High-Fiber Extruded Purple Sweet Potato (*Ipomoea batatas*) and Kidney Bean (*Phaseolus vulgaris*) Extends the Feeling of Fullness by

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Supplementary Material

Table S1. Optimization of the development of extruded purple sweet potato and kidney beans.

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Trial	Experiment			Result	Problem solving
	Formulation	Temperature	Speed		
1	Experiment with the initial formula, using 100% purple sweet potato. The amount of wet dough = 30 mL of water or approximately ~1% of the dry dough weight	Thermo -control (TC)-1 = off TC2= 60°C TC-3 =110- 136°C	Auger = 34 Hz Screw = 34 Hz Cutter = 35 Hz	The extrudates have a brittle texture, a crispy and melty mouthfeel, a very bitter and burnt taste, and a brown color. The extrudate has a long shape even though the cutter is set at maximum speed. This is because the extrudate expands very quickly from the machine.	Lower the extrusion temperature on thermo-control 3 and turn off thermo-control 1 and 2 in the next experiment to avoid hollowness in the extrudate and excessive expansion. Additionally, the addition of granulated sugar is also not carried out to prevent burnt dough.
2	Elimination of granulated sugar from the formula.	TC 1 & 2 = off TC 3 = 80- 111°C	Auger = 34 Hz Screw = 34 Hz Cutter = 35 Hz	The extrudates have a crispy texture and melt slightly in the mouth, a very bitter and burnt taste, and a light brown color. The extrudate has a small ball-like shape with a rough surface.	Lowering the extrusion temperature back to

	Total wet dough = 30 mL of water or approximately ~1% of the dry dough weight				the initial setting at TC 3 = 60°C. Substituting 50% of rice flour with tapioca flour to improve the hardness of the extrudate and reduce the melting and stickiness in the mouth. Additionally, an experiment was conducted with the addition of red beans in the formula. Substituting 50% of water with oil to prevent hollowness and enhance the crispiness of the extrudate, and emulsion was added to mix water and oil.
3	Adding red beans in the experiment with a ratio of sweet potato flour to red bean flour = 1:1. Substituting 50% of rice flour with tapioca flour.	TC 1 & 2 = off TC 3 = 60- 93°C	Auger = 34 Hz Screw = 34 Hz Cutter = 35 Hz	The extrudates have a crispier texture and are slightly sticky in the mouth, with a slightly bitter and salty taste, and a light brown color with hints of purple streaks. The extrudate has a solid crescent shape with a rough surface.	Lowering the temperature on TC 3 back to 50°C to reduce the slightly bitter taste of the extrudate.

	The total wet dough = 15 ml of water and 15 ml of oil, or approximately ~1% of the dry dough weight				Speeding up the cooking process by increasing the screw and auger rotation to 40 Hz to maintain the purple color in the final extrudate. Reattempting the formula with 100% purple sweet potato and a 50% reduction in salt.
4	The formula uses 100% purple sweet potato and a 50% reduction in salt. Total wet dough = 15 mL of water and 15 mL of oil, or approximately ~1% of the dry dough weight.	TC 1 & 2 = off TC 3 = 50-88°C	Auger = 40 Hz Screw = 40 Hz Cutter = 35 Hz	The extrudates exhibit a crispy texture reminiscent of crackers. The extrudate is stickier in the mouth, the bitter taste has disappeared, and the color is heterogeneous, ranging from light purple to brownish. The extrudate has a solid cone-like shape and a larger size due to the significant expansion of the extrudate.	Lowering the temperature on TC 3 back to 30°C and reducing the screw and auger rotation to 27 Hz to prevent excessive expansion of the extrudate. The cutter blade speed is increased to 50 Hz to reduce the size of the extrudate. Reattempting the formula with the addition of red beans.
5	The formula uses red beans in the experiment with a ratio of purple sweet	TC 1 & 2 = off TC 3 = 30-76°C	Auger = 27 Hz Screw = 27 Hz Cutter = 50 Hz	The extrudates exhibit a crispy texture. The extrudate is not very sticky in the mouth, with a slightly sour taste, and a homogeneous light brown color.	Increasing the wet dough content to 10% with a water-to-oil ratio of 4:1.

	potato flour to red bean flour = 1:1. The total wet dough = 15 mL of water and 15 mL of oil, or approximately ~1% of the dry dough weight.			The extrudate has a ball-like shape with an irregular surface.	Additionally, the extrusion temperature is raised to 50°C to prevent moist extrudate results. Experimenting with a formula containing 100% purple sweet potato content.
6	The formula uses 100% purple sweet potato. The total wet dough content is 200 mL of water and 50 mL of oil, or approximately ~10% of the dry dough weight.	TC 1 & 2 = off TC 3 = 50-81°C	Auger = 27 Hz Screw = 27 Hz Cutter = 50 Hz	The extrudates have a crispy texture and are slightly hard. The extrudate is not very sticky in the mouth, with no bitter taste and a slight sweetness. The color of the extrudate is homogeneous, being a light purple but not overly intense. The shape of the extrudate is not homogeneous, with a relatively thick crescent and small cones.	Increasing the wet dough content to 20% with a water-to-oil ratio of 12:1. Additionally, the extrusion temperature is raised to 70°C to prevent moist extrudates. Experimenting with a formula using a ratio of purple sweet potato to red beans = 70%:30%.
7	The formula uses red beans in the experiment with a ratio of purple sweet potato flour to red bean flour = 70%:30%.	TC 3 = 70-85°C	Auger = 27 Hz Screw = 27 Hz Cutter = 50 Hz	The extrudates have a somewhat soft and moist texture. The extrudate is difficult to chew due to its moisture, and sticky in the mouth. The color of the extrudate is homogeneous, being somewhat brownish-purple.	Lowering the extrusion temperature to 50°C to prevent the extrudate from turning brown due to burning.

	The total wet dough content is 600 mL of water and 50 mL of oil, or approximately ~20% of the dry dough weight.			The shape of the extrudate is uniform, resembling a thick crescent.	Substituting tapioca flour with rice flour to prevent a sticky mouthfeel.
8	The formula incorporates red beans in the experiment with a purple sweet potato flour to red bean flour ratio of 70%:30%. Substituting tapioca flour with rice flour. The total wet dough content is 600 mL of water and 50 mL of oil, or approximately ~20% of the dry dough weight.	TC 1 &2 = off TC 3 = 50- 85°C	Auger = 27 Hz Screw = 27 Hz Cutter = 50 Hz	The extrudates have a soft and moist texture. The extrudate is difficult to chew or slightly elastic due to its moisture. The color of the extrudate is uniform, being a deep purple. The shape of the extrudate is uniform, resembling red bean seeds, and it does not expand.	Lowering the extrusion temperature to 50°C to prevent the extrudate from turning brown due to burning. Reducing the wet dough content to 12.5% with a water-to-oil ratio of 6:1.
9	The formula incorporates red beans in the experiment with a sweet potato flour to red bean flour ratio of 70%:30%. The total wet dough content is 300 mL of water and 50 mL of oil, or approximately	TC 1 & 2 = off TC 3 = 50-78°C	Auger =27 Hz Screw = 27 Hz Cutter = 50 Hz	The extrudates have a slightly soft texture due to moisture. The mouthfeel of the extrudate is fairly soft and slightly sticky. The color of the extrudate is uniform, being purple. The shape of the extrudate is uniform, resembling a crescent moon shape, but it has a wavy surface.	Reducing the water content to 10% with a water-to-oil ratio of 4:1. Increasing the screw and auger rotation speed to 45 Hz to assist in the extrudate expansion.

	~12.5% of the dry dough weight.				Trying a formula with a ratio of purple sweet potato flour to red bean flour = 80%:20%. Also attempting to use tapioca flour again with a tapioca flour to rice flour ratio of 50%:50%.
10	The formula incorporates red beans in the experiment with a sweet potato flour to red bean flour ratio of 80%:20%. The formula also uses tapioca flour again with a tapioca flour to rice flour ratio of 50%:50%. The total wet dough content is 200 mL of water and 50 mL of oil, or approximately ~10% of the dry dough weigh.	TC 1 & 2 = off TC 3 = 50-75°C	Auger = 45 Hz Screw = 45 Hz Cutter = 50 Hz	The extrudates have a fairly hard texture and a relatively hard mouthfeel when bitten. The color of the extrudate is uniform, being purple. The shape of the extrudate is uniform, resembling a crescent moon shape, but the extrudate does not expand and remains small in size.	Increasing the extrusion temperature to 70°C and substituting tapioca flour with rice flour to aid in the extrudates expanding more.
11	The formula incorporates red beans in the experiment with a purple sweet potato	TC 1 & 2 = off TC 3 = 70- 105°C	Auger = 45 Hz Screw = 45 Hz Cutter = 50 Hz	The extrudates have a fairly hard texture. The mouthfeel of the extrudate is quite crispy but still somewhat hard.	Trying to substitute 50% of rice flour with cornstarch to achieve extrudate results that expand

	flour to red bean flour ratio of 80%:20%. Substituting tapioca flour with rice flour. The total wet dough content is 200 mL of water and 50 mL of oil, or approximately ~10% of the dry dough weight.			The color of the extrudate is uniform, being somewhat brownish-purple. The shape of the extrudate is uniform, resembling a crescent moon shape that has expanded quite a bit, but it has a wavy surface.	more, thus avoiding a wavy surface on the extrudate.
12	The formula incorporates red beans in the experiment with a purple sweet potato flour to red bean flour ratio of 80%:20%. Substituting 50% of rice flour with cornstarch. The total wet dough content is 200 mL of water and 50 mL of oil, or approximately ~10% of the dry dough weight.	TC 1 & 2 = off TC 3 = 70- 105°C	Auger = 45 Hz Screw = 45 Hz Cutter = 50 Hz	The extrudates have a texture that is easier to break. The mouthfeel of the extrudate is fairly crispy. The color of the extrudate is uniform, being purple with brown streaks. The shape of the extrudate is uniform, resembling a crescent moon shape that has expanded quite a bit.	Reducing the use of powdered milk to prevent brown color due to the Maillard reaction. Lowering the initial extrusion temperature to 60°C to prevent hollowness. Experimenting with a formula using 100% purple yam flour as the main ingredient.
13	The formula with the main ingredient being 100% purple sweet potato flour.	TC 1 & 2 = off TC 3 = 60- 90°C	Auger = 45 Hz Screw = 45 Hz Cutter = 50 Hz	The extrudates have a texture that is easier to break.	-

	Reducing the use of powdered milk.	The mouthfeel of the extrudate is quite crispy but still somewhat hard. The color of the extrudate is uniform, being quite intense purple.
	The total wet dough content is 200 mL of water and 50 mL of oil, or approximately ~10% of the dry dough weight.	The shape of the extrudate is uniform, resembling a crescent moon shape that has expanded quite a bit.