

Improving the Quality of Composite Bread Using Amylolytic Hydrolyzed Orange Sweet Potato Flour and Hydroxypropyl Methylcellulose

by

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Supplementary Materials

SCORING FOR SAMPLE SELECTION

The ranking analysis was performed using the weighted similarity index. First, the similarity index (SI) for each physical characteristic was calculated using Equation (1), with wheat bread (A0H0) used as the reference sample. Subsequently, the weighted similarity index was obtained by multiplying the SI of each physical characteristic by its corresponding weighting factor (W_i), which reflected the relative importance of each physical characteristic in determining similarity to wheat bread, and summing the resulting values according to Equation (2). Composite bread formulations were then ranked based on their weighted similarity index, with higher values indicating physical characteristics closer to those of wheat bread. Since the objective of this study was to identify the most promising composite bread formulation, the formulations (A0H1 and A0H2) were excluded from the final selection despite their high similarity scores.

$$SI = 1 - \frac{|X_i - X_{control}|}{X_{control}} \quad \dots (1)$$

$$\text{Weighted SI} = \sum (W_i \times SI_i) \quad \dots (2)$$

where: SI is the similarity index; X_i is the value of a given physical characteristic of the evaluated composite bread formulation; $X_{control}$ is the corresponding value of the same physical characteristic of the wheat bread (A0H0) used as the reference sample; Weighted SI is the weighted similarity index; W_i is the weighting factor assigned to each physical characteristic; and SI_i is the similarity index of the i th physical characteristic. All calculations were performed using Microsoft Excel for Microsoft 365 (Microsoft Corporation, Redmond, WA, USA)

Table S1. Result score of composite bread characteristics.

Sample	Volume (30%)		Specific volume (25%)		Cohesiveness (5%)		Chewiness (15%)		Resilience (5%)		Hardness (20%)		Total
	<i>X</i>	SI	<i>X</i>	SI	<i>X</i>	SI	<i>X</i>	SI	<i>X</i>	SI	<i>X</i>	SI	
A0H0	1073	0.00	2.99	0.00	0.75	0.00	8.100	0.00	0.35	0.00	10.62	0.00	1.00
A0H1	1143	0.93	3.22	0.92	0.87	0.84	5.697	0.70	0.43	0.77	6.433	0.61	0.82
A0H2	1219	0.86	3.30	0.90	0.81	0.91	5.810	0.72	0.42	0.81	7.008	0.66	0.81
A1H0	864.0	0.81	2.36	0.79	0.77	0.97	12.53	0.45	0.43	0.78	15.94	0.50	0.69
A1H1	802.7	0.75	2.24	0.75	0.71	0.94	20.33	0.00	0.35	0.99	28.23	0.00	0.51
A1H2	825.0	0.77	2.27	0.76	0.81	0.92	12.41	0.47	0.45	0.72	15.11	0.58	0.69
A2H0	812.7	0.76	2.25	0.75	0.80	0.93	12.18	0.50	0.49	0.61	15.01	0.59	0.68
A2H1	732.7	0.68	2.01	0.67	0.80	0.93	17.50	0.00	0.48	0.63	21.48	0.00	0.45
A2H2	716.7	0.67	2.04	0.68	0.69	0.92	26.82	0.00	0.36	0.98	38.25	0.00	0.47
A3H0	705.3	0.66	1.94	0.65	0.82	0.90	32.02	0.00	0.44	0.74	38.06	0.00	0.44
A3H1	557.7	0.52	1.48	0.49	0.88	0.82	34.15	0.00	0.41	0.84	38.30	0.00	0.36
A3H2	565.0	0.53	1.57	0.53	0.84	0.88	33.28	0.00	0.42	0.81	38.93	0.00	0.37
A4H0	552.7	0.52	1.44	0.48	0.78	0.96	32.92	0.00	0.39	0.89	41.46	0.00	0.37

Bold rows indicate the three highest-ranked composite bread formulations based on the weighted similarity index using wheat bread (A0H0) as the reference sample. Although A0H1 and A0H2 showed high similarity scores, they were excluded from the final ranking because only composite bread formulations were considered.

RAW DATA FOR COMPOSITE BREAD PHYSICAL CHARACTERISTICS

Table S2. Bread physical characteristics.

Sample	Volume (mL)	Specific volume (mL/g)	Cohesiveness	Chewiness (N)	Resilience	Hardness (N)
A0H0	1073.0±4.4 ^c	2.99±0.01 ^c	0.75±0.05 ^{ab}	8.1±0.7 ^f	0.35±0.70 ^b	10.6±1.0 ^{de}
A0H1	1143.3±8.3 ^b	3.22±0.02 ^b	0.87±0.64 ^a	5.7±1.0 ^f	0.43±0.05 ^{ab}	6.4±0.9 ^e
A0H2	1218.7±10.0 ^a	3.30± 0.03 ^a	0.81±0.04 ^{ab}	5.8±0.5 ^f	0.42±0.06 ^{ab}	7.0±0.8 ^e
A1H0	864.0±6.6 ^d	2.36± 0.02 ^d	0.77±0.01 ^{ab}	12.5±1.1 ^{ef}	0.43±0.05 ^{ab}	15.9±1.5 ^{cd}
A1H1	802.7±2.5 ^f	2.24± 0.01 ^e	0.71±0.04 ^b	20.3±0.8 ^{cd}	0.35±0.06 ^b	28.2±1.9 ^b
A1H2	825.0±3.0 ^e	2.27± 0.01 ^e	0.81±0.03 ^{ab}	12.4±2.0 ^{ef}	0.45±0.04 ^{ab}	15.1±2.7 ^{cd}
A2H0	812.7±6.4 ^{ef}	2.25±0.02 ^e	0.80±0.03 ^{ab}	12.2±1.5 ^{ef}	0.49±0.04 ^{ab}	15.0±2.3 ^{cd}
A2H1	732.7±2.5 ^g	2.01±0.01 ^f	0.80±0.03 ^{ab}	17.5±5.5 ^{de}	0.48±0.04 ^{ab}	21.5±6.9 ^{bc}
A2H2	716.7±2.9 ^{gh}	2.04±0.01 ^f	0.69±0.03 ^b	26.8±4.0 ^{bc}	0.36±0.05 ^b	38.3±6.0 ^a
A3H0	705.3±4.5 ^h	1.94±0.01 ^g	0.82±0.08 ^b	32.0±5.9 ^{ab}	0.44±0.08 ^{ab}	38.1±5.9 ^a
A3H1	557.7±8.7 ^{ij}	1.48±0.02 ⁱ	0.88±0.14 ^a	34.2±4.9 ^a	0.41±0.04 ^{ab}	38.3±5.2 ^a
A3H2	565.0± 5.6 ⁱ	1.57±0.02 ^h	0.84±0.05 ^{ab}	33.3±5.2 ^{ab}	0.42±0.03 ^{ab}	38.9±5.2 ^a
A4H0	552.7±2.1 ^{ij}	1.44±0.01 ^j	0.78±0.10 ^{ab}	32.9±5.2 ^{ab}	0.39±0.08 ^{ab}	41.5±4.8 ^a
A4H1	533.3±1.5 ^k	1.42±0.00 ^j	ND	ND	ND	ND
A4H2	544.3±1.5 ^{jk}	1.43±0.00 ^j	ND	ND	ND	ND
Factor						
A	< 0.0001	< 0.0001	0.008	<0.0001	0.201	<0.0001
H	< 0.0001	< 0.0001	0.386	0.003	0.681	<0.0001
A×H	< 0.0001	< 0.0001	0.007	<0.0001	0.001	<0.0001

Values are expressed as mean ± standard deviation. Mean values within the same column followed by the different letters are significantly different ($p<0.05$) according to Tukey's multiple comparison test. Two-way ANOVA revealed significant effects of both main factors and their interaction ($p<0.05$). A, hydrolyzed orange sweet potato flour (HOSPF); H, hydroxypropyl methylcellulose (HPMC), ND; not detected.