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Effect of Coconut Milk and Cassava Starch supplementation on functional properties of Glutinous Rice Chupatty

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Glutinous rice flour had a soft and sticky nature. The main ingredients for the preparation of the glutinous rice chupatty included sticky rice, coconut milk, cassava starch, saccharose, sodium chloride, butter, sesame, durian. The variation of coconut milk and cassava starch substituted in glutinous rice flour might cause the changes in functional properties of glutinous rice chupatty. In this research, we replaced sticky rice with coconut milk (2÷10%), cassava starch (5÷25%). Different quality attributes of the glutinous rice chupatty such as swelling volume, solubility, water absorption capacity, syneresis, viscosity and pasting temperature were carefully verified. Results showed that 6% coconut milk and 15% cassava starch incorporated to sticky rice was adequate for making the glutinous rice chupatty. These ingredients had significant impact on textural quality of the glutinous rice chupatty.

Keywords: Cassava starch, coconut milk, glutinous rice chupatty, solubility, syneresis, swelling volume, viscosity, water absorption capacity

INTRODUCTION

Glutinous rice chupatty was a popular cake in Vietnamese Lunar New Year holiday. It had traditionally developed and preserved for many years in rural areas of Vietnam. Glutinous rice chupatty baking ovens were set up on the full moon in December of the lunar year. It's the cultural identity – the agricultural civilization. This cake was as small as a dish but turning bigger than a bamboo tape fan after being baked. It's spongy, soft with a unique taste due to the greasy taste of glutinous rice, the sweet taste of sugar, the specific scent of coconut milk, durian, sesame, soybean, peanut. Glutinous rice exhibited unique viscoelastic property (Chao-Chi and An-I, 2006). Coconut milk and Cassava starch has important role contributing to specific flavor and structure of the glutinous rice chupatty. Coconut milk had an excellent source of unique taste and aroma and rich in vitamins, minerals and dietary fibers

(Trinidad et al. 2001). Its color was pure white, the fragrance was sweet, and the eating was superb (Shakhawat et al. 2016). Cassava starch was derived from cassava root as one of the important tropical food crops. Cassava starch was popularly applied in food industry due to its surface sheen, smooth texture, and neutral taste (Hughes et al. 1998; Petracci et al. 2013). Cassava had low protein content (Folake et al. 2012). Cassava starch was commonly utilized as a thickener, flavouring and a binding agent (Laswai et al. 2017). The variation of coconut milk and cassava starch substituted in glutinous rice flour might cause the changes in textural attributes of glutinous rice chupatty. Objective of our study evaluated the influence of coconut milk and cassava starch replacement to sticky rice regarding to functional attributes of the glutinous rice chupatty (Laswai et al. 2017).

MATERIALS AND METHODS

Material

The main ingredient for processing glutinous rice chupatty was sticky rice. We choose the type of fragrant and delicious sticky rice to prepare glutinous rice chupatty. Sticky rice was soaked in the clean water from overnight for softening. Apart from sticky rice, we also utilized other ingredients such as coconut milk, cassava starch, saccharose, sodium chloride, butter, sesame, durian.

Researching method

The soaked rice was put in the mortar and ground into dissolved flour. The additional ingredients such as coconut milk in different ratio (2÷10%), cassava starch (5÷25%), saccharose (5%), sodium chloride (0.5%), butter (0.5%), sesame (0.5%), durian (0.5%) were mixed thoroughly with the dissolved flour. The main utensil was a large pot filled with water with the round-shaped mouth being stretched with fabric on top. A conical-shaped lid was prepared from coconut leaves. A slightly flat coconut shell with the bottom was sharpened to be round and smooth. A thin-flattened bamboo stick was used to take the glutinous rice chupatty out easier. The glutinous rice chupatty-drying mats were made from bamboo tree. When boiling water into vapor, we utilized a water ladle to pour the dissolved flour onto the cloth; then quickly and skillfully use coconut shells to spread a thin layer of dissolved flour in a circular shape to form the cake then putting the lid on. Once glutinous rice cakewas cooked, a bamboo stick was used to take it out and place it on the rolling pin which was put under the cake and then roll it, spreaded the glutinous rice chupatty on the bamboo mat and dry it under the sun for 6 hours.

Determination of physical properties

Swelling volume (mL/g) and solubility (%) were estimated by procedure described by Cahyana et al. (2019). Water absorption capacity (g/g) was determined by method described by Subroto et al. (2019). Syneresis (%) was determined following to Wattanachant et al. (2003). Viscosity (cP) and pasting temperature (°C) were determined according to Koksel et al. (2008).

Statistical analysis

The experiments were run in triplicate with different groups of samples. The data were

presented as mean±standard deviation. Statistical analysis was performed by the Statgraphics Centurion version XVI..

RESULTS AND DISCUSSION

The impact of coconut milk supplementation to functional properties of the glutinous rice chupatty was clearly presented in table 1. The 6% coconut milk supplementation gave highest swelling volume than those of 2% and 4% of coconut milk incorporation. It could be explained by presence of water absorbing matrix in coconut milk, which increased water holding capacity leading to enhancement of swelling volume of glutinous rice chupatty. However, too much coconut milk (8% or 10%) decreased the swelling volume. Fibre was responsible for the decrease of dough gas retention (Karaoglu and Kotancilar, 2009; Kim et al. 2011). Swelling volume was one of the most important physical properties of baked glutinous rice chupatty directly affecting to consumer preferences (Singh et al. 2012). Nuwamanya et al. (2011) demonstrated that swelling was well correlated to amylose as well as its properties, and that existence of phosphate groups increased water binding capacity, hence swelling of starches. Decreasing the swelling volume of starch granules could be caused by molecular rearrangement of granules, the formation of amylose-lipid complex, degradation of amylopectin molecules, increased interaction between amylose chains, and changes in interactions between amorphous and crystalline matrix (Adebowale et al. 2005). In table 1, solubility decreased significantly until 8% coconut milk incorporation. Decreasing solubility could be caused by a large amount of amylose that formed complexes with amylopectin and fat. Decrease of amorphous portion of amylose and amylopectin molecules was responsible for the decreased solubility. Water absorption capacity of starch granules was an important index to reflect the extent of associative force within starch (Agnes et al. 2017). It's a quantitative variable strongly correlating to dough handling, crumb, texture, freshness and technological versatility (Shakhawat et al. 2016). In our research, the more coconut incorporated (2÷10%), the less water absorption capacity of the glutinour rice chupatty was noticed. The higher the coconut milk incorporation decreased the syneresis significantly (table 1).

Table1: Effect of coconut milk incorporation on functional properties of the glutinous rice chupatty

Coconut milk incorporation (%)	2	4	6	8	10
Swelling volume (mL/g)	6.23±0.11 ^c	6.95±0.07 ^b	7.76±0.16 ^a	7.33±0.08 ^{ab}	6.64±0.13 ^{bc}
Solubility (%)	47.59±0.24 ^a	46.03±0.30 ^{ab}	43.32±0.07 ^b	38.61±0.23 ^c	38.49±0.19 ^c
Water absorption capacity (g/g)	1.78±0.03 ^a	1.43±0.02 ^b	1.14±0.04 ^{bc}	1.03±0.01 ^c	1.01±0.00 ^c
Syneresis (%)	17.62±0.17 ^a	15.79±0.23 ^{ab}	13.04±0.14 ^b	11.25±0.19 ^{bc}	9.73±0.30 ^c
Viscosity (cP)	3157±16 ^a	2965±24 ^{ab}	2771±34 ^b	2538±12 ^{bc}	2342±19 ^c
Pasting temperature (°C)	75.96±0.11 ^c	77.43±0.17 ^{bc}	79.27±0.05 ^b	81.09±0.15 ^{ab}	82.65±0.09 ^a

Note: the values were expressed as the mean of twenty two samples; the same characters (denoted above), the difference between them was not significant ($\alpha = 5\%$).

Table 2: Effect of cassava starch incorporation on functional properties of the glutinous rice chupatty

Cassava starch incorporation (%)	5	10	15	20	25
Swelling volume (mL/g)	8.13±0.12 ^d	9.69±0.03 ^{cd}	10.85±0.12 ^c	13.46±0.06 ^b	16.72±0.18 ^a
Solubility (%)	49.18±0.04 ^c	50.41±0.15 ^{bc}	51.23±0.10 ^b	52.07±0.15 ^{ab}	52.88±0.12 ^a
Water absorption capacity (g/g)	1.39±0.00 ^c	1.71±0.04 ^{bc}	1.95±0.02 ^b	2.16±0.03 ^{ab}	2.39±0.01 ^a
Syneresis (%)	12.73±0.17 ^a	12.26±0.11 ^{ab}	11.83±0.06 ^b	11.35±0.12 ^{bc}	11.07±0.05 ^c
Viscosity (cP)	3415±17 ^c	3687±20 ^{bc}	3719±19 ^b	3804±10 ^{ab}	3892±14 ^a
Pasting temperature (°C)	80.07±0.03 ^c	80.69±0.08 ^{bc}	81.13±0.03 ^b	81.58±0.12 ^{ab}	81.94±0.07 ^a

Note: the values were expressed as the mean of twenty two samples; the same characters (denoted above), the difference between them was not significant ($\alpha = 5\%$).

Coconut milk caused water molecules to be bound and trapped in the amylose-amylopectin crystalline structure so that water molecules trapped inside the starch gel matrix were difficult to get out. In sticky rice, amylose was responsible for the gel strength while amylopectin was responsible for the viscoelastic attribute of a starch gel (Sun and Holley, 2011; Mahmood et al. 2017; Jailson et al. 2020). In our research, when we added more coconut milk (2÷10%), the viscosity of the glutinous rice chupatty would be decreased. Influence of coconut milk incorporation on pasting temperature of the glutinous rice chupatty was shown in table 1. The higher coconut milk supplemented, the pasting temperature increased significantly. It revealed the increased interaction of amylose molecules in the amorphous region. Generally, 6% coconut milk supplementation was adequate for the glutinous rice chupatty making.

Impact of cassava starch replacement (5÷25%) to glutinous rice in functional properties of the glutinous rice chupatty was clearly presented in table 2. The higher cassava starch incorporated; the swelling volume, solubility, water absorption capacity, viscosity and pasting temperature increased while syneresis decreased. Generally,

15% cassava starch incorporation was adequate for the glutinous rice chupatty making. Onyango et al. (2011) reported that the crumb firmness decreased with the increase in the concentration of cassava starch. Crockett et al. (2011) observed high crumb hardness for 18.5% cassava flour incorporations and 36.75% of rice flour. Due to high starch and low amylose content, cassava starch showed high pasting property (Orissa et al. 2019). Vargas-Aguilar (2016) reported that cassava had a relatively lower pasting temperature than other starches. The higher pasting temperature of glutinous rice starch may be associated with its higher amylose content, as pasting temperature and amylose content are positively correlated (Ayedigbo et al. 2018). It might be due to starch-sucrose interaction (Sharma et al. 2009). Adebowale et al. (2011) noted that 100% cassava starch had high viscosity.

CONCLUSION

Traditional glutinous rice chupatty reflects the soul and essence of the Vietnamese village. In this research, we have successfully found out the influence of coconut milk and cassava starch supplementation to the functional properties of the glutinous rice chupatty. These substances

significantly affected the swelling volume, solubility, water absorption capacity, syneresis, viscosity and pasting temperature. Appropriate coconut milk and cassava starch replacement to glutinous rice would contribute to the best quality of this traditional cake.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Nguyen Phuoc Minh arranged the experiments and also wrote the manuscript.

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