

The impact of maltodextrin and inulin on the protection of natural antioxidants in powders made of Saskatoon berry fruit, juice, and pomace as functional food ingredients

Sabina Lachowicz ^{1,*}, Anna Michalska-Ciechanowska ² and Jan Oszmiański ²

¹ Department of Fermentation and Cereals Technology, Faculty of Biotechnology and Food Science, Wrocław University of Environmental and Life Sciences, 51–630 Wrocław, Poland

² Department of Fruit, Vegetable and Plant Nutraceutical Technology, Faculty of Biotechnology and Food Science, Wrocław University of Environmental and Life Sciences, 51–630 Wrocław, Poland; anna.michalska@upwr.edu.pl (A.M.-C.), jan.oszmianski@upwr.edu.pl (J.O.)

* Correspondence: sabina.lachowicz@upwr.edu.pl

Table 1. Identification and quantification of flavan-3-ols [mg/100 g d.m.] in fruit, juice, and pomace powders made from Saskatoon berry.

Drying method	Carrier	Con. [%]	PB4	PB4	PA2	PB2	Cat	PB3	Epi	PB3	PB4	PB4	PB3	PB3	PB4	PB4	DP
FRUIT																	
FD	Inulin	30	237.8 ± 4.8	7.7 ± 0.2	82.7 ± 1.7	49.5 ± 1.0	31.6 ± 0.6	42.4 ± 0.8	4.4 ± 0.1	ND	34.3 ± 0.7	5.0 ± 0.1	16.4 ± 0.3	6.5 ± 0.1	30.5 ± 0.6	49.1 ± 1.0	8.6 ± 0.2
		40	235.7 ± 4.7	4.0 ± 0.1	76.3 ± 1.5	47.2 ± 0.9	22.8 ± 0.5	33.3 ± 0.7	5.2 ± 0.1	ND	26.6 ± 0.5	5.2 ± 0.1	14.3 ± 0.3	6.0 ± 0.1	32.5 ± 0.7	48.4 ± 1.0	9.7 ± 0.2
		50	245.1 ± 4.9	3.1 ± 0.1	50.0 ± 1.0	45.5 ± 0.9	15.1 ± 0.3	25.6 ± 0.5	6.6 ± 0.1	ND	25.0 ± 0.5	5.3 ± 0.1	13.6 ± 0.3	4.1 ± 0.1	32.8 ± 0.7	38.9 ± 0.8	7.6 ± 0.2
	Maltodextrin	30	212.9 ± 4.3	4.8 ± 0.1	70.5 ± 1.4	53.1 ± 1.1	24.8 ± 0.5	58.1 ± 1.2	5.6 ± 0.1	ND	58.7 ± 1.2	4.9 ± 0.1	16.5 ± 0.3	5.9 ± 0.1	30.9 ± 0.6	46.0 ± 0.9	8.1 ± 0.2
		40	220.3 ± 4.4	3.5 ± 0.1	79.6 ± 1.6	38.6 ± 0.8	24.6 ± 0.5	39.8 ± 0.8	2.1 ± 0.0	ND	52.4 ± 1.0	4.8 ± 0.1	15.6 ± 0.3	5.8 ± 0.1	29.3 ± 0.6	44.4 ± 0.9	9.7 ± 0.2
		50	218.2 ± 4.4	2.3 ± 0.1	48.2 ± 1.0	25.7 ± 0.5	15.2 ± 0.3	27.4 ± 0.5	2.7 ± 0.1	ND	27.2 ± 0.5	4.2 ± 0.1	14.1 ± 0.3	3.8 ± 0.1	34.0 ± 0.7	40.8 ± 0.8	7.7 ± 0.2
VD/50	Inulin	30	229.4 ± 4.6	3.4 ± 0.1	65.3 ± 1.3	32.8 ± 0.7	22.4 ± 0.4	40.0 ± 0.8	2.7 ± 0.1	3.0 ± 0.1	30.3 ± 0.6	7.8 ± 0.2	29.9 ± 0.6	5.1 ± 0.1	32.4 ± 0.6	46.1 ± 0.9	8.6 ± 0.2
		40	244.5 ± 4.9	2.5 ± 0.1	45.2 ± 0.9	51.9 ± 1.0	17.4 ± 0.3	24.5 ± 0.5	2.6 ± 0.1	2.7 ± 0.1	38.6 ± 0.8	5.8 ± 0.1	11.8 ± 0.2	4.9 ± 0.1	33.6 ± 0.7	46.6 ± 0.9	9.5 ± 0.2
		50	237.3 ± 4.7	2.1 ± 0.1	31.1 ± 0.6	15.5 ± 0.3	11.5 ± 0.2	20.8 ± 0.4	2.1 ± 0.1	0.7 ± 0.0	28.0 ± 0.6	5.5 ± 0.1	9.3 ± 0.2	3.5 ± 0.1	29.4 ± 0.6	41.3 ± 0.8	8.4 ± 0.2
	Maltodextrin	30	218.5 ± 4.4	3.7 ± 0.1	51.2 ± 1.0	30.1 ± 0.6	20.6 ± 0.4	43.9 ± 0.9	3.6 ± 0.1	5.8 ± 0.1	31.4 ± 0.6	6.8 ± 0.1	22.1 ± 0.4	4.0 ± 0.1	29.6 ± 0.6	46.0 ± 0.9	8.8 ± 0.2
		40	246.7 ± 4.9	2.4 ± 0.1	45.5 ± 0.9	16.5 ± 0.3	16.5 ± 0.3	31.3 ± 0.6	2.7 ± 0.1	3.7 ± 0.1	30.6 ± 0.6	5.6 ± 0.1	16.4 ± 0.3	2.3 ± 0.1	30.2 ± 0.6	50.2 ± 1.0	9.5 ± 0.2
		50	237.4 ± 4.7	2.1 ± 0.1	33.0 ± 0.7	12.6 ± 0.3	9.9 ± 0.2	22.4 ± 0.4	2.2 ± 0.1	1.2 ± 0.0	27.8 ± 0.6	3.8 ± 0.1	14.5 ± 0.3	1.9 ± 0.1	28.6 ± 0.6	43.2 ± 0.9	7.9 ± 0.2
VD/60	Inulin	30	236.0 ± 4.7	2.8 ± 0.1	68.0 ± 1.4	36.3 ± 0.7	22.4 ± 0.4	49.8 ± 1.0	2.9 ± 0.1	5.0 ± 0.1	55.0 ± 1.1	11.0 ± 0.2	3.6 ± 0.1	3.7 ± 0.1	33.7 ± 0.7	45.9 ± 0.9	8.9 ± 0.2
		40	238.3 ± 4.8	2.5 ± 0.1	44.3 ± 0.9	25.3 ± 0.5	13.0 ± 0.3	29.8 ± 0.6	2.6 ± 0.1	2.8 ± 0.1	37.6 ± 0.8	10.6 ± 0.2	12.9 ± 0.3	3.2 ± 0.1	30.8 ± 0.6	44.0 ± 0.9	9.7 ± 0.2
		50	246.1 ± 4.9	2.2 ± 0.1	40.2 ± 0.8	27.0 ± 0.5	11.6 ± 0.2	21.9 ± 0.4	1.6 ± 0.1	1.9 ± 0.1	29.9 ± 0.6	3.2 ± 0.1	7.9 ± 0.2	3.3 ± 0.1	29.7 ± 0.6	41.9 ± 0.8	8.4 ± 0.2
	Maltodextrin	30	229.6 ± 4.6	3.3 ± 0.1	49.1 ± 1.0	23.1 ± 0.5	16.5 ± 0.3	43.7 ± 0.9	3.6 ± 0.1	6.1 ± 0.1	52.3 ± 1.0	7.2 ± 0.1	20.2 ± 0.4	1.7 ± 0.1	28.7 ± 0.6	44.3 ± 0.9	8.6 ± 0.2
		40	219.5 ± 4.4	3.0 ± 0.1	37.8 ± 0.8	18.0 ± 0.4	11.1 ± 0.2	26.3 ± 0.5	2.6 ± 0.1	4.2 ± 0.1	17.1 ± 0.3	4.2 ± 0.1	19.8 ± 0.4	1.0 ± 0.1	17.9 ± 0.4	33.3 ± 0.7	9.7 ± 0.2
		50	237.8 ± 4.8	2.2 ± 0.1	27.4 ± 0.5	7.3 ± 0.1	8.4 ± 0.2	20.3 ± 0.4	2.3 ± 0.1	2.4 ± 0.1	28.6 ± 0.6	3.1 ± 0.1	14.8 ± 0.3	1.0 ± 0.1	31.5 ± 0.6	46.4 ± 0.9	8.4 ± 0.2
POMACE																	
FD	Inulin	30	223.4 ± 4.5	7.5 ± 0.2	7.5 ± 0.1	14.8 ± 0.3	3.9 ± 0.1	66.2 ± 1.3	14.2 ± 0.3	9.8 ± 0.2	27.3 ± 0.5	15.5 ± 0.3	63.5 ± 1.3	6.6 ± 0.1	30.1 ± 0.6	41.8 ± 0.8	9.6 ± 0.2
		40	231.3 ± 4.6	6.9 ± 0.1	3.6 ± 0.1	13.7 ± 0.3	3.6 ± 0.1	45.8 ± 0.9	12.3 ± 0.2	8.8 ± 0.2	25.4 ± 0.5	12.2 ± 0.2	51.4 ± 1	3.7 ± 0.1	32.1 ± 0.6	40.9 ± 0.8	9.7 ± 0.2

	Maltodextrin	50	230.8 ± 4.6	5.1 ± 0.1	3.0 ± 0.1	8.9 ± 0.2	2.8 ± 0.1	41.1 ± 0.8	11.8 ± 0.2	7.7 ± 0.2	13.1 ± 0.1	7.4 ± 0.1	22.5 ± 0.4	5.1 ± 0.1	26.6 ± 0.5	40.0 ± 0.8	9.5 ± 0.2	
		30	234.4 ± 4.7	7.5 ± 0.1	4.6 ± 0.1	12.5 ± 0.2	5.4 ± 0.1	65.0 ± 1.3	15.0 ± 0.3	10.5 ± 0.2	32.2 ± 0.6	11.8 ± 0.2	31.2 ± 0.6	12.2 ± 0.2	27.3 ± 0.5	41.9 ± 0.8	9.0 ± 0.2	
		40	229.9 ± 4.6	7.2 ± 0.1	4.6 ± 0.1	11.0 ± 0.2	3.9 ± 0.1	56.9 ± 1.1	13.1 ± 0.3	9.8 ± 0.2	26.5 ± 0.5	12.4 ± 0.2	65.6 ± 1.3	7.1 ± 0.1	26.8 ± 0.5	38.0 ± 0.8	9.7 ± 0.2	
		50	199.9 ± 4.0	5.7 ± 0.1	3.3 ± 0.1	10.2 ± 0.2	2.2 ± 0.1	44.1 ± 0.9	12.2 ± 0.2	5.4 ± 0.1	16.1 ± 0.3	8.5 ± 0.2	28.9 ± 0.6	7.4 ± 0.1	24.5 ± 0.5	39.7 ± 0.8	9.9 ± 0.2	
		VD/50	Inulin	30	221.4 ± 4.4	3.8 ± 0.1	4.2 ± 0.1	18.2 ± 0.4	16.6 ± 0.3	41.0 ± 0.8	29.9 ± 0.6	5.9 ± 0.1	20.8 ± 0.4	10.1 ± 0.2	20 ± 0.4	10.1 ± 0.2	26.3 ± 0.5	37.1 ± 0.7
40	234.2 ± 4.7			3.1 ± 0.1	4.0 ± 0.1	14.1 ± 0.3	10.0 ± 0.2	28.8 ± 0.6	21.6 ± 0.4	2.7 ± 0.1	16.8 ± 0.3	8.5 ± 0.2	16.0 ± 0.3	6.5 ± 0.1	23.1 ± 0.5	42.0 ± 0.8	10.0 ± 0.2	
Maltodextrin	50		233.3 ± 4.7	2.6 ± 0.1	1.9 ± 0.0	11.3 ± 0.2	6.6 ± 0.1	22.1 ± 0.4	18.6 ± 0.4	3.6 ± 0.1	14.0 ± 0.3	4.6 ± 0.1	14.6 ± 0.3	6.8 ± 0.1	30.2 ± 0.6	42.0 ± 0.8	9.8 ± 0.2	
	30		237.3 ± 4.7	4.9 ± 0.1	5.0 ± 0.1	18.5 ± 0.4	12.5 ± 0.3	43.1 ± 0.9	27.3 ± 0.5	5.2 ± 0.1	24.7 ± 0.5	8.1 ± 0.2	52.2 ± 1.0	13.1 ± 0.3	30.2 ± 0.6	40.2 ± 0.8	10.0 ± 0.2	
	40		232.2 ± 4.6	4.6 ± 0.1	3.6 ± 0.1	14.3 ± 0.3	11.2 ± 0.2	30.3 ± 0.6	22.2 ± 0.4	5.3 ± 0.1	17.0 ± 0.3	6.3 ± 0.1	42.2 ± 0.8	10.5 ± 0.2	28.6 ± 0.6	42.9 ± 0.9	10.2 ± 0.2	
50	229.1 ± 4.6	3.4 ± 0.1	2.5 ± 0.1	11.6 ± 0.2	6.6 ± 0.1	31.5 ± 0.6	17.2 ± 0.3	3.8 ± 0.1	14.1 ± 0.3	5.7 ± 0.1	27.1 ± 0.5	7.6 ± 0.2	28.2 ± 0.6	39.0 ± 0.8	10.1 ± 0.2			
	VD/60	Inulin	30	235.9 ± 4.7	2.0 ± 0.1	4.6 ± 0.1	71.6 ± 1.4	14.7 ± 0.3	33.9 ± 0.7	31.1 ± 0.6	2.7 ± 0.1	19.2 ± 0.4	10.5 ± 0.2	26.4 ± 0.5	8.4 ± 0.2	29.5 ± 0.6	43.1 ± 0.9	10.7 ± 0.2
			40	260.9 ± 5.2	2.2 ± 0.1	1.6 ± 0.1	71.0 ± 1.4	13.1 ± 0.3	32.3 ± 0.6	27.7 ± 0.6	2.4 ± 0.1	17.0 ± 0.3	9.0 ± 0.2	21.1 ± 0.4	9.8 ± 0.2	30.8 ± 0.6	46.9 ± 0.9	11.0 ± 0.2
		Maltodextrin	50	252.1 ± 5.0	0.7 ± 0.1	7.5 ± 0.2	33.4 ± 0.7	10.4 ± 0.2	26.3 ± 0.5	21.2 ± 0.4	3.2 ± 0.1	14.5 ± 0.3	3.7 ± 0.1	15.5 ± 0.3	7.7 ± 0.2	24.3 ± 0.5	45.2 ± 0.9	9.8 ± 0.2
			30	250.1 ± 5.0	6.5 ± 0.1	8.2 ± 0.2	28.1 ± 0.6	16.9 ± 0.3	53.8 ± 1.1	30.3 ± 0.6	2.9 ± 0.1	21.2 ± 0.4	11.0 ± 0.2	31.6 ± 0.6	10.8 ± 0.2	30.5 ± 0.6	46.4 ± 0.9	10.8 ± 0.2
			40	248.5 ± 5.0	4.1 ± 0.1	7.0 ± 0.1	23.9 ± 0.5	13.7 ± 0.3	45.0 ± 0.9	25.7 ± 0.5	3.3 ± 0.1	16.1 ± 0.3	8.0 ± 0.2	31.1 ± 0.6	8.9 ± 0.2	31.7 ± 0.6	46.2 ± 0.9	10.7 ± 0.2
50	248.1 ± 5.0	3.7 ± 0.1	1.7 ± 0.1	16.3 ± 0.3	9.1 ± 0.2	26.5 ± 0.5	24.7 ± 0.5	5.2 ± 0.1	11.2 ± 0.2	5.9 ± 0.1	17.1 ± 0.3	7.7 ± 0.2	34.3 ± 0.7	45.0 ± 0.9	10.5 ± 0.2			
JUICE																		
	FD	Inulin	30	237.6 ± 4.8	6.8 ± 0.1	8.7 ± 0.2	19.4 ± 0.4	18.8 ± 0.4	38.5 ± 0.8	2.4 ± 0.1	1.0 ± 0.1	29.5 ± 0.6	6.0 ± 0.1	5.1 ± 0.1	2.1 ± 0.1	28.8 ± 0.6	44.3 ± 0.9	8.7 ± 0.2
			40	238.8 ± 4.8	4.5 ± 0.1	7.9 ± 0.2	14.9 ± 0.3	14.5 ± 0.3	22.8 ± 0.5	1.4 ± 0.1	0.7 ± 0.1	19.0 ± 0.4	4.3 ± 0.1	3.4 ± 0.1	1.2 ± 0.1	30.6 ± 0.6	42.6 ± 0.9	8.1 ± 0.2
		Maltodextrin	50	235.1 ± 4.7	1.5 ± 0.1	6.7 ± 0.1	9.0 ± 0.2	10.4 ± 0.2	16.5 ± 0.3	0.2 ± 0.1	0.6 ± 0.1	4.1 ± 0.1	4.2 ± 0.1	1.3 ± 0.1	2.4 ± 0.1	18.9 ± 0.4	13.4 ± 0.3	8.9 ± 0.2
			30	235.8 ± 4.7	6.1 ± 0.1	6.6 ± 0.1	14.2 ± 0.3	15.0 ± 0.3	45.4 ± 0.9	1.9 ± 0.1	0.4 ± 0.1	29.0 ± 0.6	6.6 ± 0.1	7.9 ± 0.2	6.4 ± 0.1	27.8 ± 0.6	44.3 ± 0.9	4.7 ± 0.1
			40	231.7 ± 4.6	4.5 ± 0.1	4.9 ± 0.1	10.3 ± 0.2	8.3 ± 0.2	34.6 ± 0.7	1.4 ± 0.1	0.3 ± 0.1	20.5 ± 0.4	5.9 ± 0.1	6.0 ± 0.1	3.4 ± 0.1	32.7 ± 0.7	42.9 ± 0.9	4.6 ± 0.1
50	229.9 ± 4.6	3.0 ± 0.1	2.7 ± 0.1	9.8 ± 0.2	7.6 ± 0.2	20.4 ± 0.4	1.0 ± 0.1	0.1 ± 0.1	14.9 ± 0.3	5.5 ± 0.1	4.7 ± 0.1	3.4 ± 0.1	28.2 ± 0.6	42.6 ± 0.9	5.0 ± 0.1			
	VD/50	Inulin	30	236.3 ± 4.7	4.8 ± 0.1	7.2 ± 0.1	15.4 ± 0.3	14.4 ± 0.3	28.1 ± 0.6	2.8 ± 0.1	6.0 ± 0.1	22.7 ± 0.5	6.8 ± 0.1	5.4 ± 0.1	3.7 ± 0.1	32.6 ± 0.7	41.7 ± 0.8	7.4 ± 0.1
			40	215.2 ± 4.3	3.9 ± 0.1	6.5 ± 0.1	12.3 ± 0.2	12.3 ± 0.2	22.7 ± 0.5	1.8 ± 0.1	5.6 ± 0.1	18.0 ± 0.4	6.3 ± 0.1	5.2 ± 0.1	6.0 ± 0.1	27.9 ± 0.6	36.6 ± 0.7	7.7 ± 0.2
		Maltodextrin	50	237.1 ± 4.7	2.7 ± 0.1	5.4 ± 0.1	8.9 ± 0.2	10.5 ± 0.2	18.1 ± 0.4	0.8 ± 0.1	3.2 ± 0.1	13.6 ± 0.3	5.8 ± 0.1	4.1 ± 0.1	8.4 ± 0.2	28.4 ± 0.6	41.1 ± 0.8	7.7 ± 0.2
			30	229.1 ± 4.6	4.9 ± 0.1	5.5 ± 0.1	16.5 ± 0.3	17.1 ± 0.3	36.0 ± 0.7	2.4 ± 0.1	7.1 ± 0.1	23.7 ± 0.5	6.1 ± 0.1	7.7 ± 0.2	7.6 ± 0.2	27.2 ± 0.5	42.3 ± 0.8	4.6 ± 0.1
			40	229.8 ± 4.6	3.8 ± 0.1	4.1 ± 0.1	11.1 ± 0.2	13.7 ± 0.3	29.2 ± 0.6	1.2 ± 0.1	1.1 ± 0.1	17.7 ± 0.4	4.3 ± 0.1	6.2 ± 0.1	7.6 ± 0.2	30.3 ± 0.6	43.0 ± 0.9	4.6 ± 0.1
50	226.4 ± 4.5	2.7 ± 0.1	3.3 ± 0.1	8.8 ± 0.2	11.3 ± 0.2	21.6 ± 0.4	1.3 ± 0.1	1.1 ± 0.1	13.2 ± 0.3	3.7 ± 0.1	4.7 ± 0.1	6.7 ± 0.1	30.2 ± 0.6	40.8 ± 0.8	5.0 ± 0.1			
	VD/60	Inulin	30	263.1 ± 5.3	5.4 ± 0.1	5.9 ± 0.1	19.9 ± 0.4	17.6 ± 0.4	29.7 ± 0.6	5.8 ± 0.1	6.8 ± 0.1	25.5 ± 0.5	7.1 ± 0.1	8.1 ± 0.2	8.0 ± 0.2	31.7 ± 0.6	48.9 ± 1.0	8.5 ± 0.2
			40	244.9 ± 4.9	3.0 ± 0.1	5.9 ± 0.1	14.7 ± 0.3	12.1 ± 0.2	15.3 ± 0.3	3.5 ± 0.1	2.8 ± 0.1	14.7 ± 0.3	4.1 ± 0.1	4.0 ± 0.1	7.4 ± 0.1	30.0 ± 0.6	45.9 ± 0.9	8.5 ± 0.2
		Maltodextrin	50	233.7 ± 4.7	4.3 ± 0.1	5.5 ± 0.1	11.7 ± 0.2	12.1 ± 0.2	15.2 ± 0.3	3.2 ± 0.1	1.0 ± 0.1	20.1 ± 0.4	3.2 ± 0.1	5.7 ± 0.1	5.7 ± 0.1	26.6 ± 0.5	42.4 ± 0.8	8.8 ± 0.2
			30	251.2 ± 5.0	5.9 ± 0.1	6.7 ± 0.1	19.7 ± 0.4	19.4 ± 0.4	33.3 ± 0.7	5.2 ± 0.1	3.7 ± 0.1	26.8 ± 0.5	5.5 ± 0.1	6.8 ± 0.1	5.3 ± 0.1	23.0 ± 0.5	44.5 ± 0.9	4.1 ± 0.1
			40	244.0 ± 4.9	4.5 ± 0.1	4.7 ± 0.1	13.4 ± 0.3	13.8 ± 0.3	29.7 ± 0.6	3.1 ± 0.1	3.0 ± 0.1	18.9 ± 0.4	3.7 ± 0.1	6.3 ± 0.1	5.0 ± 0.1	21.0 ± 0.4	44.5 ± 0.9	4.9 ± 0.1
50	244.7 ± 4.9	2.8 ± 0.1	3.0 ± 0.1	8.6 ± 0.2	6.9 ± 0.1	20.3 ± 0.4	2.7 ± 0.1	2.8 ± 0.1	13.6 ± 0.3	3.3 ± 0.1	3.8 ± 0.1	4.7 ± 0.1	20.0 ± 0.4	40.7 ± 0.8	5.8 ± 0.1			

¹ Values are expressed as the mean ($n = 3$) ± standard deviation. ND, no detect; FD, freeze-drying; VD/50, vacuum-drying in 50 °C; VD/60, vacuum-drying in 60 °C; PP, polymeric procyanidins; F3O, sum of flavan-3-ols (monomers, oligomers, and polymers); DP, degree of polymerization; Epi, (–)-epicatechin; Cat, (+)-catechin; PB4, B-type procyanidin tetramer; PB3, B-type procyanidin trimer; PB2, B-type procyanidin dimer; PA2, A-type procyanidin dimer.

Table 2. Identification and quantification of anthocyanins [mg/100 g d.m.] in the fruit, juice, and pomace powders made from Saskatoon berry.

Drying method	Type of carriers	Con. [%]	C-3-O-gal	C-3-O-glu	C-3-O-ara	C-3-O-xyl	C	C
FRUIT								
FD	Inulin	30	1717.5 ± 34.4	460.7 ± 9.2	110.3 ± 2.2	166.3 ± 3.3	2.8 ± 0.1	ND
		40	1276.4 ± 25.5	362.0 ± 7.2	103.0 ± 2.1	144.6 ± 2.9	1.7 ± 0.1	ND
		50	871.3 ± 17.4	258.7 ± 5.2	59.9 ± 1.2	91.0 ± 1.8	1.0 ± 0.1	ND
	Maltodextrin	30	1562.0 ± 31.2	440.0 ± 8.8	66.7 ± 1.3	125.1 ± 2.5	2.1 ± 0.1	ND
		40	1003.4 ± 20.1	277.4 ± 5.5	107.7 ± 2.2	107.4 ± 2.1	1.9 ± 0.1	ND
		50	791.2 ± 15.8	192.5 ± 3.8	52.6 ± 1.1	74.3 ± 1.5	1.2 ± 0.1	ND
VD/50	Inulin	30	619.1 ± 12.4	63.8 ± 1.3	24.7 ± 0.5	31.3 ± 0.6	1.1 ± 0.1	1.4 ± 0.1
		40	668.9 ± 13.4	60.3 ± 1.2	38.5 ± 0.8	38.4 ± 0.8	1.9 ± 0.1	1.5 ± 0.1
		50	527.5 ± 10.5	41.8 ± 0.8	19.5 ± 0.4	26.5 ± 0.5	1.2 ± 0.1	1.0 ± 0.1
	Maltodextrin	30	767.1 ± 15.3	63.9 ± 1.3	20.6 ± 0.4	42.0 ± 0.8	3 ± 0.1.1	1.2 ± 0.1
		40	556.3 ± 11.1	51.9 ± 1.0	38.5 ± 0.8	31.3 ± 0.6	2.4 ± 0.1	1.3 ± 0.1
		50	419.2 ± 8.4	38.3 ± 0.8	15.1 ± 0.3	21.7 ± 0.4	1.1 ± 0.1	1.1 ± 0.1
VD/60	Inulin	30	731.3 ± 14.6	78.4 ± 1.6	23.0 ± 0.5	38.9 ± 0.8	1.5 ± 0.1	1.3 ± 0.1
		40	548.1 ± 11.0	47.7 ± 1.0	38.4 ± 0.8	28.0 ± 0.6	2.3 ± 0.1	1.4 ± 0.1
		50	478.5 ± 9.6	33.7 ± 0.7	20.1 ± 0.4	21.4 ± 0.4	0.7 ± 0.1	1.5 ± 0.1
	Maltodextrin	30	614.7 ± 12.3	57.0 ± 1.1	18.6 ± 0.4	39.6 ± 0.8	3 ± 0.1.1	2.3 ± 0.1
		40	489.9 ± 9.8	46.9 ± 0.9	26.5 ± 0.5	25.7 ± 0.5	1.7 ± 0.1	1.8 ± 0.1
		50	416.5 ± 8.3	41.0 ± 0.8	12.3 ± 0.2	21.6 ± 0.4	1.3 ± 0.1	1.0 ± 0.1
POMACE								
FD	Inulin	30	2420.2 ± 48.4	787.4 ± 15.7	214.8 ± 4.3	282.9 ± 5.7	1.5 ± 0.1	4.9 ± 0.1
		40	2036.4 ± 40.7	742.5 ± 14.8	120.7 ± 2.4	233.1 ± 4.7	1.6 ± 0.1	5.0 ± 0.1
		50	1473.5 ± 29.5	570.8 ± 11.4	65.7 ± 1.3	172.3 ± 3.4	1.9 ± 0.1	2.9 ± 0.1
	Maltodextrin	30	2241.6 ± 44.8	701.7 ± 14.0	193.8 ± 3.9	256.2 ± 5.1	1.6 ± 0.1	4.9 ± 0.1
		40	1623.3 ± 32.5	517.2 ± 10.3	143.7 ± 2.9	185.3 ± 3.7	1.2 ± 0.1	4.6 ± 0.1
		50	1482.6 ± 29.7	496.5 ± 9.9	112.2 ± 2.2	171.6 ± 3.4	1.3 ± 0.1	3.6 ± 0.1
VD/50	Inulin	30	2037.8 ± 40.8	155.9 ± 3.1	71.8 ± 1.4	102.5 ± 2.0	1.6 ± 0.1	4.9 ± 0.1
		40	1475.8 ± 29.5	114.9 ± 2.3	53.2 ± 1.1	74.1 ± 1.5	1.2 ± 0.1	4.6 ± 0.1
		50	1347.8 ± 27.0	110.3 ± 2.2	41.6 ± 0.8	68.6 ± 1.4	1.3 ± 0.1	3.6 ± 0.1
	Maltodextrin	30	2200.2 ± 44.0	175.0 ± 3.5	79.6 ± 1.6	113.2 ± 2.3	1.5 ± 0.1	4.9 ± 0.1
		40	1851.3 ± 37.0	165.0 ± 3.3	44.7 ± 0.9	93.3 ± 1.9	1.6 ± 0.1	5.0 ± 0.1
		50	1339.6 ± 26.8	126.9 ± 2.5	24.4 ± 0.5	68.9 ± 1.4	1.9 ± 0.1	2.9 ± 0.1
VD/60	Inulin	30	1451.8 ± 29.0	132.9 ± 2.7	38.7 ± 0.8	75.8 ± 1.5	1.5 ± 0.1	4.6 ± 0.1
		40	1420.6 ± 28.4	126.4 ± 2.5	38.3 ± 0.8	72.9 ± 1.5	1.1 ± 0.1	4.2 ± 0.1
		50	720.9 ± 14.4	88.4 ± 1.8	12.4 ± 0.2	45.3 ± 0.9	1.3 ± 0.1	1.9 ± 0.1
	Maltodextrin	30	2336.4 ± 46.7	230.1 ± 4.6	50.9 ± 1.0	119.9 ± 2.4	1.1 ± 0.1	6.1 ± 0.1
		40	1718.5 ± 34.4	141.2 ± 2.8	55.5 ± 1.1	84.0 ± 1.7	1.0 ± 0.1	4.0 ± 0.1
		50	1140.8 ± 22.8	111.6 ± 2.2	22.6 ± 0.5	59.2 ± 1.2	1.5 ± 0.1	2.8 ± 0.1
JUICE								
FD	Inulin	30	158.2 ± 3.2	38.6 ± 0.8	11.6 ± 0.2	24.1 ± 0.5	ND	ND

	Maltodextrin	40	106.9 ± 2.1	26.4 ± 0.5	9.8 ± 0.2	14.6 ± 0.3	ND	ND
		50	80.6 ± 1.6	29.2 ± 0.6	7.3 ± 0.1	16.1 ± 0.3	ND	ND
		30	131.1 ± 2.6	33.5 ± 0.7	11.2 ± 0.2	21.8 ± 0.4	ND	ND
		40	104.0 ± 2.1	29.3 ± 0.6	9.3 ± 0.2	15.9 ± 0.3	ND	ND
		50	89.2 ± 1.8	29.6 ± 0.6	6.4 ± 0.1	13.9 ± 0.3	ND	ND
	Inulin	30	116.8 ± 2.3	10.1 ± 0.2	4.2 ± 0.1	4.8 ± 0.1	ND	0.4 ± 0.01
		40	48.6 ± 1.1	3.0 ± 0.1	1.8 ± 0.1	1.1 ± 0.1	ND	0.4 ± 0.01
		50	44.3 ± 0.9	3.6 ± 0.1	1.1 ± 0.1	1.0 ± 0.1	ND	0.1 ± 0.01
		30	79.6 ± 1.6	7.2 ± 0.1	1.6 ± 0.1	3.4 ± 0.1	ND	0.4 ± 0.01
		40	75.1 ± 1.5	6.7 ± 0.1	1.9 ± 0.1	4.7 ± 0.1	ND	0.3 ± 0.01
VD/50	Maltodextrin	50	58.4 ± 1.2	5.3 ± 0.1	2.4 ± 0.1	3.0 ± 0.1	ND	0.2 ± 0.01
		30	31.1 ± 0.6	4.5 ± 0.1	1.1 ± 0.1	2.3 ± 0.1	ND	0.5 ± 0.01
		40	19.6 ± 0.4	1.7 ± 0.1	0.7 ± 0.1	2.0 ± 0.1	ND	0.5 ± 0.01
		50	28.0 ± 0.6	3.2 ± 0.1	1.8 ± 0.1	1.2 ± 0.1	ND	0.2 ± 0.01
		30	78.9 ± 1.6	7.2 ± 0.1	4.0 ± 0.1	4.0 ± 0.1	ND	0.5 ± 0.01
	Inulin	40	66.1 ± 1.3	6.5 ± 0.1	4.4 ± 0.1	3.0 ± 0.1	ND	0.3 ± 0.01
		50	47.4 ± 0.9	5.6 ± 0.1	1.3 ± 0.1	2.7 ± 0.1	ND	0.4 ± 0.01
		30	31.1 ± 0.6	4.5 ± 0.1	1.1 ± 0.1	2.3 ± 0.1	ND	0.5 ± 0.01
		40	19.6 ± 0.4	1.7 ± 0.1	0.7 ± 0.1	2.0 ± 0.1	ND	0.5 ± 0.01
		50	28.0 ± 0.6	3.2 ± 0.1	1.8 ± 0.1	1.2 ± 0.1	ND	0.2 ± 0.01
VD/60	Maltodextrin	30	78.9 ± 1.6	7.2 ± 0.1	4.0 ± 0.1	4.0 ± 0.1	ND	0.5 ± 0.01
		40	66.1 ± 1.3	6.5 ± 0.1	4.4 ± 0.1	3.0 ± 0.1	ND	0.3 ± 0.01
		50	47.4 ± 0.9	5.6 ± 0.1	1.3 ± 0.1	2.7 ± 0.1	ND	0.4 ± 0.01
		30	31.1 ± 0.6	4.5 ± 0.1	1.1 ± 0.1	2.3 ± 0.1	ND	0.5 ± 0.01
		40	19.6 ± 0.4	1.7 ± 0.1	0.7 ± 0.1	2.0 ± 0.1	ND	0.5 ± 0.01
	Inulin	50	28.0 ± 0.6	3.2 ± 0.1	1.8 ± 0.1	1.2 ± 0.1	ND	0.2 ± 0.01
		30	78.9 ± 1.6	7.2 ± 0.1	4.0 ± 0.1	4.0 ± 0.1	ND	0.5 ± 0.01
		40	66.1 ± 1.3	6.5 ± 0.1	4.4 ± 0.1	3.0 ± 0.1	ND	0.3 ± 0.01
		50	47.4 ± 0.9	5.6 ± 0.1	1.3 ± 0.1	2.7 ± 0.1	ND	0.4 ± 0.01
		30	31.1 ± 0.6	4.5 ± 0.1	1.1 ± 0.1	2.3 ± 0.1	ND	0.5 ± 0.01

¹ Values are expressed as the mean ($n = 3$) ± standard deviation. ND, no detect; FD, freeze-drying; VD/50, vacuum-drying at 50 °C; VD/60, vacuum-drying at 60 °C; ANT, sum of anthocyanins; C-3-gal, cyanidin-3-O-galactoside; C-3-glu, cyanidin-3-O-glucoside; C-3-ara, cyanidin-3-O-arabinoside; C-3-xyl, cyanidin-3-O-xyloside; C, cyanidin.

Table 3. Identification and quantification of phenolic acids [mg/100 g d.m.] in the fruit, juice, and pomace powders made from Saskatoon berry.

Drying method	Type of carriers	Con. [%]	PrA	CH	ThA	3CQA	Cag	5CQA	4CQA	3pCQA	DCQA	DCQA
FRUIT												
FD	Inulin	30	7.2 ± 0.1	6.9 ± 0.1	23.2 ± 0.5	332.7 ± 6.7	74.3 ± 1.5	848.9 ± 17.0	208.3 ± 4.2	3.5 ± 0.1	9.4 ± 0.2	58 ± 1.2
		40	8.6 ± 0.2	6.3 ± 0.1	22.9 ± 0.5	293.3 ± 5.9	66.5 ± 1.3	611.7 ± 12.2	114.2 ± 2.3	1.8 ± 0.1	5.3 ± 0.1	44.9 ± 0.9
		50	9.4 ± 0.2	6.6 ± 0.1	14.3 ± 0.3	250.3 ± 5	57.7 ± 1.2	499.5 ± 10	76.9 ± 1.5	1.2 ± 0.1	4.6 ± 0.1	11.9 ± 0.2
	Maltodextrin	30	10.3 ± 0.2	5.9 ± 0.1	24.8 ± 0.5	340 ± 6.8	69.6 ± 1.4	817.8 ± 16.4	205.7 ± 4.1	2.9 ± 0.1	7.9 ± 0.2	20.5 ± 0.4
		40	9.1 ± 0.2	5.1 ± 0.1	18.7 ± 0.4	323.2 ± 6.5	71.3 ± 1.4	720.6 ± 14.4	166.4 ± 3.3	2.1 ± 0.1	5.5 ± 0.1	15.2 ± 0.3
		50	8.7 ± 0.2	5.4 ± 0.1	11.7 ± 0.2	205.5 ± 4.1	55.0 ± 1.1	460.7 ± 9.2	145 ± 2.9	1.4 ± 0.1	3.2 ± 0.1	10.5 ± 0.2
VD/50	Inulin	30	9.7 ± 0.2	7.8 ± 0.2	19.7 ± 0.4	339.0 ± 6.8	96.6 ± 1.9	971.5 ± 19.4	335.1 ± 6.7	4.4 ± 0.1	6.6 ± 0.1	40.9 ± 0.8
		40	10.1 ± 0.2	6.3 ± 0.1	10.9 ± 0.2	215.6 ± 4.3	65.2 ± 1.3	749.4 ± 15.0	206.4 ± 4.1	2.5 ± 0.1	4.0 ± 0.1	42.5 ± 0.8
		50	8.9 ± 0.2	5.2 ± 0.1	10.5 ± 0.2	170.1 ± 3.4	46.9 ± 0.9	565.7 ± 11.3	146.9 ± 2.9	1.8 ± 0.1	3.2 ± 0.1	21.2 ± 0.4
	Maltodextrin	30	10.3 ± 0.2	9.7 ± 0.2	17.6 ± 0.4	363.7 ± 7.3	92.3 ± 1.8	1050.0 ± 21.0	262.8 ± 5.3	3.4 ± 0.1	7.1 ± 0.1	88.6 ± 1.8
		40	10.5 ± 0.2	8.3 ± 0.2	12 ± 0.2	227.5 ± 4.6	81.5 ± 1.6	853.0 ± 17.1	233.0 ± 4.7	2.0 ± 0.1	4.1 ± 0.1	42.7 ± 0.9
		50	9.9 ± 0.2	6.2 ± 0.1	10.4 ± 0.2	158.6 ± 3.2	53.9 ± 1.1	534.1 ± 10.7	159.2 ± 3.2	1.5 ± 0.1	3.3 ± 0.1	26.4 ± 0.5
VD/60	Inulin	30	6.8 ± 0.1	8.9 ± 0.2	20.6 ± 0.4	361.1 ± 7.2	99.6 ± 2.0	911.2 ± 18.2	281 ± 5.6	5.3 ± 0.1	6.7 ± 0.1	42.1 ± 0.8
		40	6.1 ± 0.1	6.3 ± 0.1	14.4 ± 0.3	222.9 ± 4.5	72.6 ± 1.5	660 ± 13.2	252.5 ± 5.1	4.2 ± 0.1	3.6 ± 0.1	37.4 ± 0.7
		50	5.8 ± 0.1	5.0 ± 0.1	12.5 ± 0.3	164.1 ± 3.3	55.9 ± 1.1	460.4 ± 9.2	147.4 ± 2.9	1.4 ± 0.1	3.2 ± 0.1	12.9 ± 0.3
	Maltodextrin	30	9.8 ± 0.2	7.9 ± 0.2	15.8 ± 0.3	311.4 ± 6.2	103 ± 2.1	906.3 ± 18.1	268.5 ± 5.4	4.2 ± 0.1	6.8 ± 0.1	75.4 ± 1.5
		40	7.8 ± 0.2	8.6 ± 0.2	12.3 ± 0.2	200.6 ± 4.0	84.7 ± 1.7	608.9 ± 12.2	226.4 ± 4.5	3.7 ± 0.1	3.9 ± 0.1	43.8 ± 0.9
		50	6.2 ± 0.1	5.6 ± 0.1	10.2 ± 0.2	161.4 ± 3.2	58.4 ± 1.2	463.8 ± 9.3	178.4 ± 3.6	3 ± 0.1	3.6 ± 0.1	28.6 ± 0.6
POMACE												
FD	Inulin	30	10.0 ± 0.2	2.0 ± 0.1	38.4 ± 0.8	571.5 ± 11.4	36.7 ± 0.7	800.1 ± 16.0	290.1 ± 5.8	2.8 ± 0.1	4.3 ± 0.1	27.8 ± 0.6
		40	8.4 ± 0.2	1.7 ± 0.1	45.8 ± 0.9	474.5 ± 9.5	30.7 ± 0.6	684.2 ± 13.7	235.5 ± 4.7	2.5 ± 0.1	5.5 ± 0.1	24.2 ± 0.5
		50	8.0 ± 0.2	1.5 ± 0.1	47.8 ± 1.0	323.5 ± 6.5	27.6 ± 0.6	523.0 ± 10.5	201.1 ± 4.0	2.7 ± 0.1	6.7 ± 0.1	32.0 ± 0.6
	Maltodextrin	30	10.4 ± 0.2	1.2 ± 0.1	83.6 ± 1.7	369.9 ± 7.4	44.6 ± 0.9	896.7 ± 17.9	282.1 ± 5.6	3.0 ± 0.1	8.2 ± 0.2	31.2 ± 0.6
		40	9.9 ± 0.2	1.4 ± 0.1	61.0 ± 1.2	286.5 ± 5.7	31.4 ± 0.6	688.6 ± 13.8	249.6 ± 5.0	2.0 ± 0.1	5.5 ± 0.1	25.4 ± 0.5
		50	7.1 ± 0.1	1.4 ± 0.1	41.4 ± 0.8	259.0 ± 5.2	25.8 ± 0.5	455.8 ± 9.1	190.0 ± 3.8	1.3 ± 0.1	3.8 ± 0.1	15.5 ± 0.3
VD/50	Inulin	30	10.9 ± 0.2	2.2 ± 0.1	37.7 ± 0.8	358.2 ± 7.2	52.2 ± 1.0	717.4 ± 14.3	322.6 ± 6.5	3.1 ± 0.1	5.3 ± 0.1	51.4 ± 1.0
		40	10.1 ± 0.2	1.6 ± 0.1	27.3 ± 0.5	252.0 ± 5.0	36.3 ± 0.7	699.0 ± 14.0	236.3 ± 4.7	2.4 ± 0.1	3.5 ± 0.1	34.0 ± 0.7
		50	10.6 ± 0.2	1.7 ± 0.1	23.9 ± 0.5	237.2 ± 4.7	32.0 ± 0.6	684.4 ± 13.7	175.1 ± 3.5	1.6 ± 0.1	2.8 ± 0.1	31.7 ± 0.6
	Maltodextrin	30	10.6 ± 0.2	2.9 ± 0.1	39.1 ± 0.8	378.7 ± 7.6	54.2 ± 1.1	709.1 ± 14.2	302.2 ± 6.0	2.4 ± 0.1	5.1 ± 0.1	78.3 ± 1.6
		40	10.2 ± 0.2	2.9 ± 0.1	32.9 ± 0.7	303.7 ± 6.1	44.0 ± 0.9	663.2 ± 13.3	268.4 ± 5.4	1.7 ± 0.1	3.5 ± 0.1	58.2 ± 1.2
		50	10.0 ± 0.2	1.9 ± 0.1	23.5 ± 0.5	237.6 ± 4.8	32.2 ± 0.6	658.5 ± 13.2	225.2 ± 4.5	1.5 ± 0.1	3.1 ± 0.1	50.3 ± 1.0
VD/60	Inulin	30	10.9 ± 0.2	3.8 ± 0.1	19.2 ± 0.4	181.6 ± 3.6	59.8 ± 1.2	573.7 ± 11.5	383.2 ± 7.7	2.4 ± 0.1	2.5 ± 0.1	56.1 ± 1.1
		40	10.8 ± 0.2	2.4 ± 0.1	18.5 ± 0.4	171.8 ± 3.4	51.5 ± 1.0	554.8 ± 11.1	283.4 ± 5.7	2.4 ± 0.1	2.4 ± 0.1	40.9 ± 0.8
		50	10.5 ± 0.2	2.1 ± 0.1	17.4 ± 0.3	161.4 ± 3.2	58.4 ± 1.2	530.3 ± 10.6	260.6 ± 5.2	2.1 ± 0.1	2.3 ± 0.1	51.5 ± 1.0
	Maltodextrin	30	11.3 ± 0.2	3.1 ± 0.1	29.6 ± 0.6	282.2 ± 5.6	70.3 ± 1.4	569.5 ± 11.4	303.1 ± 6.1	3.1 ± 0.1	3.9 ± 0.1	69.0 ± 1.4
		40	10.9 ± 0.2	4.3 ± 0.1	23.6 ± 0.5	206.0 ± 4.1	65.7 ± 1.3	547.2 ± 10.9	261.5 ± 5.2	2.2 ± 0.1	2.7 ± 0.1	42.3 ± 0.8
		50	10.8 ± 0.2	2.3 ± 0.1	18.3 ± 0.4	146.2 ± 2.9	40.8 ± 0.8	525.0 ± 10.5	252.0 ± 5.0	1.6 ± 0.1	1.7 ± 0.1	49.6 ± 1.0
JUICE												
FD	Inulin	30	9.1 ± 0.2	5.5 ± 0.1	46.7 ± 0.9	360.5 ± 7.2	86.8 ± 1.7	654.1 ± 13.1	211.2 ± 4.2	2.1 ± 0.1	9.0 ± 0.2	15.5 ± 0.3

		40	9.7 ± 0.2	4.3 ± 0.1	29.3 ± 0.6	230.9 ± 4.6	57.1 ± 1.1	595.9 ± 11.9	132.7 ± 2.7	1.2 ± 0.1	6.5 ± 0.1	9.9 ± 0.2
		50	9.9 ± 0.2	6.6 ± 0.1	22.3 ± 0.4	164.5 ± 3.3	60.6 ± 1.2	488.1 ± 9.8	104.2 ± 2.1	1.9 ± 0.1	3.5 ± 0.1	6.2 ± 0.1
		30	9.3 ± 0.2	8.9 ± 0.2	43.3 ± 0.9	344.3 ± 6.9	96.3 ± 1.9	691.4 ± 13.8	202.5 ± 4.1	1.7 ± 0.1	8.5 ± 0.2	12.5 ± 0.3
	Maltodextrin	40	9.3 ± 0.2	7.4 ± 0.1	31.4 ± 0.6	244.7 ± 4.9	77.0 ± 1.5	609.5 ± 12.2	166.3 ± 3.3	1.4 ± 0.1	5.9 ± 0.1	9.6 ± 0.2
		50	9.3 ± 0.2	9.2 ± 0.2	20.3 ± 0.4	150.5 ± 3.0	56.2 ± 1.1	508.2 ± 10.2	111.6 ± 2.2	1.1 ± 0.1	3.2 ± 0.1	5.8 ± 0.1
VD/50	Inulin	30	8.7 ± 0.2	5.8 ± 0.1	32.5 ± 0.6	280.0 ± 5.6	72.1 ± 1.4	557.2 ± 11.1	272.7 ± 5.5	2.2 ± 0.1	7.3 ± 0.1	11.3 ± 0.2
		40	10 ± 0.2	6.2 ± 0.1	26.2 ± 0.5	203.3 ± 4.1	66.4 ± 1.3	529.7 ± 10.6	150.7 ± 3.0	2.2 ± 0.1	4.8 ± 0.1	8.6 ± 0.2
		50	9.7 ± 0.2	5.7 ± 0.1	19.2 ± 0.4	151.2 ± 3.0	57.1 ± 1.1	436.1 ± 8.7	135.4 ± 2.7	1.3 ± 0.1	3.8 ± 0.1	5.3 ± 0.1
	Maltodextrin	30	9.5 ± 0.2	7.0 ± 0.1	34.8 ± 0.7	295.7 ± 5.9	84.6 ± 1.7	594.4 ± 11.9	216.0 ± 4.3	1.8 ± 0.1	7.4 ± 0.1	11.9 ± 0.2
		40	9.9 ± 0.2	6.3 ± 0.1	27.2 ± 0.5	217.1 ± 4.3	75.1 ± 1.5	557.4 ± 11.1	186.4 ± 3.7	1.8 ± 0.1	5.1 ± 0.1	8.7 ± 0.2
		50	9.5 ± 0.2	4.9 ± 0.1	19.9 ± 0.4	158.1 ± 3.2	53.8 ± 1.1	446.5 ± 8.9	140.5 ± 2.8	1.1 ± 0.1	3.8 ± 0.1	6.4 ± 0.1
VD/60	Inulin	30	10.3 ± 0.2	11.3 ± 0.2	35.3 ± 0.7	259.9 ± 5.2	112.5 ± 2.3	472.5 ± 9.4	235.1 ± 4.7	2.3 ± 0.1	6.6 ± 0.1	9.8 ± 0.2
		40	10.2 ± 0.2	4.1 ± 0.1	21.6 ± 0.4	157.8 ± 3.2	50.4 ± 1.0	456.7 ± 9.1	200.4 ± 4.0	2.1 ± 0.1	4.7 ± 0.1	6.8 ± 0.1
		50	9.1 ± 0.2	5.4 ± 0.1	29.2 ± 0.6	217.7 ± 4.4	64.9 ± 1.3	377.1 ± 7.5	158.1 ± 3.2	1.9 ± 0.1	6.1 ± 0.1	9.2 ± 0.2
	Maltodextrin	30	10.4 ± 0.2	7.6 ± 0.2	42.1 ± 0.8	347.9 ± 7.0	104.1 ± 2.1	482.3 ± 9.6	251.4 ± 5.0	3.9 ± 0.1	7.4 ± 0.1	14.5 ± 0.3
		40	10.3 ± 0.2	6.4 ± 0.1	30.2 ± 0.6	244.6 ± 4.9	80.0 ± 1.6	486.3 ± 9.7	201.5 ± 4.0	2.6 ± 0.1	5.9 ± 0.1	10.2 ± 0.2
		50	10.1 ± 0.2	5.4 ± 0.1	19.5 ± 0.4	151.5 ± 3.0	74.1 ± 1.5	396.2 ± 7.9	157.2 ± 3.1	2.0 ± 0.0	3.9 ± 0.1	5.5 ± 0.1

¹ Values are expressed as the mean ($n = 3$) ± standard deviation. FD, freeze-drying; VD/50, vacuum-drying at 50 °C; VD/60, vacuum-drying at 60 °C; PA, sum of phenolic acids; PP, polymeric procyanidins; PrA, protocatechuic acid; Cag, caffeic acid glucoside; Chx, caffeoylhexose; ThA, trihydroxycinnamoylquinic acid isomers; 3CQA, 3-*O*-caffeoylquinic acid; 5CQA, 5-*O*-caffeoylquinic acid; 4CQA, 4-*O*-caffeoylquinic acid; 3pCQA, 3-*O*-*p*-coumaroylquinic acid; DCQA, di-caffeoylquinic acid; DCQA, di-caffeoylquinic acid.

Table 4. Identification and quantification of flavonols [mg/100 g d.m.] in the fruit, juice, and pomace powders made from Saskatoon berry.

Drying method	Type of carriers	Con. [%]	K-3-gal	Q-3-ara	K-3-glu	Q	Q-3-rut	Q-3-rob	Q-3-gal	Q-3-glu	Q-3-ara	Q-3-xyl	Q-3-6gal	Q-3-6glu	Qdhe
FRUIT															
FD	Inulin	30	44.1 ± 0.9	3.4 ± 0.1	2.3 ± 0.1	0.2 ± 0.01	44.9 ± 0.9	0.2 ± 0.01	210.0 ± 4.2	10.3 ± 0.2	3.7 ± 0.1	1.9 ± 0.1	2.1 ± 0.1	6.5 ± 0.1	5.4 ± 0.1
		40	36.8 ± 0.7	2.7 ± 0.1	2.1 ± 0.1	0.2 ± 0.01	34.5 ± 0.7	0.2 ± 0.01	170.3 ± 3.4	8.2 ± 0.2	3.4 ± 0.1	1.4 ± 0.1	1.7 ± 0.1	5.2 ± 0.1	4.4 ± 0.1
		50	25.0 ± 0.5	1.3 ± 0.1	0.7 ± 0.1	0.1 ± 0.01	26.9 ± 0.5	0.1 ± 0.01	131.4 ± 2.6	6.5 ± 0.1	2.8 ± 0.1	1.1 ± 0.1	1.2 ± 0.1	3.5 ± 0.1	3.7 ± 0.1
	Maltodextrin	30	52.2 ± 1.0	3.7 ± 0.1	2.2 ± 0.1	0.1 ± 0.01	48.8 ± 1.0	0.3 ± 0.01	234.1 ± 4.7	11.4 ± 0.2	5.7 ± 0.1	2.0 ± 0.1	2.1 ± 0.1	8.0 ± 0.2	8.0 ± 0.2
		40	38.5 ± 0.8	2.7 ± 0.1	1.7 ± 0.1	0.1 ± 0.01	37.3 ± 0.7	0.2 ± 0.01	181.1 ± 3.6	8.6 ± 0.2	4.1 ± 0.1	1.5 ± 0.1	1.6 ± 0.1	6.5 ± 0.1	5.5 ± 0.1
		50	22.9 ± 0.5	1.6 ± 0.1	1.1 ± 0.0	0.1 ± 0.01	23.9 ± 0.5	0.2 ± 0.01	113.8 ± 2.3	5.7 ± 0.1	2.2 ± 0.1	1.1 ± 0.1	1.0 ± 0.1	4.0 ± 0.1	3.5 ± 0.1
VD/50	Inulin	30	26.3 ± 0.5	2.8 ± 0.1	2.8 ± 0.1	0.1 ± 0.01	45.4 ± 0.9	0.3 ± 0.01	200.0 ± 4.0	9.4 ± 0.2	3.2 ± 0.1	2.0 ± 0.1	1.6 ± 0.1	5.9 ± 0.1	12.7 ± 0.3
		40	23.2 ± 0.5	2.7 ± 0.1	1.9 ± 0.1	0.1 ± 0.01	29.3 ± 0.6	0.2 ± 0.01	147.3 ± 2.9	6.7 ± 0.1	1.3 ± 0.1	1.1 ± 0.1	1.1 ± 0.1	5.0 ± 0.1	11.1 ± 0.2
		50	17.6 ± 0.4	1.8 ± 0.1	1.2 ± 0.1	0.1 ± 0.01	23.1 ± 0.5	0.2 ± 0.01	115.4 ± 2.3	5.5 ± 0.1	2.0 ± 0.1	0.9 ± 0.1	1.0 ± 0.1	3.8 ± 0.1	7.1 ± 0.1
	Maltodextrin	30	30.3 ± 0.6	3.9 ± 0.1	3.9 ± 0.1	0.2 ± 0.01	46.2 ± 0.9	0.3 ± 0.01	207.8 ± 4.2	9.9 ± 0.2	2.7 ± 0.1	1.9 ± 0.1	1.7 ± 0.1	6.6 ± 0.1	14.2 ± 0.3
		40	19.5 ± 0.4	2.7 ± 0.1	2.2 ± 0.1	0.2 ± 0.01	31.0 ± 0.6	0.2 ± 0.01	148.1 ± 3.0	7.1 ± 0.1	2.5 ± 0.1	1.6 ± 0.1	1.2 ± 0.1	4.9 ± 0.1	9.6 ± 0.2
		50	13.9 ± 0.3	2.0 ± 0.1	1.3 ± 0.1	0.2 ± 0.01	22.0 ± 0.4	0.1 ± 0.01	110.2 ± 2.2	5.3 ± 0.1	2.1 ± 0.1	1.0 ± 0.1	0.8 ± 0.1	3.3 ± 0.1	5.3 ± 0.1
VD/60	Inulin	30	29.8 ± 0.6	2.6 ± 0.1	3.0 ± 0.1	0.2 ± 0.01	44.0 ± 0.9	0.3 ± 0.01	208.1 ± 4.2	10.4 ± 0.2	4.3 ± 0.1	2.5 ± 0.1	1.8 ± 0.1	6.8 ± 0.1	8.3 ± 0.2
		40	19.6 ± 0.4	2.4 ± 0.1	2.4 ± 0.1	0.2 ± 0.01	29.6 ± 0.6	0.2 ± 0.01	145.0 ± 2.9	6.5 ± 0.1	3.2 ± 0.1	2.0 ± 0.1	1.2 ± 0.1	5.1 ± 0.1	8.7 ± 0.2
		50	15.2 ± 0.3	1.4 ± 0.1	1.4 ± 0.1	0.1 ± 0.01	23.2 ± 0.5	0.3 ± 0.01	112.1 ± 2.2	5.6 ± 0.1	2.1 ± 0.1	1.0 ± 0.1	0.9 ± 0.1	4.0 ± 0.1	4.6 ± 0.1
	Maltodextrin	30	24.6 ± 0.5	3.4 ± 0.1	4.1 ± 0.1	0.1 ± 0.01	41.5 ± 0.8	0.1 ± 0.01	208.7 ± 4.2	10.1 ± 0.2	3.1 ± 0.1	1.8 ± 0.1	1.7 ± 0.1	7.0 ± 0.1	16.3 ± 0.3
		40	17.3 ± 0.3	2.0 ± 0.1	1.9 ± 0.1	0.1 ± 0.01	29.1 ± 0.6	0.1 ± 0.01	145.5 ± 2.9	7.0 ± 0.1	3.2 ± 0.1	1.3 ± 0.1	1.0 ± 0.1	4.5 ± 0.1	9.6 ± 0.2
		50	13.7 ± 0.3	1.9 ± 0.1	1.5 ± 0.1	0.1 ± 0.01	23.0 ± 0.5	0.2 ± 0.01	115.6 ± 2.3	5.7 ± 0.1	2.9 ± 0.1	1.2 ± 0.1	0.8 ± 0.1	3.6 ± 0.1	6.4 ± 0.1
POMACE															
FD	Inulin	30	106.4 ± 2.1	5.2 ± 0.1	6.5 ± 0.1	ND	35.4 ± 0.7	0.4 ± 0.01	489.1 ± 9.8	23.1 ± 0.5	9.9 ± 0.2	3.5 ± 0.1	3.3 ± 0.1	16.4 ± 0.3	11.1 ± 0.2
		40	90.0 ± 1.8	4.9 ± 0.1	4.5 ± 0.1	ND	31.1 ± 0.6	0.3 ± 0.01	409.3 ± 8.2	19.7 ± 0.4	8.9 ± 0.2	2.9 ± 0.1	2.4 ± 0.1	14.2 ± 0.3	8.3 ± 0.2
		50	69.1 ± 1.4	3.2 ± 0.1	2.5 ± 0.1	ND	22.5 ± 0.4	0.2 ± 0.01	463.1 ± 9.3	14.2 ± 0.3	5.7 ± 0.1	2.4 ± 0.1	2.0 ± 0.1	10.1 ± 0.2	7.1 ± 0.1
	Maltodextrin	30	132.8 ± 2.7	8.8 ± 0.2	8.1 ± 0.2	0.3 ± 0.01	42.6 ± 0.9	0.4 ± 0.01	515.7 ± 10.3	25.3 ± 0.5	10.3 ± 0.2	4.2 ± 0.1	2.6 ± 0.1	20.4 ± 0.4	18.6 ± 0.4
		40	11.00 ± 2.2	5.9 ± 0.1	5.9 ± 0.1	0.2 ± 0.01	32.7 ± 0.7	0.3 ± 0.01	397.8 ± 8.0	19.8 ± 0.4	8.2 ± 0.2	3.5 ± 0.1	2.3 ± 0.1	14.5 ± 0.3	13.5 ± 0.3
		50	81.1 ± 1.6	3.5 ± 0.1	4.2 ± 0.1	0.1 ± 0.01	25.2 ± 0.5	0.2 ± 0.01	278.9 ± 5.6	14.1 ± 0.3	5.6 ± 0.1	2.3 ± 0.1	1.2 ± 0.1	9.9 ± 0.2	5.3 ± 0.1
VD/50	Inulin	30	69.5 ± 1.4	5.3 ± 0.1	2.6 ± 0.1	0.2 ± 0.01	50.6 ± 1	0.5 ± 0.01	348.3 ± 7.0	17.2 ± 0.3	8.1 ± 0.2	2.7 ± 0.1	3.2 ± 0.1	11.5 ± 0.2	15.5 ± 0.3
		40	49.0 ± 1.0	4.2 ± 0.1	2.9 ± 0.1	0.2 ± 0.01	36.2 ± 0.7	0.4 ± 0.01	257.0 ± 5.1	12.6 ± 0.3	5.3 ± 0.1	2.2 ± 0.1	2.3 ± 0.1	8.3 ± 0.2	10.5 ± 0.2
		50	40.6 ± 0.8	4.3 ± 0.1	3.6 ± 0.1	0.1 ± 0.01	30.0 ± 0.6	0.2 ± 0.01	217.2 ± 4.3	10.5 ± 0.2	4.6 ± 0.1	1.8 ± 0.1	2.1 ± 0.1	7.4 ± 0.1	7.9 ± 0.2
	Maltodextrin	30	76.4 ± 1.5	7.0 ± 0.1	4.5 ± 0.1	0.1 ± 0.01	48.5 ± 1.0	0.4 ± 0.01	333.5 ± 6.7	16.2 ± 0.3	6.4 ± 0.1	3.4 ± 0.1	3.2 ± 0.1	11.4 ± 0.2	14.1 ± 0.3
		40	62.6 ± 1.3	5.8 ± 0.1	2.4 ± 0.1	0.1 ± 0.01	38.7 ± 0.8	0.3 ± 0.01	270.3 ± 5.4	13.2 ± 0.3	8.2 ± 0.2	2.4 ± 0.1	2.5 ± 0.1	8.8 ± 0.2	16.0 ± 0.3
		50	42.2 ± 0.8	3.6 ± 0.1	1.9 ± 0.1	0.1 ± 0.01	30.7 ± 0.6	0.2 ± 0.01	206.0 ± 4.1	10.4 ± 0.2	4.2 ± 0.1	2.0 ± 0.1	1.8 ± 0.1	7.0 ± 0.1	9.5 ± 0.2
VD/60	Inulin	30	48.6 ± 1.0	8.4 ± 0.2	2.3 ± 0.1	0.1 ± 0.01	68.0 ± 1.4	0.7 ± 0.01	287.4 ± 5.7	13.1 ± 0.3	4.4 ± 0.1	2.4 ± 0.1	5.4 ± 0.1	9.3 ± 0.2	15.0 ± 0.3
		40	44.5 ± 0.9	7.3 ± 0.1	1.6 ± 0.1	0.1 ± 0.01	59.3 ± 1.2	0.4 ± 0.01	251.1 ± 5.0	11.9 ± 0.2	6.1 ± 0.1	2.1 ± 0.1	4.0 ± 0.1	7.6 ± 0.2	14.3 ± 0.3
		50	25.0 ± 0.5	5.1 ± 0.1	2.2 ± 0.1	0.1 ± 0.01	42.7 ± 0.9	0.3 ± 0.01	162.7 ± 3.3	6.9 ± 0.1	2.6 ± 0.1	1.5 ± 0.1	2.5 ± 0.1	4.3 ± 0.1	15.7 ± 0.3
	Maltodextrin	30	78.2 ± 1.6	11.2 ± 0.2	4.7 ± 0.1	0.1 ± 0.01	75.8 ± 1.5	0.3 ± 0.01	340.6 ± 6.8	16.0 ± 0.3	6.0 ± 0.1	2.8 ± 0.1	4.1 ± 0.1	10.9 ± 0.2	16.2 ± 0.3
		40	56.2 ± 1.1	8.5 ± 0.2	3.5 ± 0.1	0.1 ± 0.01	58.6 ± 1.2	0.3 ± 0.01	258.5 ± 5.2	12.0 ± 0.2	7.3 ± 0.1	2.1 ± 0.1	3.4 ± 0.1	8.3 ± 0.2	16.2 ± 0.3
		50	35.6 ± 0.7	6.2 ± 0.1	1.4 ± 0.1	0.1 ± 0.01	40.3 ± 0.8	0.2 ± 0.01	197.8 ± 4.0	9.7 ± 0.2	5.4 ± 0.1	2.0 ± 0.1	2.5 ± 0.1	6.9 ± 0.1	10.2 ± 0.2
JUICE															
FD	Inulin	30	10.2 ± 0.2	1.9 ± 0.1	0.5 ± 0.01	0.1 ± 0.01	33.5 ± 0.7	0.1 ± 0.01	95.1 ± 1.9	4.8 ± 0.1	3.0 ± 0.1	1.4 ± 0.1	0.6 ± 0.01	3.6 ± 0.1	2.5 ± 0.1

		40	6.1 ± 0.1	2.0 ± 0.1	0.1 ± 0.01	0.1 ± 0.01	19.7 ± 0.4	0.2 ± 0.01	62.2 ± 1.2	5.4 ± 0.1	1.9 ± 0.1	1.1 ± 0.1	0.5 ± 0.01	2.6 ± 0.1	1.9 ± 0.1
		50	4.7 ± 0.1	0.3 ± 0.1	0.0 ± 0.00	0.1 ± 0.01	26.7 ± 0.5	0.1 ± 0.01	48.1 ± 1.0	2.6 ± 0.1	1.6 ± 0.1	0.9 ± 0.1	0.2 ± 0.01	0.4 ± 0.01	1.5 ± 0.1
		30	9.0 ± 0.2	1.6 ± 0.1	1.7 ± 0.1	0.1 ± 0.01	39.1 ± 0.8	0.1 ± 0.01	91.9 ± 1.8	4.7 ± 0.1	2.3 ± 0.1	1.2 ± 0.1	0.7 ± 0.01	3.8 ± 0.1	2.7 ± 0.1
	Maltodextrin	40	6.6 ± 0.1	1.8 ± 0.1	0.3 ± 0.01	0.1 ± 0.01	28.0 ± 0.6	0.2 ± 0.01	66.8 ± 1.3	3.5 ± 0.1	2.2 ± 0.1	1.0 ± 0.1	0.4 ± 0.01	2.8 ± 0.1	1.4 ± 0.1
		50	4.4 ± 0.1	0.9 ± 0.1	0.3 ± 0.01	0.1 ± 0.01	18.0 ± 0.4	0.2 ± 0.01	47.3 ± 0.9	2.6 ± 0.1	1.8 ± 0.1	0.9 ± 0.1	0.2 ± 0.01	1.9 ± 0.1	0.8 ± 0.1
VD/50	Inulin	30	8.7 ± 0.2	1.9 ± 0.1	0.5 ± 0.01	0.6 ± 0.01	32.4 ± 0.6	0.2 ± 0.01	98.3 ± 2.0	5.0 ± 0.1	2.8 ± 0.1	1.3 ± 0.1	0.7 ± 0.01	3.2 ± 0.1	3.8 ± 0.1
		40	5.1 ± 0.1	2.1 ± 0.1	1.3 ± 0.1	0.4 ± 0.01	20.3 ± 0.4	0.6 ± 0.01	72.9 ± 1.5	5.9 ± 0.1	2.2 ± 0.1	0.9 ± 0.1	0.4 ± 0.01	2.5 ± 0.1	2.5 ± 0.1
		50	3.8 ± 0.1	1.0 ± 0.1	0.0 ± 0.00	0.4 ± 0.01	19.0 ± 0.4	0.1 ± 0.01	54.3 ± 1.1	2.7 ± 0.1	1.9 ± 0.1	0.8 ± 0.1	0.8 ± 0.01	2.0 ± 0.1	1.8 ± 0.1
	Maltodextrin	30	8.1 ± 0.2	1.3 ± 0.1	0.2 ± 0.01	0.4 ± 0.01	33.9 ± 0.7	0.1 ± 0.01	96.8 ± 1.9	4.9 ± 0.1	2.3 ± 0.1	1.3 ± 0.1	0.8 ± 0.01	3.3 ± 0.1	4.5 ± 0.1
		40	5.2 ± 0.1	2.4 ± 0.1	0.4 ± 0.01	0.3 ± 0.01	25.9 ± 0.5	0.2 ± 0.01	76.1 ± 1.5	5.7 ± 0.1	1.5 ± 0.1	1.0 ± 0.1	0.5 ± 0.01	2.5 ± 0.1	2.5 ± 0.1
		50	4.2 ± 0.1	0.9 ± 0.1	0.3 ± 0.01	0.2 ± 0.01	18.8 ± 0.4	0.1 ± 0.01	54.8 ± 1.1	2.6 ± 0.1	1.2 ± 0.1	0.8 ± 0.1	0.3 ± 0.01	2.1 ± 0.1	1.4 ± 0.1
VD/60	Inulin	30	5.9 ± 0.1	1.1 ± 0.1	0.4 ± 0.01	0.4 ± 0.01	41.0 ± 0.8	0.3 ± 0.01	100.6 ± 2	4.5 ± 0.1	2.5 ± 0.1	1.5 ± 0.1	0.7 ± 0.01	2.9 ± 0.1	3.8 ± 0.1
		40	3.6 ± 0.1	2.6 ± 0.1	0.2 ± 0.01	0.3 ± 0.01	26.2 ± 0.5	0.4 ± 0.01	58.2 ± 1.2	5.4 ± 0.1	1.0 ± 0.1	0.9 ± 0.1	0.5 ± 0.01	1.9 ± 0.1	1.5 ± 0.1
		50	5.1 ± 0.1	1.5 ± 0.1	0.3 ± 0.01	0.3 ± 0.01	20.4 ± 0.4	0.3 ± 0.01	78.5 ± 1.6	3.9 ± 0.1	1.7 ± 0.1	1.5 ± 0.1	0.4 ± 0.01	3.2 ± 0.1	3.0 ± 0.1
	Maltodextrin	30	8.7 ± 0.2	1.6 ± 0.1	0.2 ± 0.01	0.3 ± 0.01	39.2 ± 0.8	0.2 ± 0.01	115.3 ± 2.3	5.4 ± 0.1	1.4 ± 0.1	1.5 ± 0.1	0.9 ± 0.01	3.2 ± 0.1	4.7 ± 0.1
		40	6.1 ± 0.1	2.9 ± 0.1	0.4 ± 0.01	0.2 ± 0.01	28.2 ± 0.6	0.3 ± 0.01	82.8 ± 1.7	5.9 ± 0.1	2.0 ± 0.1	1.2 ± 0.1	0.4 ± 0.01	2.5 ± 0.1	3.2 ± 0.1
		50	4.2 ± 0.1	1.1 ± 0.1	0.3 ± 0.01	0.2 ± 0.01	19.9 ± 0.4	0.1 ± 0.01	53.5 ± 1.1	2.5 ± 0.1	1.1 ± 0.1	0.7 ± 0.1	0.5 ± 0.01	1.7 ± 0.1	2.2 ± 0.1

¹ Values are expressed as the mean ($n = 3$) ± standard deviation. ND, no detect; FD, freeze-drying; VD/50, vacuum-drying at 50 °C; VD/60, vacuum-drying at 60 °C; FL, sum of flavonols; Q, quercetin; Q-3-rob, quercetin-3-*O*-robinobioside; Q-3-rut; quercetin-3-*O*-rutinoside; Q-3-ara; quercetin-3-*O*-arabinoside; Q-3-xyl, quercetin-3-*O*-xyloside; Q-3-glu, quercetin-3-*O*-glucoside; Q-3-gal, quercetin-3-*O*-galactoside; Q-3-arab; quercetin-3-*O*-arabinobioside; Q-3-6glu, quercetin-3-*O*-(6"-acetyl)glucoside; Q-3-6gal, quercetin-3-*O*-(6"-acetyl)galactoside; Qdhe, quercetin-deoxyhexo-heksoside; K-3-gal, kaempferol-3-*O*-galactoside; K-3-glu, kaempferol-3-*O*-glucoside.