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RESEARCH ARTICLE

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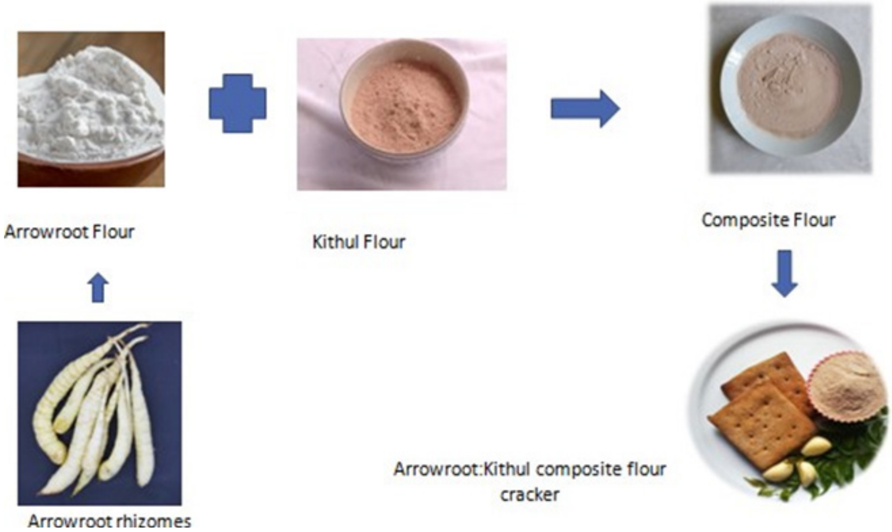

Highlights

- Arrowroot (*Maranta arundinacea*) and *Kithul* (*Caryota urens*) are underutilized flour sources in Sri Lanka.
- Arrowroot and *Kithul* incorporated composite flours possess good gel formation properties.
- Cracker development is feasible with Arrowroot and *Kithul* composite flour to replace 70 % wheat flour.
- 25 % *Kithul* flour + 75 % Arrowroot flour composite flour cracker was the most consumer-preferred combination.
- Composite flour cracker is rich in crude fiber than wheat flour cracker.

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Characterization of Composite Flours from Arrowroot (*Maranta arundinacea*) and *Kithul* (*Caryota urens*) for Cracker Development

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Abstract: Both Arrowroot and *Kithul* are underutilized sources of flour in Sri Lanka. This study aimed to develop composite flours from Arrowroot and *Kithul* to evaluate their nutritional and physicochemical properties, and to determine their potential in cracker production. Three different composite flour ratios were made using Arrowroot (ARF) and *Kithul* (KF) *viz.,* 25 % ARF + 75 % KF, 50 % ARF+ 50 % KF and 75 % ARF + 25 % KF. Proximate parameters and physicochemical properties were determined. The developed composite flour blends resulted in lower crude protein and fat contents with high crude fiber contents in comparison to wheat flour. Composite flour blends had high viscosities, swelling power, and solubility indices which are beneficial in gel formation property. Composite flours were able to replace wheat flour up to 70 % in cracker development and 25 % KF + 75 % ARF cracker was the most consumer-preferred blend. Due to the low gluten content, composite flour-based cracker had low dimensions but it had a higher fiber content than the wheat flour cracker. Utilization of Arrowroot and *Kithul* in developing composite flours and crackers is feasible, thus increasing the potential of utilizing both Arrowroot and *Kithul* flours in food industry.

Keywords: Arrowroot; *Caryota urens*; Composite flour; Cracker; Proximate analysis

INTRODUCTION

Wheat flour-based products are consumed widely around the globe and it is the biggest agricultural import over time in Sri Lanka (Jayasinghe, 2018; Dissanayake & Thibbotuwana, 2021). Wheat is a staple food of a large percentage of the world population and it is a common ingredient of most bakery products due to its gluten proteins. Developing countries have been focused on substituting wheat flour with locally available flour. Promoting composite flour in baked products has become a novel trend in the food industry to replace wheat flour by decreasing wheat flour importation. Cultivation of wheat is difficult in tropical countries like Sri Lanka (Olaoye et al., 2006).

Composite flour technology refers to combining various flours from tubers with cereals or legumes in proper proportions, with or without the addition of wheat flour, for economic use of locally cultivated crops producing high-quality food products (Tharise et al., 2014). The market for composite flour is rising nowadays, because of the high consumer preference for healthy foods. It is a novel approach to exploit uncommon resources for food products with various quality characteristics.

Arrowroot (*Maranta arundinacea* L.) is a perennial underutilized crop in Sri Lanka that belongs to the family Marantaceae and is locally known as "Hulankeeriya" or "Aerukka". Arrowroot produces gluten-free flour that can be used to substitute wheat flour (Malki et al., 2022). A study has been carried out by incorporating Arrowroot flour with cassava and potato as composite flour (Damak et al., 2022). It has been found that the development of composite flours from Arrowroot and wheat flour would increase the functional properties of the flour. The health benefits of Arrowroot flour are multiple but the best known are those related to the digestive system, being frequently used to treat diarrhea and relieve stomach pain. Arrowroot flour is a good source of potassium, iron, magnesium, zinc, phosphorus and has a low-calorie intake (Martinescu et al., 2020). *Kithul* (*Caryota urens* L.) is also an underutilized palm in Sri Lanka which belongs to the family Arecacea. It has been identified as a gluten-free potential flour source for the food industry with good functional properties (Wijesinghe, 2015).

Since both Arrowroot and *Kithul* are underutilized sources of flour with good functional properties it would be a potential alternative for wheat flour as a composite flour. Cracker is one of the most popular snacks around the globe which is most commonly prepared from wheat flour. A cracker is a flat, dry-baked food typically made with flour and is a popular food product around the world. Crackers are manufactured mainly from wheat flour. The present study aimed at the characterization of composite flours from Arrowroot and *Kithul* as a substitute for wheat flour

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for the development of crackers to enhance the utilization of Arrowroot and *Kithul*.

MATERIALS AND METHODS

Materials

Arrowroot rhizomes were collected from home gardens and small commercial cultivations and *Kithul* flour, salt, baking soda (INS 500), baking powder (INS 500), coconut oil, cumin seeds, curry leaves, garlic powder, and dry yeast (*Saccharomyces cerevisiae*) (Mauri Dry Yeast, AB Mauri Lanka) were purchased from local markets in Sri Lanka.

Development of Composite Flours

Arrowroot flour extraction was carried out using the method described by Nogueira et al. (2018) with a few minor adjustments. The Arrowroot rhizomes were washed, peeled, and cut. The slices were blended into a homogeneous mass for five minutes in a high-speed stainless steel blender (Preethi MG-172 E, Preethi Electrical Appliances, India) adding tap water into arrowroot in a 1: 2 (w/v) ratio. Double cotton cloth was used to filter the resultant sludge. After overnight sedimentation, water was manually decanted. The sediment was oven dried or 8 hours at 60 °C with air circulation in a dry oven (Memmert UN 160, Germany), and the resulting pellets were ground. The extracted Arrowroot flour and *Kithul* flour were sieved (425 µm) and kept at - 18 °C. Arrowroot (ARF) and *Kithul* (KF) flours were combined in three different ratios (25:75, 50:50, and 75:25) to create composite flours.

Determination of Proximate Composition

Using an infrared moisture analyzer, the moisture content (%) of Arrowroot flour samples was assessed (Kett FD-660, Kett, Japan) (AOAC, 2010). After drying for three hours at 105°C in the oven, the total solid content was calculated (AOAC, 2010). The crude protein was measured using the Kjeldahl digestion/distillation method (AOAC, 2010), and the ash content was estimated using the muffle incineration method (at 540 °C) for 4 hours (AOAC, 2010). The crude fiber was measured using a fiber analyzer (Fiber Extraction System F-6P, Spain) (AOAC, 2010). The solvent extraction method was used to measure the crude fat content (Fat Extraction System SX-6 MP, Spain) (AOAC, 2010). Following Diddana et al. (2021), the total gross energy and total carbohydrate content were calculated.

Determination of Physico-chemical Properties

Flour Densities

Flour densities were measured by dividing a known amount of flour by its occupied volume.

Bulk Density: The flour (20 g) sample was weighed and added to a 100 ml glass graduated cylinder, and its occupied volume was measured. The flour's weight was then divided by the occupied volume to determine the sample's bulk density (Musa et al., 2011).

Tapped Density: A graduated cylinder containing 20 g of flour was dropped 50 times from a height of 20 mm onto a bench to measure the volume of each drop (Musa et al., 2011)

Carr's Index: To calculate the ratio and subsequently represent it as a percentage, the difference between the tapped density and the bulk density was divided by the tapped density (Musa et al., 2011).

Hausner Ratio – Calculated by dividing the tapped density by the bulk density (Musa et al., 2011).

Flour Colour

To evaluate the colour of composite flours, a colourimeter (PCE-CSM 2, PCE Instruments, United States) was used. Using the included calibration disc, the colorimeter was calibrated. Using the L*a*b* values as colour coordinates were determined. L* (L* = 0 for black and L* = 100 for white), a* (-a for greenness and +a for redness), and b* (-b for blueness and +b for yellowness) were the three different colour measuring parameters (Malki et al., 2022).

Amylose Content

Composite flour (1 g) was combined with 9 ml of 1 N NaOH and 1 ml of 95 % (v/v) ethanol. The mixture was heated for 10 min before being diluted to 100 ml. The sample suspension was mixed with 50 ml of distilled water, 1.5 ml of iodine solution, and 1 ml of 1 N acetic acid. The suspension was kept for 20 min. The volume was made up to 100 ml in a volumetric flask. A UV-visible spectrophotometer (JENWAY 6305, Cole-Parmer Ltd, United Kingdom) was used to detect the absorbance at 620 nm. Pure potato amylose was used to generate the standard curve (Juliano, 1971).

Flour Viscosity

Using a digital viscometer (VISCOTM-6800, ATAGO, Japan), composite flour samples were assessed for viscosity. Flour was mixed with distilled water and heated at 78 °C to form a 10

% starch suspension. At 20 rpm, the viscosity of flour suspensions was tested every three minutes (Sopade & Kassam, 1992).

Swelling Power and Solubility

The procedure described by Leach et al. (1959) was used to test the swelling power and solubility of composite flour samples with slight modifications as described by Wijesinghe et al., 2015. After heating for 30 min at 78 °C with continual stirring using 0.25 g of flour and 10 ml of distilled water, the mixture was centrifuged (FLC-04S, Huangama Faithful Instrument, China) for 15 min at 3000 rpm. It was then cooled to room temperature. The starch sediment was measured after the supernatant was carefully removed. The supernatant was transferred to a pre-weighed petri dish, evaporated for two hours at 130 °C, and then weighed. The amount of starch dissolved in water that was left after drying the supernatant was used to determine the residual. Equations (1) and (2) were for calculations.

$$\text{Solubility } \% = \frac{\text{Wss} \times 100}{\text{Ws}} \quad (1)$$

$$\text{Swelling power (g/g)} = \frac{\text{Wsp} \times 100}{\text{Ws} \times (100 - \text{Solubility\%})} \quad (2)$$

Where, Wss – *weight of the soluble starch*, Ws – *weight of the sample*, Wsp – *weight of the sediment paste*

Moisture Sorption Capacity

The moisture sorption capacity was determined using the technique described by Shiihii et al. (2011). Each sample of dry flour was evenly spread on Petri plates, placed in a desiccator with a relative humidity of 98 % at room temperature achieved by filling the desiccator with distilled water, and occasionally weighed until a constant weight was obtained. The percentage of increased weight was used to measure the moisture sorption capacity.

Development of Cracker

The crackers were prepared using the process described by Martin-Diana et al. (2015) but slight changes were done in baking time. To develop the recipe, preliminary tests were conducted to determine the ideal composite flour: wheat flour ratio. Composite flour was able to substitute wheat flour by up to 70 % in cracker development. By varying the flour ratio, six distinct types of crackers were prepared (Table 1). Slightly warm water at 60 °C was combined with one gram of yeast. The mixture was allowed to ferment for 5 minutes. The ingredients and flours were carefully mixed. The flour mixture was progressively infused with dried and powdered cumin seeds, curry powder, curry leaf powder, and garlic powder. Coconut oil, salt, sugar, baking soda, baking powder, and were all added to the batter and thoroughly combined. The dough was kept at room temperature for two hours under a wet cloth (34 °C). The dough was flattened with a rolling pin. on a table with a smooth surface that had been lightly dusted with flour, Square crackers were cut into 7.5 × 7.5 cm pieces with a 2 mm of thickness, placed on greased baking sheets, and baked for 25 min at 170 °C.

Sensory Evaluation of Crackers

Using a 5-point hedonic scale, a group of 30 semi-trained tasters (representing both males and females who are aged between 24 – 45) assessed the sensory qualities of crackers (5 being "like extremely" to 1 being "dislike extremely"). The following factors were evaluated: appearance, color, aroma, texture, mouth feel, and overall acceptability. The best flour combination was chosen for additional analysis based on the sensory assessment.

Determination of Physico-chemical Properties of Crackers

Using an electronic balance, the weight of crackers (g) was determined (Usman et al., 2007). Crackers were measured in centimeters using a vernier caliper for length, width, and thickness (height). As diameter (mm)/height (mm), the spread ratio was determined. Using the seed displacement method, the volume of crackers was calculated (Akubor & Ishiwu, 2013). By dividing weight (g) by volume(ml), density was determined.

Experimental Design and Statistical Analysis

A completely randomized design was used. The results of the sensory evaluation were analyzed using the Friedman test. Analysis of Variance (ANOVA) was used to analyze the parametric data. The analysis was conducted using SAS 9.2 and Minitab (version 19) software.

RESULTS AND DISCUSSION

Proximate Composition and Physico-chemical Properties of Composite Flours

Results of the proximate composition and physicochemical properties of three different composite flours made with Arrowroot and *Kithul* are presented in Table 2.

The moisture content of the three different Arrowroot: *Kithul* composite flours was under an acceptable level for consumption (<15 %) (Reddy et al., 2017). Flours with high moisture content tend to spoil easily due to mold growth. The moisture content of the three flour blends ranged between 9.5±0.53 - 10.66±0.12. The total solid content, ash content, crude protein, and crude fat contents were not significantly different among the three different composite flour treatments. The ash content of starches represents the available mineral compounds such as sodium, potassium, calcium, and, magnesium (Azima et al., 2020). Low amounts of crude protein and crude fat contents have been

Table 1: Cracker formulations with different proportions of Arrowroot flour and Kithul flour.

Ingredients	***(Formulation) Treatments***					
	T1	***T2***	***T3***	***T4***	***T5***	***T6***
Arrowroot flour (g)	-	-	100.00	52.50	35.00	17.50
Kithul flour (g)	-	100.00	-	17.50	35.00	52.50
Wheat flour (g)	100.00	-	-	30.00	30.00	30.00
Yeast (g)	1.00	1.00	1.00	1.00	1.00	1.00
Salt (g)	1.00	1.00	1.00	1.00	1.00	1.00
Baking soda (g)	1.00	1.00	1.00	1.00	1.00	1.00
Baking powder (g)	0.75	0.75	0.75	0.75	0.75	0.75
Cumin seed (g)	1.00	1.00	1.00	1.00	1.00	1.00
Curry leaves (g)	1.00	1.00	1.00	1.00	1.00	1.00
Garlic powder (g)	3.00	3.00	3.00	3.00	3.00	3.00
Coconut oil (ml)	25	25	25	25	25	25
Water (ml)	37	37	37	37	37	37

Table 2: Proximate composition and physicochemical properties of three different Arrowroot: *Kithul* composite flours.

Parameter	25 %KF+75 % ARF	50 %KF+50 % ARF	75 %KF+25 % ARF
Proximate components			
Moisture (%)	9.5±0.53^{b}	10.17±0.21^{ab}	10.66±0.12^{a}
Total solid (%)	91.32±2.89^{a}	91.25±0.87^{a}	91.76±0.68^{a}
Ash (%)	1.22±0.21^{a}	1.23±0.48^{a}	2.44±1.33^{a}
Crude fat (%)	0.12±0.12^{a}	0.02±0.03^{a}	0.04±0.01^{a}
Crude protein (%)	1.09±0.16^{a}	1.21±0.01^{a}	1.26±0.09^{a}
Crude fiber (%)	1.06±0.08^{b}	1.20±0.24^{b}	1.79±0.05^{a}
Carbohydrate (%)	89.29	88.6	88.04
Energy (kcal/100 g)	362.6	359.42	357.56
Physico-chemical properties			
L*	82.36±1.49^{a}	78.66±0.40^{b}	73.07±0.57^{c}
a*	5.56±0.06^{c}	7.46±0.07^{b}	8.93±0.21^{c}
b*	13.79±0.39^{c}	16.83±0.13^{b}	19.52±0.55^{c}
Bulk Density (g/ml)	0.67±0.00^{a}	0.67±0.00^{a}	0.67±0.00^{a}
Tapped Density (g/ml)	0.80±0.00^{c}	0.86±0.00^{b}	0.86±0.00^{a}
Carr's Index (%)	16.67±0.00^{c}	23.33±0.00^{b}	23.33±0.00^{a}
Hausner Ratio	1.20±0.00^{c}	1.30±0.00^{b}	1.30±0.00^{a}
Swelling Power (g/g)	11.34±0.08^{b}	14.06±0.91^{a}	13.55±0.89^{a}
Solubility (%)	13.74±0.08^{b}	16.68±4.52^{a}	16.34±3.76^{a}
Amylose content (%)	22.24±0.37^{a}	15.52±0.25^{c}	19.18±1.96^{b}
Viscosity (cP)	6788±30.2^{b}	5075±15.72^{c}	7611±291^{a}

Mean±SD; *n* = 3
Between columns, mean values followed by different superscript letters are significantly different at p = 0.05

recorded for all the composite flour blends comparatively to Arrowroot flour. Past studies revealed that the crude protein content of Arrowroot ranged between 0.4 – 0.8 % and crude fat content ranged between 0.12 – 1.0 % (Erdman, 1986; Perez & Lares, 2005; Madineni et al., 2012; Gordillo et al., 2014; Capina & Capina, 2017; Nougueira et al., 2018). Root and tuber starches have low-fat and protein content (<1.0 %) (Moorthy, 2002). Wijesinghe et al., (2015) reported crude protein content as 1.00±0.20 % and crude fat content as 0.33±0.08 % for *Kittul* flour in Sri Lanka. Since both flour types were having low crude fat and protein contents, composite flours also had low fat and protein contents. Lower crude fat and protein levels indicate the purity and quality of the flour (Nougueira et al., 2018; Azima et al., 2020). Crude fiber content was significantly different in three different composite flour treatments. *Kithul* flour is having 1.00±0.50 % of crude fiber content in Sri Lanka (Wijesinghe et al., 2015). Arrowroot flour is having 0.03 – 1.50 % of crude fiber contents from Philipines, Brazil, India, and Venezuela (Perez & Lares, 2005; Peroni et al., 2006; Madineni et al., 2012; Capina & Capina, 2017). According to the results, 25 % ARF+75 % KF treatment was having the highest crude fiber content while 50 % ARF+ 50 % KF treatment was the second highest. However, high crude fiber content is beneficial since it enhances the nutritional profile of the composite flours.

The colour of the three different composite flours has been described by L*a*b* values. Flour colour is important when used as a raw material for food preparations. Arrowroot flour is white in colour. It is similar to the colour of wheat flour (Malki et al., 2022).

Bulk density and tapped density are not significantly different among the three different composite flours. When the Carrs index exceeds 23 % and the Hausner ratio exceeds 1.2, that flour does not have a good flow or compressibility. Of the three compositions tested, the composite flour 75 % ARF+25 %KF possesses a high potential for use in the pharmaceutical industry due to beneficial flowability and compressibility abilities.

Swelling power and solubility indices were significantly higher in 25 % ARF+75 % KF composite flour than in 75 % ARF+ 25 % KF composite flour. When the temperature increases, the swelling of starch granules increases and it indicates the strength of the internal forces of starch granules which maintains the granule structure (Hoover et al., 2010). When the temperature of the water is gradually increased, the molecules in starch granules vibrate vigorously, breaking the intermolecular hydrogen bonds in amorphous regions. Water molecules hydrogen bond to exposed hydroxyl groups of amylose and amylopectin as a result of swelling and partial solubilization of polymers, particularly amylose, increasing granule size (Hoover, 2001). According to Madineni et al. (2012), the high swelling power and solubility of Arrowroot flour are caused by the loose structure and low molecular weight of amylose, which leaches out of the amorphous region of starch granules. Because Arrowroot and *Kithul* flour both have good swelling and solubility properties, the developed composite flours do as well. So, they are beneficial in using food development because swelling and solubility are important in gelatinization.

The amylose content of the three different composite flour treatments is significantly different from each other. Moorthy (2002) reported a range of 16 – 27% for the total amylose content of Arrowroot starch and it was compatible with several previous studies (Tharanathan, 2003; Li et al., 2011; Fakhoury et al., 2012; Romero-Bastida et al., 2015). Wijesinghe et al., 2015 recorded the amylose content of *Kithul* flour from Sri Lanka as 28.42±0.04 %. Flours are classified as low amylose (12-20%), intermediate amylose (20-24%), or high amylose (>24%) based on their amylose content. Food products made with Arrowroot flour may have slightly higher stickiness and hardness due to the high amylose content, but this can be reduced by creating composite flours by combining them with *Kithul* flour (Thumrongchote et al., 2012).

The viscosity of composite flour with a high proportion of *Kithul* flour has the highest viscosity and indicates the better gel-forming ability of the flour. The viscosity of the products has a significant impact on their texture and integrity. The viscosity is determined by the flour processing method and the interactions of starch with hydrocolloids. Higher viscosity flours are appropriate as thickeners or stabilizers.

Starches with a high moisture sorption capacity are easy to soften and digest, but they spoil faster (Aidoo et al., 2022). The composite flour which is having a high *Kithul* flour proportion shows high moisture absorbance (Figure 1).

Sensory evaluation, proximate composition, and physico-chemical properties of developed crackers

Sensory evaluation indicated treatment 4 (75% ARF + 25% KF) as the formulation having the highest consumer-preference. There were significant differences among the six different treatments for sensory attributes of appearance, colour, flavour, texture, aroma, mouth feel, and overall acceptability (P<0.05; Figure 2). Treatment 4 was selected for further analysis.

The contents of moisture, crude fat, crude protein, crude fiber, carbohydrate, and total solid were significantly different (P<0.05) between the control (100 % wheat flour) and the selected composite flour cracker from the sensory evaluation (Table 3). The developed composite flour-based cracker had a significantly higher crude fiber content (0.86%) and total solid contents (97.76%) when compared to the control (0.73% and 95.76%, respectively). Composite flour-incorporated crackers had a lower crude protein content (5.45%) than the control (13.55%). The protein content of Arrowroot starch has been reported to be low (0.24%; Faridah et al., 2014) and this can cause the low protein content of developed crackers. A cracker from Arrowroot: *Kithul* composite flour has a significantly higher crude fiber content than the 100 % wheat flour cracker due to the higher fiber content in Arrowroot and *Kithul* flours.

The length (cm) of the composite flour cracker (6.97) was significantly lower than 100 % wheat flour cracker (7.47). The width of the 25%KF + 75 % ARF cracker was significantly lower than the 100 % wheat flour cracker.

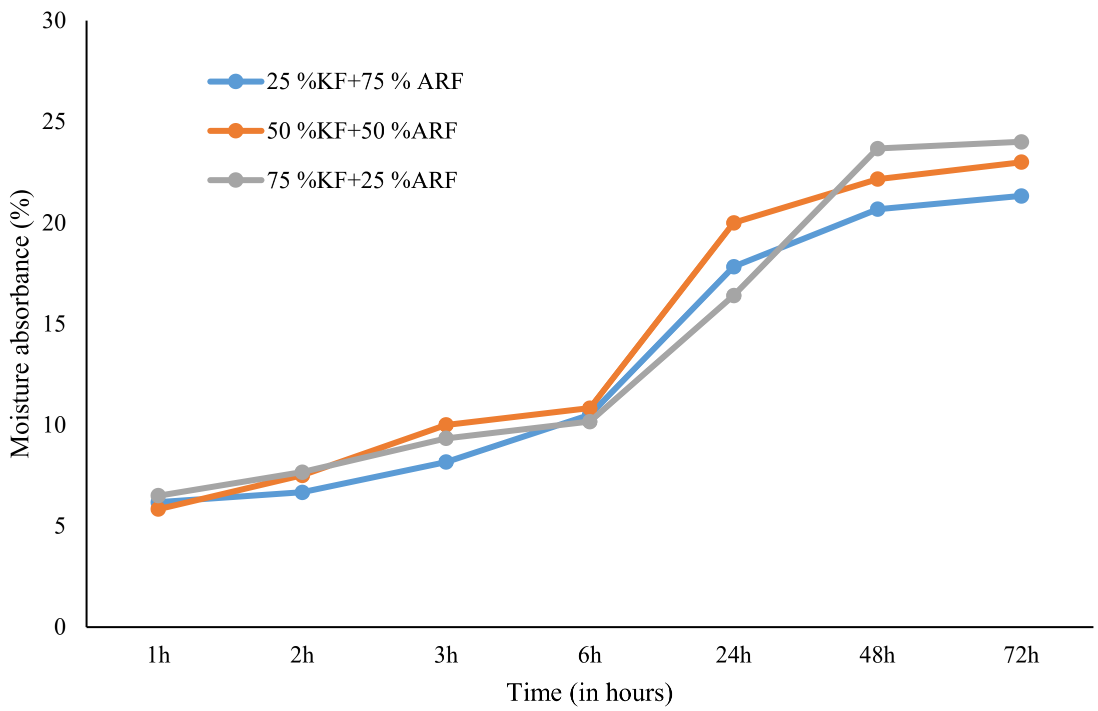

Figure 1: Moisture absorbance patterns of three different composite flour treatments.
ARF – Arrowroot flour, KF – Kithul flour.

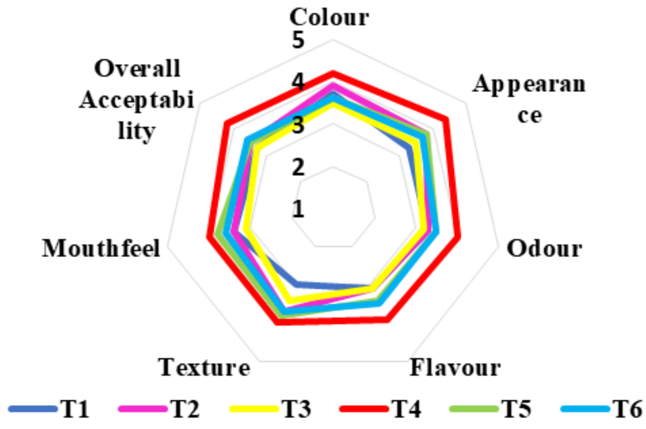

Figure 2: The mean score obtained from the Friedman test for sensory attributes of the ARF and KF incorporated crackers. *T1 - 100% WF, T2 – 100%KF, T3 - 100% ARF, T4 – 75%ARF+25%KF, T5 – 50%ARF+50%KF, T6 – 25%ARF+75%KF*

As a result, the volume of the developed composite flour cracker was lower compared to the control sample (100 % wheat flour), while the density was relatively higher in the developed composite flour cracker against the control. The thickness of the cracker from 100 % wheat flour was significantly higher than the composite flour cracker because the gluten in wheat flour enhances the dough formation but the spread ratio was not significantly different between the two different cracker treatments (Table 3). From the angle of consumer perception, low volume and thickness could be disadvantageous but from the sensory evaluation results it has been proved that consumer acceptability of 75%ARF + 25%KF had the highest consumer preference.

CONCLUSION

Arrowroot: *Kithul* composite flour has profiles with lower crude protein and crude fat contents but considerably higher crude fiber contents. This may be advantageous in certain food applications. The flour colour of the composite flour blends varied with the proportion of *Kithul* flour. The lightness of the flour colour increased when the amount of Arrowroot flour was increased. The 25 % KF+75% ARF composite flour was acceptable to use in the pharmaceutical industry for tablet formulation according to Carr's Index and Hausner ratio. Composite flour mixtures had better swelling power and solubility indices which are

Table 3: Proximate composition and physicochemical properties of 100 % cracker and 25% KF + 75 % ARF cracker.

Parameter	100 % wheat flour cracker (control)	25 % KF: 75 % ARF cracker
Proximate composition		
Moisture (%)	2.47±0.15[a]	2.00±0.50[b]
Total solid content (%)	95.76±2.26[b]	97.76±0.18[a]
Ash content (%)	13.55±0.00[a]	5.45±0.24[b]
Crude protein (%)	19.10±1.16[a]	18.97±0.35[a]
Crude fat (%)	0.73±0.13[b]	0.86±0.08[a]
Crude fiber (%)	1.99±2.09[b]	2.85±1.23[a]
Carbohydrate (%)	62.97±2.49[b]	71.06±1.96[a]
Energy (kcal/100 g)	476.85±3.04[a]	476.77±9.58[a]
Physico-chemical properties		
Length (cm)	7.47±0.15[a]	6.97±0.15[b]
Width (cm)	6.83±0.14[a]	6.53±0.19[b]
Weight (g)	17.64±0.94[a]	17.69±1.77[a]
Thickness (cm)	0.58±0.03[a]	0.04±0.22[b]
Volume (cm^3)	31.77±2.31[a]	28.17±0.76[b]
Spread ratio	11.71±0.48[a]	16.96±10.85[a]
Density (g/cm^3)	0.56±0.02[a]	0.63±0.08[a]

Mean±SD; n = 3
Between columns, mean values followed by different superscript letters are significantly different at p = 0.05

important in food preparations and gelatinization. The 25% KF+75%ARF composite flour had the highest amylose content due to the high Arrowroot proportion. The viscosity of the three composite flour blends was considerably high indicating the potential of forming highly viscous gels beneficial in the food industry. The composite flour containing 75% Arrowroot flour and 25% *Kithul* flour resulted in crackers with desirable organoleptic properties. The selected composite flour-incorporated crackers had a higher crude fiber content, carbohydrate, and total solid contents compared to the 100% wheat flour-based crackers. Therefore, Arrowroot flour and *Kithul* flour-based crackers can be promoted as a healthier alternative to minimize the use of wheat flour for cracker preparation and to use Arrowroot and *Kithul* flour in the local food industry.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare no conflict of interest.

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