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Several Variables Affecting to Production of Young Winter Melon (*Benincasa hispida*) Pickle

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ABSTRACT

Winter melon (*Benincasa hispida*) is an important crop with different healthy advantages. It's a rich source of vitamins, dietary fibres, minerals, phytochemical constituents. Purpose of this research focused on a lactic acid fermentation from young winter melon by under different technical parameters such as blanching, salt:sugar ration in immersion, fermentation time to physicochemical, phytochemical and organoleptic properties of pickle. Results showed that young winter melon should be blanched in hot water at 95°C in 8 seconds with 0.45% $CaCl_2$; lactic fermentation in 5.0%:5.0% salt:sugar solution in 13 days to obtain a pleasant taste in good overall acceptance, high total phenolic retention, excellent texture firmness of pickled young winter melon. As a result from pickling, young winter melon will have a longer stability, translucent appearance, firm texture and pickle flavor. Production of pickle from this vegetable can enhance the added value as well as to minimize post-harvest losses.

KEY WORDS: BLANCHING, $CACL_2$, FIRMNESS, LACTIC FERMENTATION, OVERALL ACCEPTANCE, PICKLE, TOTAL PHENOLIC, YOUNG WINTER MELON.

INTRODUCTION

Winter melon (*Benincasa hispida*) belongs to a family of Cucurbitaceae. It's widely consumed in Vietnam for different nutritional and medicinal applications (Nimbal et al., 2011; Zaini et al., 2011; Nguyen et al., 2019). It's highly prefered due to its abundant of vitamins, dietary fibers, antioxidant compounds (Rana and Suttee, 2012; Mandana et al., 2012). It has been utilized to cure gastrointestinal problems, respiratory diseases, heart diseases, diabetes mellitus, urinary diseases as well as other healthy benefits (Rayees, et al., 2013; Rajalakshmi (2018). Vegetable can be safely preserved through lactic fermentation, direct acidification or a combination of these along with other processing conditions (Joshi and Sharma, 2009).

Pickle products by lactic acid fermentation have specific taste with a great healthful advantages. They play an important role in intestinal functions such as modulating immunity, lowering cholesterol and improving lactose intolerance (Isabelle, 2010). Pickling encourages and initiates efficient food processing manipulations and simultaneously minimizes losses due to spoilage and rotten in harvested crops (Sultana et al., 2014). There was not any research mentioned to lactic acid fermentation of young winter melon into pickle. Hence, purpose of this research focused on the effect of various parameters such as blanching, salt:sugar immersion, fermentation duration to physicochemical, phytochemical and overall acceptance of pickled young winter melon.

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MATERIAL AND METHODS

Young winter melons were collected from Vinh Long province, Vietnam. They must be cultivated following VietGAP to ensure food safety. After collecting, they must be conveyed to laboratory as soon as possible for experiments. They were washed under tap water to remove dirty and foreign matters. Besides young winter melon, we also used other materials such as NaCl, $CaCl_2$, sugar, methanol, sodium carbonate, gallic acid. Lab utensils and equipments included knife, weight balance, cooker, fermentator, biuret, micropippetor, centrifugator, spectrophotometer.

Effect of blanching temperature and time to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: Young winter melon were blanched in hot water containing 0.3% $CaCl_2$ in various condition (100/4, 95/8; 90/12, 85/16, 80/20 °C/seconds). The blanched young winter melon would be fermented at ambient temperature in 4.0% salt: 6.0% sugar solution in 7 days. Total phenolic content (mg GAE/100g), firmness (N), overall acceptance of pickled young winter melon would be evaluated to define the optimal blanching formula.

Effect of $CaCl_2$ concentration in blanching to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: Young winter melon were blanched at 95°C in 8 seconds in hot water containing $CaCl_2$ in various condition (0.3, 0.35, 0.40, 0.45, 0.50%). The blanched young winter melon would be fermented at ambient temperature in 4.0% salt: 6.0% sugar solution in 7 days. Total phenolic content (mg GAE/100g), firmness (N), overall acceptance of pickled young winter melon would be evaluated to define the optimal $CaCl_2$ concentration in blanching.

Effect of salt: sugar ratio in fermentation to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: Young winter melon were blanched at 95°C in 8 seconds in hot water containing 0.45% $CaCl_2$. The blanched young winter melon would be fermented at ambient temperature in salt:sugar mixture (4.0%:6.0%; 4.5%:5.5%; 5.0%:5.0%; 5.5%:4.5%; 6.0%:4.0%) in 7 days. Total phenolic content (mg GAE/100g), firmness (N), overall acceptance of pickled young winter melon would be evaluated to define the optimal salt:sugar percentage in fermentation.

Effect of fermentation duration to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: Young winter melon were blanched at 95°C in 8 seconds in hot water containing 0.45% $CaCl_2$. The blanched young winter melon would be fermented at ambient temperature in salt:sugar mixture 5.0%:5.0% in different durations (7, 10, 13, 16, 19 days). Total phenolic content (mg GAE/100g), firmness (N), overall acceptance of pickled young winter melon would be evaluated to define the optimal fermentation duration.

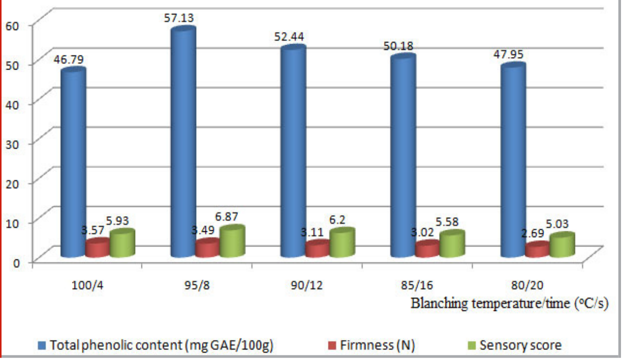
Physico-chemical, overall acceptance and statistical analysis: Total phenolic content (mg GAE/100g) content was estimated using Folin-Ciocalteu reagent procedure. Firmness (N) was estimated by penetrometer. Overall acceptance was evaluated by a group of 11 panelists using 9 point-Hedonic scale. The experiments were run in triplicate with three different lots of samples. The data were presented as mean±standard deviation. Statistical analysis was performed by the Statgraphics Centurion version XVI.

RESULTS AND DISCUSSION

Effect of blanching temperature and time to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: Blanching is normally performed in hot water within a short period of to inactivate enzymes and to eliminate various microorganism present in raw green vegetables (Prakash et al., 2018). Peroxidase is used as an indicator of blanching complement (Badwaik et al., 2015). Hot water blanching significantly delayed tissue lignificaton (Luo et al., 2012). Blanching caused loss of turgor in cells, integrity of the cell membranes and partial degradation of cell wall components. In our research, young winter melon were blanched in hot water containing 0.3% $CaCl_2$ in various condition (100/4, 95/8; 90/12, 85/16, 80/20 oC/seconds).

The blanched young winter melon would be fermented at ambient temperature in 4.0% salt: 6.0% sugar solution in 7 days. Our results were presented in table 1. It's clearly realized that 95°C in 8 seconds was appropriate for blanching of young winter melon. According to Badwaik et al. (2015), the high blanching temperature reduced lightness and long time blanching destroyed firmness of bamboo shoot. Low temperature short time blanching was proven to better product quality in respect of physical characteristics apart from proximate retention.

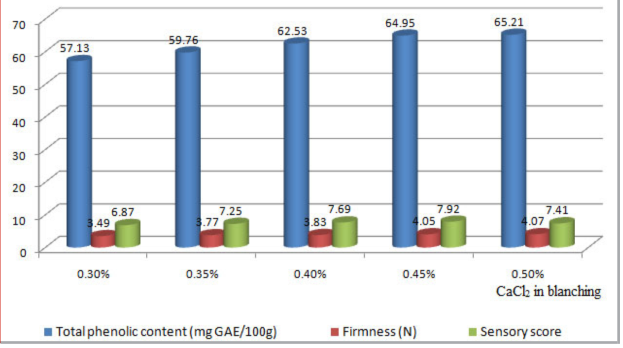
Figure 1: Effect of blanching temperature and time to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon.



Effect of $CaCl_2$ concentration in blanching to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: High intensity of thermal treatment lead to the significant loss of phenolic content due to thermal degradation, leaching or diffusion of elements into solution (Goncalves et al., 2010). It could be attributed that during thermal treatment phenylalanine ammonia-lyase and polyphenol oxidase gets inactivated leading to the reduction of phenolic consituents. Texture of blanched vegetable could be attributed to the loss of lignin and cellulosic components of cell wall. There was decrease in lignin and cellulose with increase in time and temperature of blanching (Miao et al., 2011). Softening of tissue after hot water blanching was due to the degradation of pectin with some other biochemical modifications (Badwaik et al., 2015). Blanching altered the chloroplast integrity where the chlorophyll pigments were embedded and results in the formation of pheophytin as the time and temperature of blanching progresses (Llano et al., 2003). Commercial implementation of $CaCl_2$ for fermentation variably resulted in texture and color defects that can impact product quality (Erin and Suzanne, 2018).

$CaCl_2$ played an important role as firming agent at low level to minimize thermal softening and enhance the freshness of blanched vegetable (Martin et al. 2007). $CaCl_2$ included in mild thermal treatment could induce the formation of calcium pectate cross-bonds which stabilized tissue cell membranes (Oms et al. 2010). In our research, young winter melon were blanched at 95°C in 8 seconds in hot water containing $CaCl_2$ in various condition (0.3, 0.35, 0.40, 0.45, 0.50%). The blanched young winter melon would be fermented at ambient temperature in 4.0% salt: 6.0% sugar solution in 7 days. Our results were presented in table 2. The optimal $CaCl_2$ was recorded at 0.45% for blanching of young winter melon. $CaCl_2$ in spinach blanching has been reported to be efficient to E. coli disinfection (Kim et al., 2015).

Figure 2: Effect of $CaCl_2$ concentration in blanching to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon



Effect of salt: sugar ratio in fermentation to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: Salt and sugar provide a natural fermentation for the lactic acid bacteria proliferation and inhibit salt-sensitive spoilage bacteria (Erin and Suzanne, 2018). Salt is one of the most commonly employed agents for food conservation, extending storage stability by reducing water activity (Arghya et al., 2017). Salt is very important as it enhance the preservative, technological and organoleptic properties of food (Brady, 2002). Sugar is metabolized to turn into lactic acid and inhibit the proliferation of pathogens and other non acidic tolerant microorganisms especially aerobic spoilage microorganisms (Nguyen, 2019).

In our present study, different salt:sugar mixture (4.0%:6.0%; 4.5%:5.5%; 5.0%:5.0%; 5.5%:4.5%; 6.0%:4.0%) were examined. Our results were presented in table 3. The optimal salt:sugar was noticed at 5.0%:5.0%. In another report, Susilowati et al. (2018) studied the effect of salt concentration on pH value, total acidity number and microbial characteristic of pickled ginger. They concluded that ginger should be prepared using 2.5% w/w salt with pH value of 3.40, total acidity 0.92% and lactic acid bacteria total counts of 7.56 x 106 CFU/ml.

Figure 3: Effect of salt: sugar ratio in fermentation to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon

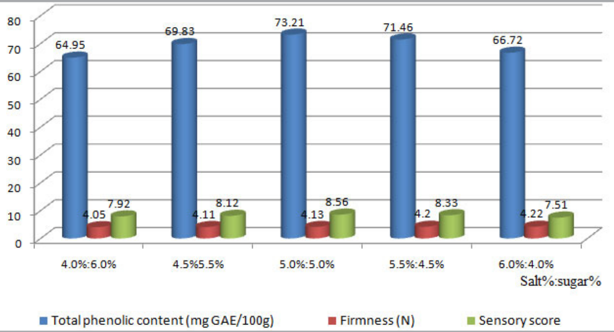
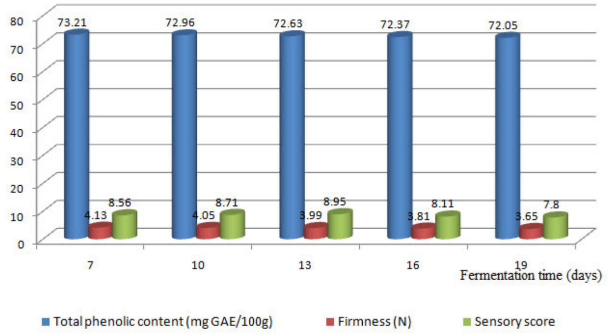


Figure 4: Effect of fermentation duration to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon.



Effect of fermentation duration to total phenolic content (mg GAE/100g), firmness (N) and overall acceptance of pickled young winter melon: The blanched young winter melon would be fermented at ambient temperature in salt:sugar mixture 5.0%:5.0% in different durations (7, 10, 13, 16, 19 days). It's clearly shown that the lactic acid fermentation for young winter melon should be 13 days to obtain the best physicochemical and phytochemical quality as well as overall acceptance. In another report, Susilowati et al. (2018) studied the effect fermentation time on pH value, total acidity number and microbial characteristic of pickled ginger. They concluded that ginger should be prepared in 5 days fermentation at 26^{o}C.

CONCLUSION

Winter melon is one of the most highly prized vegetables due to its nutritional value and impressive health benefits. Processing and preservation of vegetable into pickle form could reduce price fluctuation of agricultural commodities between the peak harvesting period and off season. High temperature treatment with short duration was most suitable method of blanching to retain total phenolic, textural and organoleptic properties. Salt:sugar ratio, fermentation time were also significantly affected to the quality of winter melon pickle.

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

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