hr (approximately)
Dimensions - 760x620x920mm (LxWxH)
Total weight - 54 kg

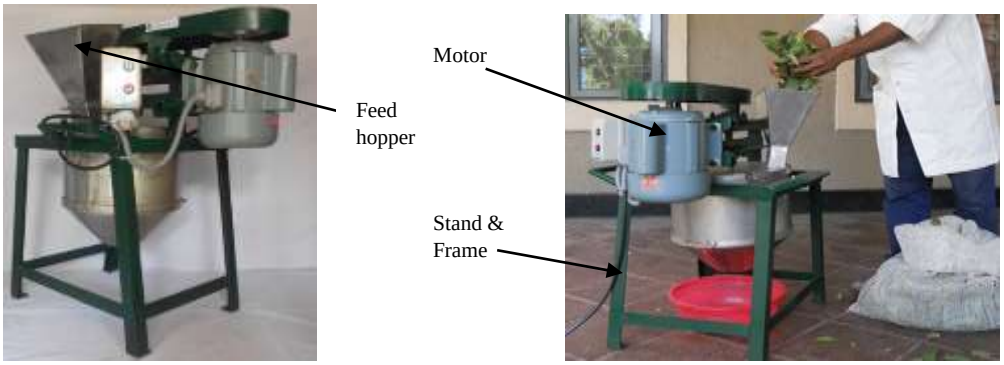

Fig. 1. Crusher for herbal leaves & seeds

Specifications of the Hydraulic Jack Operated Juice/Oil Extractor

Operated using 4-ton hydraulic jack
Capacity - approximately 3 kg of crushed leaves or 1 kg of crushed seed per batch
Dimensions - 370x280x1360mm (LxWxH)
Total weight - 52 kg

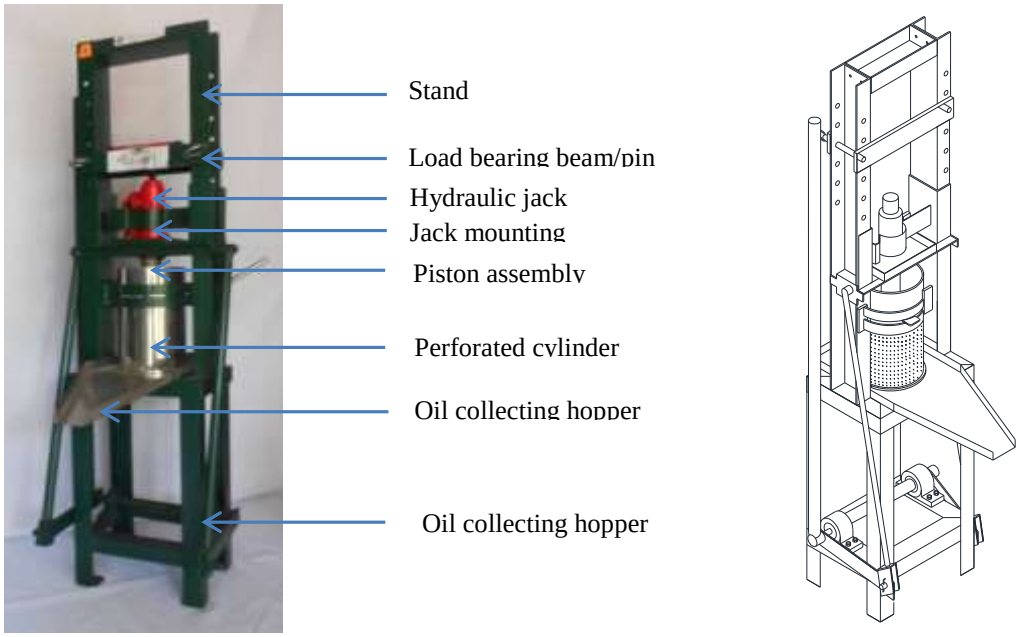

Fig. 2. Main components of the Hydraulic Jack Operated Juice/Oil Extractor

Table 1. Field trial results of crushed leaves

Material	Crushed leave quantity (kg)	Extracted juice quantity (kg)	Remaining pressed cake quantity (kg)	Extracted juice % (wet basis)	Average Extracted Juice % (wet basis)
Gotukola – Trial 1	9.00	5.80	3.20	64.44	
Gotukola – Trial 2	8.00	5.19	2.81	64.88	64.88
Gotukola – Trial 3	6.00	3.95	2.05	65.83	
Neeramulliya - Trial 1	13.00	7.60	5.40	58.46	
Neeramulliya - Trial 2	10.00	5.99	4.01	59.90	59.9
Neeramulliya - Trial 3	7.00	4.30	2.70	61.43	

Table 2. Field trial results of crushed seeds

Material	Crushed seed quantity (g)	Extracted oil/juice quantity (g)	Remaining pressed cake quantity (g)	Extracted oil/juice % (wet basis)
Mee (without steaming)	375	140	235	36.00
Mee (steamed)	450	220	230	48.89
Sesame (black)	1000	198	802	19.80
Sesame (normal)	1500	306	1194	20.40
Nelli (without seeds)	1620	1110	510	68.52
Nelli (with seeds)	3000	1560	1440	52.00

The trials revealed a significant increase in the yield of *Mee* oil when extracted from steamed *Mee* seeds compared to extraction without steaming. As per the views of the Ayurvedic doctors involved in the field trials, it was revealed that, there was a significant juice/oil increase, and a remarkable time decrease in using Hydraulic Jack Operated Herbal Juice/Oil Extractor for the extraction process compared to the traditional extraction method. With the success of the project, the Ministry of Indigenous Medicine requested the fabrication of more than 100 jack-operated juice/oil extractors (under project numbers A&PHT/COM/03/79/2014 and A&PHT/COM/03/141/2014) for distribution among Ayurvedic Sanrakshana Sabhas island-wide, as these machines are essential for improving the quality and efficiency of Ayurvedic drug preparation.

4. CONCLUSION

In response to the needs of the Ayurvedic sector, a jack-operated juice/oil extractor was developed. The extractor has a capacity of approximately 3 kg of crushed leaves per batch or 1 kg of crushed seeds per batch. These machines are primarily used by Ayurvedic doctors involved in small to medium-scale medicine preparation. The machine offers significant advantages in handling materials under hot conditions during the extraction process, designed to increase yield while eliminating practical challenges. Ultimately, over 100 jack-operated juice/oil extractors were fabricated and distributed island-wide. Feedback indicates that these machines are functioning well across all locations.

5. REFERENCES

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