Science & Technology Development Journal – Engineering and Technology 2022, 5(4):1711-1718

Open Access Full Text Article

Research Article

Pasta making from wheat semolina and watermelon rind: Effects of ratios of watermelon rind flour on the product quality

Long Dien Quang, Trieu Thi Mien, Tran Thi Thu Tra, Le Thi Thuy, Ton Nu Minh Nguyet, Le Van Viet Man*

ABSTRACT

Watermelon juice production generates watermelon rind. This by-product contained high levels of dietary fiber and phenolic compounds with antioxidant activity. In the present study, watermelon rind was dried, pulverized and screen through a 40-mesh sieve to yield watermelon rind flour which was subsequently supplemented to wheat semolina at 0% (control sample), 5%, 10%, 15%, 20%, and 25% of the blend weight for pasta making. The quality of the obtained pasta samples was then evaluated and compared. When the ratio of watermelon rind flour was varied from 0 to 25%, the content of total dietary fiber and phenolics of the product increased by 3,3 and 8,5 times, respectively, while its 2,2-diphenyl-1-picrylhydrazyl scavenging capacity and ferric reducing antioxidant power were improved by 7,5 and 3,1 times, respectively. At the 25% supplementation level, the adhesiveness of pasta was enhanced by 56% while its cooking loss was increased by 87%. The elongation rate and tensile strength of pasta added with 25% watermelon rind flour were 59 and 27% lower, respectively, than those of the control pasta. In addition, the water absorption index and swelling index of high fiber pasta were gradually decreased as the watermelon rind ratio in the product recipe was augmented. The increased ratio of watermelon rind flour in the pasta formulation slightly enhanced the darkness (reduced *L** value) and yellowness intensity (increased *b** value) of the product while the change in redness intensity (*a** value) was very little. Supplementation of watermelon rind flour to pasta making also reduced the overall sensory score of the product. Nevertheless, the pasta samples with 10-20% watermelon rind flour were considered as high fiber product and their overall sensory scores were acceptable. Watermelon rind flour was a fiber and antioxidant material for improvement in nutritional quality of pasta.

Key words: watermelon rind, dietary fiber, antioxidant, pasta

Department of Food Technology, Ho Chi Minh City University of Technology (HCMUT), Vietnam National University Ho Chi Minh City (VNU-HCM), 268 Ly Thuong Kiet street, District 10, Ho Chi Minh City, Vietnam

Correspondence

Le Van Viet Man, Department of Food Technology, Ho Chi Minh City University of Technology (HCMUT), Vietnam National University Ho Chi Minh City (VNU-HCM), 268 Ly Thuong Kiet street, District 10, Ho Chi Minh City, Vietnam

Email: lvvman@hcmut.edu.vn

History

- Received: 31-07-2022
- Accepted: 12-02-2023
- Published: 11-03-2023

DOI :

https://doi.org/10.32508/stdjet.v5i4.1032

INTRODUCTION

Dietary fiber and antioxidants have attracted attention on account of their various benefits to human health [1]. Nowadays, food products with high level of dietary fiber and antioxidants are of great interest to consumers because of health improvement [2]. Food fortification with dietary fiber and antioxidants is a current trend for new product development [2]. Pasta has been a well-known food around the world due to its affordability and simplicity of preparation [1,3]. Nevertheless, conventional pasta is low in dietary fiber and antioxidants [2]. Different fiber and antioxidant sources have been added to pasta recipes for improving product quality [2].

Watermelon is a plant species of the *Cucurbitaceae* family fruits and it is widely cropped in the Middle East, East, and South East Asia [4]. The global production of watermelon fruit in 2020 is about 101,6 million tones [5]. This fruit has been used to produce watermelon juice, the production of which generates the fruit rind accounting for 30% of the fruit weight [6]. Watermelon rind is frequently utilized to make fertilizer or animal forage. However, this by-product has high levels of dietary fibers, protein, and minerals. Moreover, watermelon rind also contains phenolic compounds with high antioxidant activity [6]. It is reported that watermelon rind flour is supplemented to the formulation of different food products, including bread [7], cookies [8] and noodles [9] for improvement in their fiber level as well as antioxidant capacity. Nevertheless, the use of watermelon rind flour in pasta recipe has not been considered.

In this research, a mixture of wheat semolina and watermelon rind flour was used to make pasta. The purpose of this study was to examine the impacts of watermelon rind flour ratios on the proximate composition, antioxidant activity, textural profile, cooking properties and overall sensory score of pasta.

MATERIALS AND METHODS

Materials

Watermelon fruits were purchased from a farm in Long An province. The white rind was obtained after

Cite this article : Quang L D, Mien T T, Tra T T T, Thuy L T, Nguyet T N M, Man L V V. **Pasta making from wheat semolina and watermelon rind: Effects of ratios of watermelon rind flour on the product quality**. *Sci. Tech. Dev. J. – Engineering and Technology; 2022,* 5(4):1711-1718.

the green peel was manually removed; the white rind was then sliced thin into $6 \times 2 \times 0,2$ cm pieces, dried at 50^oC for 16 h to a moisture content of 12%, pulverized, and screened through a 40-mesh sieve. The watermelon rind flour was preserved in polyethylene bags at 4^oC, and utilized for experiments. Durum wheat semolina was procured from Vietnam Wheat Milling Co., Ltd. Refined salt with iodine addition was provided by Vietnam Southern Salt Group.

For determination of dietary fiber, Termamyl®SC α-amylase, Alcalase®2.5 L protease, and Dextrozyme®GA glucoamylase were purchased from Novozymes (Denmark). All chemicals of analytical grade, including 3,5-dinitrosalicylic acid, 2,4,6-tri(2-pyridyl)-s-triazine, Trolox, gallic acid (GA), and 2,2-diphenyl-1-picrylhydrazyl (DPPH) were originated from Merck KGaA (Germany).

Experimental methods

Procedure of pasta making

A stand mixer machine with a paddle-shaped stirrer was used to blend 150 g durum wheat semolina and watermelon rind powder with 0,75 g table salt for 2 min. The ratio of watermelon rind powder was 0% (control), 5%, 10%, 15%, 20%, and 25% of the blend weight. The dry mixture was subsequently intermixed with 70 mL distilled water at 42^oC and stirred at 120 rpm for 2 min before being kneaded at 120 rpm for another 20 min to produce pasta dough using dough hook mixer. The dough was then extruded at pressure of 720 kgf/cm^2. The obtained pasta was then dried at 50^oC for 4 h and the dry pasta was stored in polyethylene stand pouches at 4^oC before analysis.

Proximate composition

Moisture was measured by drying at 105^oC to constant mass, using a moisture analyzer. Lipid was examined by the Soxhlet extraction method. Protein was estimated according to the Kjeldahl method; the conversion factor of nitrogen to protein was 6,25. Ash was quantified by incineration 600^oC. Carbohydrate content was computed by deducting lipid, protein, and ash contents from the dry basis [10]. Starch was analyzed using AOAC 996.11 method [11]; reducing sugars were assessed by spectrophotometric method using 3,5-dinitrosalicylic acid [3]. Soluble dietary fiber (SDF) and insoluble dietary fiber (IDF) and were evaluated following the AOAC 993.19 and 991.42 methods, respectively [11]. Total dietary fiber (TDF) content was the sum of IDF and SDF contents [3].

Total phenolic and antioxidant capacity

Phenolics were extracted from uncooked pasta using 60% (v/v) ethanol solvent; the obtained extract was utilized to evaluate the content of total phenolics, ferric reducing antioxidant power and DPPH scavenging capacity; the procedure was described elsewhere [3].

Textural quality of cooked pasta and color of uncooked pasta

Textural quality of cooked pasta was measured using a TA-XT plusC texture analyzer (Stable Micro Systems Co., UK). The adhesiveness, cohesiveness, elongation rate (%) and tensile strength (kPa) were recorded [3]. Instrumental color values, including L^*, a^* and b^* were metered using a CCM-3700A colorimeter (Konica Minolta, Japan). The color difference (ΔE) between the pasta added with watermelon rind flour and the control pasta was calculated by the formula presented by Nguyen et al. (2020) [3].

Cooking quality

Cooking properties including cooking loss, optimal cooking time, water absorption index, and swelling index were determined by the procedure reported by Nguyen et al. (2020) [3].

Overall sensory score

A 9-point hedonic test (9 points - extremely like and 1 point - extremely dislike) to was applied for evaluation of overall sensory score of pasta samples [3].

Statistical analysis

Three duplicates of each experiment were carried out. The results were expressed by mean±standard deviation. Analysis of variance was done with the Statgraphics Centurion XVII program (USA). The multiple range test was eventually applied to identify significant difference ($p < 0,05$).

RESULTS AND DISCUSSION

Proximate composition of uncooked pasta

Table 1 presents proximate composition of uncooked pasta with various ratios of watermelon rind flour. The moisture content of all pasta samples was statistically equivalent, and met the requirement for pasta preservation at room temperature [12]. As the ratio of watermelon rind flour increased from 0 to 25%, the lipid and ash contents of the product were enhanced by 25% and 2,4 times, respectively. This was due to the higher lipid (2,8 g/100 g dw) and ash (12,7 g/100 g dw) contents of watermelon rind flour than those (1,7 g/100 g dw for lipid and 0,5 g/100 g dw for ash) of durum wheat semolina. The pasta incorporated with different ratios of watermelon rind flour and the control pasta had similar protein content since both watermelon rind flour and durum wheat semolina contained the same protein level of 13,3 g/100 g dw. Increase in watermelon rind powder ratio from 0 to 25% in the pasta recipe reduced the total carbohydrate content by 5,4%. It can be explained that watermelon rind powder contained less carbohydrate (71,2 g/100 g dw) than durum semolina (84,1 g/100 g dw).

When the watermelon rind power ratio in the pasta recipe was changed from 0 to 25%, the SDF, IDF and TDF content of the product augmented by 2,9; 3,4 and 3,3 and times, respectively, while the starch content was reduced by 28%. The SDF, IDF and TDF contents of watermelon rind flour was 11,6; 29,0 and 40,5 g/100 g dw, respectively, which were much greater than those of durum wheat semolina (0,7 g/100g dw for SDF; 2,7 g/100 g dw for IDF and 3,6 g/100 g dw for TDF). Meanwhile, the watermelon rind flour contained much less starch (2,6 g/100 g dw) than the wheat semolina (71,9 g/100 g dw). Increase in fiber content of pasta was previously reported when mango peel was added to the product recipe [1]. It should be mentioned that the pasta with 10% watermelon rind powder was regarded as a fiber-rich product since its TDF content was greater than 6 g/100 g [3]. The IDF/SDF index of pasta sample was gradually augmented with the enhanced supplementation level of watermelon rind flour. Nevertheless, the IDF/SDF index of the high fiber pasta samples in the current study was nearly comparable to the recommended value of 3/1 suggested for satiety and energy intake [3].

Antioxidant content and capacity of uncooked pasta

The effects of addition level of watermelon rind flour on the total phenolic level and antioxidant capacity of uncooked pasta are demonstrated in Figure 1. When the watermelon rind flour ratio was raised from 0 to 25%, the phenolic content of pasta grew by 8,5 times while its ferric reducing power and DPPH radical scavenging activity increased by 7,5 and 3,1 times, respectively. The phenolic content of pasta positively correlated with ferric reducing power (R=0,995) and DPPH scavenging activity (R=0,996). It can be noted that the antioxidant capacity measured by DPPH assay was greater than that quantified by FRAP assay. The reason could be that the main phenolics of watermelon rind are hydroxybenzoic acid group [13] which reveals a strong scavenging effect with free radical DPPH [14].

When cucumber peel flour was supplemented to pasta recipe in the investigation by Kaur et al. (2021), the content of total phenolics and antioxidant capacity were also escalated [15]. As a result, watermelon rind powder was a potential supplement for enhancement antioxidant content and activity of pasta products.

Textural quality of cooked pasta

The effects of watermelon rind flour on texture profile of cooked pasta are displayed in Table 2. At 25% addition level, the adhesiveness of pasta increased by 56% while its cohesiveness dropped by 19%. It was probably due to by the presence of fiber components which disturb the protein-starch network, leading to an enhanced release of exudates from pasta strands into boiling water [3]. As a result, the cohesiveness of the pasta texture was weakened and the adhesiveness on the surface of pasta strands was increased [15]. Similar results were also reported when grape peel was incorporated into the pasta recipe [16]. When the ratio of watermelon rind flour in pasta samples increased from 0 to 25%, the elongation rate was lowered by 59% and the tensile strength was decreased by 27%. The decreased gluten pasta samples reduced their capacity to withstand the tensile strength of cooked pasta strands [3].

Instrumental color of uncooked pasta

The color values of uncooked pasta fortified with different levels of watermelon rind flour is described in Table 2. The increased ratio of watermelon rind powder in the pasta recipe slightly enhanced the darkness (reduced L^* value) of the product as well as its yellowness intensity (increased b^* values), while the change in a^* value was very little. Lycopene and anthocyanin are detected in watermelon rind and they show the yellow-red colored pigments [6]. As a result, the use of watermelon rind powder slightly changed the pasta color. The difference in color between the pasta incorporated with 5 or 10% watermelon rind flour and the control was little and could not be detected easily by naked eyes since the ΔE value was less than 5,0.

Cooking quality of pasta

The cooking properties of all pasta samples are illustrated in Table 3. Increment in watermelon flour ratio from 0 to 25% enhanced the cooking loss by 87% and shortened the optimal cooking time by 42%. It can be explained that using watermelon rind powder reduced the amount of gluten in the pasta dough leading to a weakened gluten network structure [17] as well as allowing water to quickly diffuse into pasta

Table 1: Proximate composition of pasta with various adding ratios of watermelon rind flour

Ratio of watermelon rind flour (%)	0	5	10	15	20	25
Moisture (g/100 g)	9,0 ± 0,1[a]	9,0 ± 0,1[a]	9,0 ± 0,2[a]	9,1 ± 0,1[a]	9,1 ± 0,1[a]	9,1 ± 0,2[a]
Lipid (g/100 g dw)	1,7 ± 0,1[a]	2,4 ± 0,1[b]	2,6 ± 0,1[bc]	2,7 ± 0,1[c]	2,8 ± 0,1[c]	3,0 ± 0,1[d]
Protein (g/100 g dw)	12,7 ± 0,5[a]	13,0 ± 0,5[a]	13,1 ± 0,6[a]	13,2 ± 0,4[a]	13,4 ± 0,4[a]	13,2 ± 0,6[a]
Ash (g/100 g dw)	0,8 ± 0,1[a]	1,5 ± 0,0[b]	2,0 ± 0,1[c]	2,6 ± 0,1[d]	3,2 ± 0,0[e]	3,6 ± 0,0[f]
Carbohydrate (g/100 g dw)	84,7 ± 0,5[d]	83,0 ± 0,5[c]	82,3 ± 0,4[c]	81,4 ± 0,4[b]	80,7 ± 0,3[ab]	80,1 ± 0,5[a]
Starch (g/100 g dw)	71,1 ± 1,0[f]	63,8 ± 0,9[e]	61,5 ± 0,9[d]	59,2 ± 0,9[c]	54,0 ± 0,8[b]	50,8 ± 0,7[a]
Total dietary fiber (g/100 g dw)	3,5 ± 0,1[a]	5,5 ± 0,2[b]	7,3 ± 0,3[c]	8,6 ± 0,4[d]	10,6 ± 0,5[e]	11,5 ± 0,4[f]
Insoluble dietary fiber (IDF) (g/100 g dw)	2,7 ± 0,1[a]	4,3 ± 0,2[b]	5,8 ± 0,3[c]	6,9 ± 0,3[d]	8,5 ± 0,4[e]	9,2 ± 0,4[f]
Soluble dietary fiber (SDF) (g/100 g dw)	0,8 ± 0,0[a]	1,2 ± 0,0[b]	1,5 ± 0,1[c]	1,7 ± 0,1[d]	2,0 ± 0,1[e]	2,3 ± 0,1[f]
IDF/SDF index	3,3 ± 0,1[a]	3,6 ± 0,1[b]	3,7 ± 0,3[bc]	4,0 ± 0,1[cd]	4,2 ± 0,1[cd]	4,0 ± 0,2[d]

dw: dry weight; values that do not share the lowercase letter (a–f) in each row are significantly different (p < 0,05)

and exudate to release more into the cooking water. When mango peel and grape peel were supplemented to pasta recipe, the decrease in optimal cooking time and the increase in cooking loss were also reported[1,16].

Additionally, the swelling index and water adsorption index of pasta incorporated with 25% watermelon rind powder were reduced by 19% and 33%, respectively, due to the decreased starch content of the product. Gelatinization of starch could affect water absorption and expansion of pasta in boiling process[18]. Decrease in swelling index and water absorption index was also noted for pasta fortified with tomato peel[19].

Overall acceptability of pasta

Table 3 presents the sensory overall acceptability of pasta samples. All pasta samples supplemented with watermelon rind powder had lower sensory scores than the control sample. Increase in watermelon rind powder ratio from 5 to 20% did not change the level of acceptance of the product. The pasta sample supplemented with 25% watermelon rind powder had lower acceptability than that with 15% powder. The pasta samples incorporated with 10-20% watermelon rind powder were considered acceptable.

CONCLUSION

Watermelon rind was a material with high dietary fiber and phenolic contents. High supplementation ratio of watermelon rind flour in the pasta recipe improved the fiber and phenolic contents and antioxidant capacity of the product but the starch content was decreased. High addition ratio of watermelon rind flour also enhanced the adhesiveness and cooking loss while reduced the cohesiveness, elongation rate, tensile strength, swelling index, optimal cooking time, and overall sensory score of the product. The pasta samples fortified with 10-20% watermelon rind powder were high fiber product with acceptable sensory quality. Future research on pilot scale is therefore essential to confirm the potential of watermelon

Table 2: Texture profile and color values of pasta samples with various ratios of watermelon rind flour

The ratio of watermelon rind flour (%)	0	5	10	15	20	25
Adhesiveness	-10,24 ± 0,42[e]	-11,10 ± 0,26[d]	-11,83 ± 0,80[d]	-13,39 ± 0,42[c]	-14,77 ± 0,50[b]	-15,94 ± 0,67[a]
Cohesiveness	0,65 ± 0,01[e]	0,61 ± 0,00[d]	0,59 ± 0,01[c]	0,59 ± 0,01[c]	0,55 ± 0,02[b]	0,53 ± 0,02[a]
Elongation rate (%)	57,7 ± 0,8[e]	54,9 ± 2,7[d]	55,1 ± 2,1[d]	47,1 ± 0,9[c]	33,2 ± 1,5[b]	23,6 ± 0,7[a]
Tensile strength (kPa)	25,13 ± 0,74[d]	24,38 ± 0,55[d]	23,08 ± 0,36[c]	22,85 ± 0,32[c]	21,98 ± 0,63[b]	18,46 ± 0,43[a]
L*	89,32 ± 0,04[f]	88,72 ± 0,24[e]	87,28 ± 0,20[d]	86,55 ± 0,23[c]	86,06 ± 0,01[b]	84,96 ± 0,41[a]
a*	1,07 ± 0,01[a]	1,01 ± 0,08[a]	1,26 ± 0,02[b]	1,40 ± 0,02[c]	1,47 ± 0,02[c]	1,73 ± 0,10[d]
b*	8,74 ± 0,02[a]	10,40 ± 0,07[b]	12,16 ± 0,09[c]	13,80 ± 0,02[d]	14,34 ± 0,17[e]	14,41 ± 0,16[e]
E	NA	1,77 ± 0,11[b]	3,98 ± 0,18[c]	5,78 ± 0,11[d]	6,49 ± 0,14[e]	7,18 ± 0,39[e]

NA: not applicable; values that do not share the lowercase letter (a–f) in each row are significantly different ($p < 0,05$).

Table 3: Cooking quality and overall sensory score of pasta samples with various ratios of watermelon rind flour

The ratio of watermelon rind flour (%)	0	5	10	15	20	25
Optimal cooking time (min)	14,0 ± 0,4[f]	12,6 ± 0,4[e]	11,0 ± 0,4[d]	10,3 ± 0,3[c]	8,7 ± 0,3[b]	8,1 ± 0,2[a]
Cooking loss (%)	4,6 ± 0,1[a]	5,0 ± 0,2[b]	5,9 ± 0,2[c]	7,5 ± 0,3[d]	7,8 ± 0,2[d]	8,6 ± 0,4[e]
Water absorption index	1,56 ± 0,04[e]	1,50 ± 0,04[e]	1,37 ± 0,04[d]	1,25 ± 0,05[c]	1,14 ± 0,06[b]	1,04 ± 0,04[a]
Swelling index	1,83 ± 0,05[cd]	1,87 ± 0,04[d]	1,74 ± 0,07[bc]	1,68 ± 0,04[b]	1,56 ± 0,05[a]	1,49 ± 0,07[a]
Overall acceptability	6,7 ± 1,4[c]	6,1 ± 1,6[b]	6,0 ± 1,6[b]	6,1 ± 1,5[b]	5,6 ± 1,5[ab]	5,3 ± 1,6[a]

Values that do not share the lowercase letter (a–f) in each row are significantly different ($p < 0,05$).

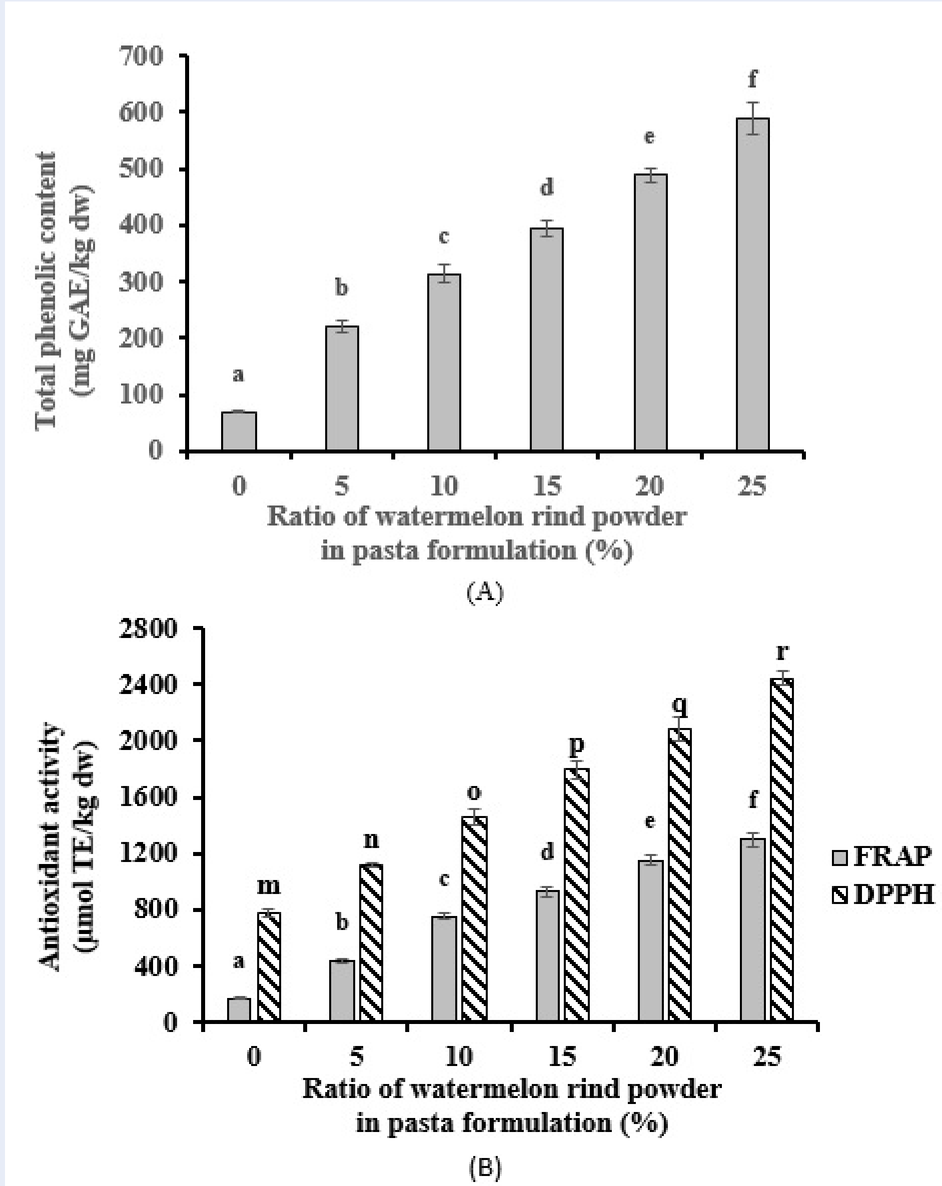

Figure 1: Total phenolic content (A), ferric reducing antioxidant power and DPPH inhibition activity (B) of uncooked pasta with various ratios of watermelon rind flour.[a]

[a] *Values that do not share the lowercase letter (a–f, m-r) in each sub-figure are significantly different (p < 0,05).*

rind flour in the making of high fiber and antioxidant pasta.

ACKNOWLEDGEMENT

This research is funded by Vietnam National University Ho Chi Minh City (VNU-HCM) under grant number NCM2020-20-01. We acknowledge the support of time and facilities from Ho Chi Minh City University of Technology (HCMUT), VNU-HCM for this study.

CONFLICTS OF INTEREST

All authors of this paper have no conflict of interest to declare.

AUTHORS' CONTRIBUTION

Long Dien Quang: Investigation (Equal), Data curation (Equal), Formal analysis (Equal), Writing-original draft; **Trieu Thi Mien**: Investigation (Equal), Data curation (Equal), Formal analysis (Equal);

Tran Thi Thu Tra: Methodology (Equal), Resources (Equal), Visualization (Equal); **Le Thi Thuy**: Methodology (Equal), Resources (Equal), Visualization (Equal); **Ton Nu Minh Nguyet**: Methodology (Equal), Resources (Equal), Visualization (Equal); **Le Van Viet Man**: Conceptualization, Project administration, Writing-review & editing.

REFERENCES

1. Ajila CM, Aalami M, Leelavathi K, Rao UJSP. Mango peel powder: A potential source of antioxidant and dietary fiber in macaroni preparations. Innov Food Sci Emerg Technol. 2010;11(1):219-24;Available from: https://doi.org/10.1016/j.ifset.2009.10.004.
2. Dziki D. Current trends in enrichment of wheat pasta: quality, nutritional value and antioxidant properties. Processes. 2021;9(8):1280;Available from: https://doi.org/10.3390/pr9081280.
3. Nguyen SN, Tu Ngo TC, Tra Tran TT, Nguyet Ton NM, Man Le VV. Pasta from cellulase-treated wheat bran and durum semolina: effects of vital gluten addition and/or transglutaminase treatment. Food Biosci. 2020;38:100782;Available from: https://doi.org/10.1016/j.fbio.2020.100782.
4. Dane F, Liu JJGR. Diversity and origin of cultivated and citron type watermelon (Citrullus lanatus). Genet Resour Crop Evol. 2007;54(6):1255-65;Available from: https://doi.org/10.1007/s10722-006-9107-3.
5. FAO. Watermelons - Faostat - un data. 2022. United Nations Food and Agriculture Organization FAOSTAT;.
6. Rico X, Gullón B, Alonso JL, Yáñez R. Recovery of high value-added compounds from pineapple, melon, watermelon and pumpkin processing by-products: an overview. Food Res Int. 2020;132:109086;PMID: 32331642. Available from: https://doi.org/10.1016/j.foodres.2020.109086.
7. Shivapour M, Yousefi S, Seyedain Ardabili SMS, Weisany W. Optimization and quality attributes of novel toast breads developed based on the antistaling watermelon rind powder. Journal of Agriculture and Food Research. 2020;2:100073;Available from: https://doi.org/10.1016/j.jafr.2020.100073.
8. Naknaen P, Itthisoponkul T, Sondee A, Angsombat N. Utilization of watermelon rind waste as a potential source of dietary fiber to improve health promoting properties and reduce glycemic index for cookie making. Food Sci Biotechnol. 2016;25(2):415-24;PMID: 30263285. Available from: https://doi.org/10.1007/s10068-016-0057-z.
9. Ho LH, Che Dahri N. Effect of watermelon rind powder on physicochemical, textural, and sensory properties of wet yellow noodles. CyTA J Food. 2016;14(3):1-8;Available from: https://doi.org/10.1080/19476337.2015.1134672.
10. Fradinho P, Oliveira A, Domínguez H, Torres MD, Sousa I, Raymundo A. Improving the nutritional performance of gluten-free pasta with potato peel autohydrolysis extract. Innov Food Sci Emerg Technol. 2020;63:102374;Available from: https://doi.org/10.1016/j.ifset.2020.102374.
11. AOAC. Association of Official Analytical Chemists. Official Methods of Analysis. 17th ed, 2000;.
12. Moreno-Martínez E, Rivera A, Badillo MV. Effect of fungi and fungicides on the preservation of wheat seed stored with high and low moisture content. J Stored Prod Res. 1998;34(4):231-6;Available from: https://doi.org/10.1016/S0022-474X(97)00059-3.
13. Zia S, Khan MR, Shabbir MA, Aadil RM. An update on functional, nutraceutical and industrial applications of watermelon by-products: A comprehensive review. Trends Food Sci Technol. 2021;114:275-91;Available from: https://doi.org/10.1016/j.tifs.2021.05.039.
14. Chen J, Yang J, Ma L, Li J, Shahzad N, Kim CK. Structure-antioxidant activity relationship of methoxy, phenolic hydroxyl, and carboxylic acid groups of phenolic acids. Sci Rep. 2020;10(1):2611;PMID: 32054964. Available from: https://doi.org/10.1038/s41598-020-59451-z.
15. Kaur M, Dhaliwal M, Kaur H, Singh M, Punia Bangar S, Kumar M et al. Preparation of antioxidant-rich tricolor pasta using microwave processed orange pomace and cucumber peel powder: A study on nutraceutical, textural, color, and sensory attributes. J Texture Stud, Accepted in 2021. 2022;53(6):834-43;PMID: 34910831. Available from: https://doi.org/10.1111/jtxs.12654.
16. Ungureanu-Iuga M, Dimian M, Mironeasa S. Development and quality evaluation of gluten-free pasta with grape peels and whey powders. LWT. 2020;130:109714;Available from: https://doi.org/10.1016/j.lwt.2020.109714.
17. Tolve R, Pasini G, Vignale F, Favati F, Simonato B. Effect of grape pomace addition on the technological, sensory, and nutritional properties of durum wheat pasta. Foods. 2020;9(3):354;PMID: 32204341. Available from: https://doi.org/10.3390/foods9030354.
18. Rakhesh N, Fellows CM, Sissons M. Evaluation of the technological and sensory properties of durum wheat spaghetti enriched with different dietary fibres. J Sci Food Agric. 2015;95(1):2-11;PMID: 24798805. Available from: https://doi.org/10.1002/jsfa.6723.
19. Padalino L, Conte A, Lecce L, Likyova D, Sicari V, Pellicanò TM et al. Functional pasta with tomato by-product as a source of antioxidant compounds and dietary fibre. Czech J Food Sci. 2017;35(1):48-56;Available from: https://doi.org/10.17221/171/2016-CJFS.

Tạp chí Phát triển Khoa học và Công nghệ – Kĩ thuật và Công nghệ 2022, 5(4):1711-1718
Open Access Full Text Article

Bài nghiên cứu

Mì pasta từ bột lúa mì cứng và vỏ dưa hấu: Ảnh hưởng của tỷ lệ bột vỏ dưa hấu đến chất lượng sản phẩm

Long Điền Quang, Triệu Thị Miến, Trần Thị Thu Trà, Lê Thị Thúy, Tôn Nữ Minh Nguyệt, Lê Văn Việt Mẫn*

TÓM TẮT
Quy trình sản xuất nước ép dưa hấu thải ra phần vỏ dưa. Phụ phẩm này có chứa nhiều chất xơ và các hợp chất phenolic có hoạt tính chống oxy hóa. Trong nghiên cứu này, vỏ dưa hấu được đem sấy, nghiền và cho qua rây 40-mesh để tạo thành bột vỏ dưa. Phần bột vỏ dưa hấu qua rây được phối trộn với bột lúa mì cứng với tỉ lệ 0% (mẫu đối chứng), 5%, 10%, 15%, 20% và 25% so với tổng khối lượng hỗn hợp bột để làm mì pasta. Chất lượng các mẫu mì thành phẩm đã được đánh giá và so sánh. Khi thay đổi tỉ lệ bột vỏ dưa từ 0 đến 25%, tổng hàm lượng chất xơ và phenolic của mì pasta thành phẩm tăng lần lượt là 3,3 và 8,5 lần; trong khi đó hoạt tính kháng oxy hóa theo phản ứng khử sắt và bắt gốc tự do DPPH cũng tăng lên lần lượt là 3,1 và 7,5 lần. Với tỉ lệ bổ sung bột vỏ dưa là 25%, độ kết dính của sản phẩm tăng thêm 56%, trong khi độ tổn thất nấu cũng tăng thêm 87%. Tỷ lệ kéo dãn và độ bền kéo của mẫu mì có bổ sung 25% bột vỏ dưa lần lượt thấp hơn 59 và 27% so với mẫu mì đối chứng. Ngoài ra, chỉ số hấp thu nước và chỉ số trương nở của mì giàu xơ bị giảm đi khi tăng dần tỉ lệ bột vỏ dưa trong công thức làm mì. Sự gia tăng tỉ lệ bột vỏ dưa trong quy trình chế biến còn làm tăng độ sậm màu (giảm giá trị L*) và sắc vàng (tăng giá trị b*) của sợi mì, trong khi sắc đỏ (giá trị a*) thay đổi rất ít. Việc sử dụng bột vỏ dưa còn làm giảm đi điểm cảm quan về độ yêu thích chung của mì pasta. Tuy nhiên, các mẫu mì pasta được bổ sung 10-20% bột vỏ dưa hấu là sản phẩm giàu chất xơ và có điểm đánh giá cảm quan tổng thể ở mức chấp nhận được. Bột vỏ dưa hấu là một nguồn nguyên liệu cung cấp chất xơ và chất chống oxy hóa để cải thiện chất lượng dinh dưỡng của mì pasta.
Từ khoá: vỏ dưa hấu, chất xơ, chất kháng oxy hóa, mì pasta

Bộ môn Công nghệ thực phẩm, Trường Đại học Bách khoa, Đại học Quốc gia Tp. Hồ Chí Minh, 268 Lý Thường Kiệt, Quận 10, Thành phố Hồ Chí Minh, Việt Nam

Liên hệ

Lê Văn Việt Mẫn, Bộ môn Công nghệ thực phẩm, Trường Đại học Bách khoa, Đại học Quốc gia Tp. Hồ Chí Minh, 268 Lý Thường Kiệt, Quận 10, Thành phố Hồ Chí Minh, Việt Nam

Email: lvvman@hcmut.edu.vn

Lịch sử
- Ngày nhận: 31-07-2022
- Ngày chấp nhận: 12-02-2023
- Ngày đăng: 11-3-2023

DOI : https://doi.org/10.32508/stdjet.v5i4.1032

Trích dẫn bài báo này: Quang L D, Miến T T, Trà T T T, Thúy L T, Nguyệt T N M, Mẫn L V V. **Mì pasta từ bột lúa mì cứng và vỏ dưa hấu: Ảnh hưởng của tỷ lệ bột vỏ dưa hấu đến chất lượng sản phẩm.** *Sci. Tech. Dev. J. - Eng. Tech.;* 2022, 5(4):1711-1718.