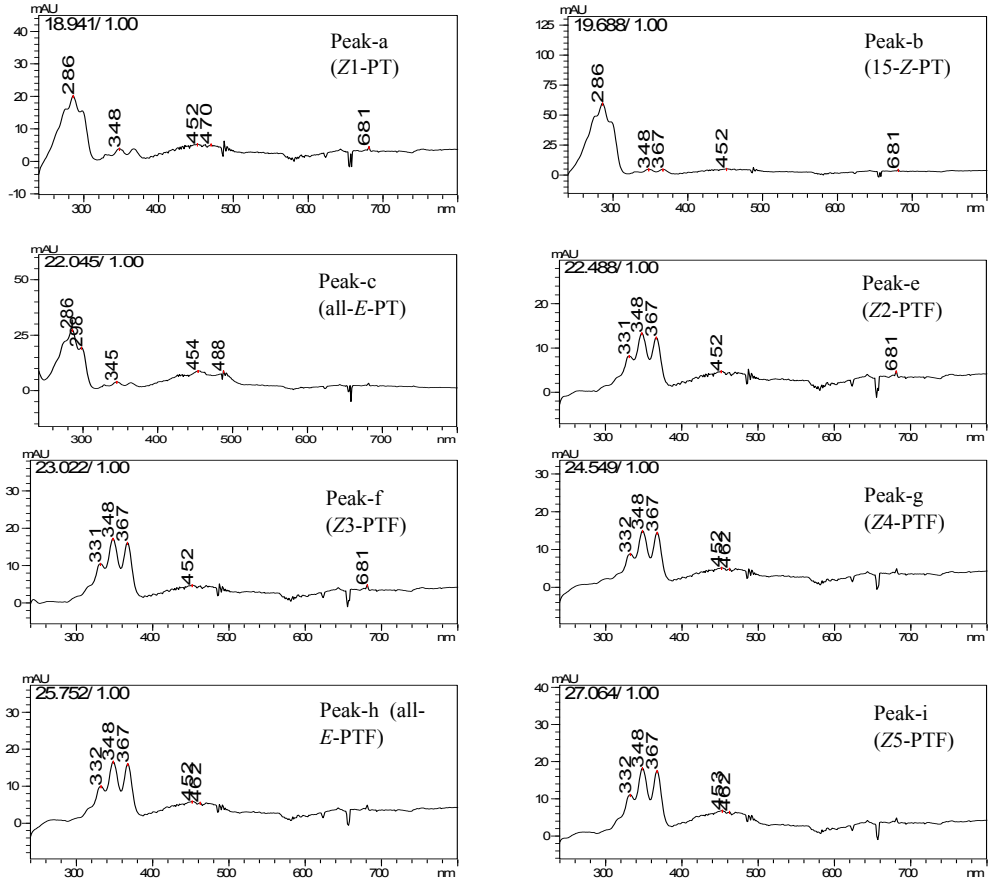

Fig. S1. The spectra in the mobile phase of the main geometric isomers of phytoene (PT) and phytofluene (PTF)

Table S1. Preparations of tomato-EVOO-onion sauces with different proportion of three ingredients cooking in microwave oven at 600 W for 5 min

	Tomato (HB or CB) (g)	EVOO (g)	Onion (g)
HB-$E_{2.5\%}$ (S1)	48.75	1.25	0.00
HB-$E_{2.5\%}$-$O_{5\%}$ (S2)	46.25	1.25	2.50
HB-$E_{2.5\%}$-$O_{10\%}$ (S3)	43.75	1.25	5.00
HB-$E_{2.5\%}$-$O_{20\%}$ (S4)	38.75	1.25	10.00
CB-$E_{2.5\%}$ (S5)	48.75	1.25	0.00
CB-$E_{2.5\%}$-$O_{5\%}$ (S6)	46.25	1.25	2.50
CB-$E_{2.5\%}$-$O_{10\%}$ (S7)	43.75	1.25	5.00
CB-$E_{2.5\%}$-$O_{20\%}$ (S8)	38.75	1.25	10.00

EVOO: extra virgin olive oil;

HB-$E_{t\%}$-$O_{m\%}$: hot break tomato puree-t% EVOO-m% onion puree; CB-$E_{t\%}$-$O_{m\%:}$ cold break tomato puree-t% EVOO-m% onion puree

Onion puree, potato puree, and minced beef meat preparations

Fresh onion was first carefully washed and peeled, then peeled onion was cut into small pieces, mixed with a blender for onion puree. Potatoes were boiled in tap water, peeled and hand pureed. Beef meat (5% fat) was medium fried in a frying pan without added fat and then minced. The onion purees were used to make the tomato-based sauce; however, the potato purees and minced beef meats were for preparation of meals as macronutrients used in *in vitro* digestion experiments. The proportions of each macronutrient found in the tested meals are close to the US dietary reference intakes (DRI). All samples were frozen and stored at -20ºC until processing. Prior to sample processing, these samples were thawed overnight at 4ºC.

Preparations of tomato-onion-EVOO sauces

Three components (tomato puree (HB and CB), onion puree (0, 5, 10, and 20%) and EVOO (2.5 %) were weighted and mixed following Table S1. For CB with dially disulfide (DADS) sauce, DADS was added directly to CB puree, and final concentrations of EVOO and DADS in the puree were adjusted to 2.5% and 0.50 mg/g puree, respectively. Then the purees in beakers (250 mL) were put into a microwave oven and heating at 600 W for 5 min. Every time, four beakers with the samples (each one 50 g) were uniformly put into the microwave oven. After heating, the prepared sauces were immediately cooled in ice water and stored at -20ºC until analysis. Two types of tomato-EVOO-onion sauces (HB-EVOO-onion (HB-E-O), (CB-EVOO-onion (CB-E-O)) were prepared.

Table S2. Proportion (%) of phytoene (PT) and phytofluene (PTF) in tomato-based sauces

	Phytoene (PT)			Phytofluene (PTF)				
	*Z*1-PT	15-*Z*-PT	all-*E*-PT	*Z*1-PTF	*Z*2,3-PTF	*Z*4-PTF	all-*E*-PTF	*Z*5-PTF
HB-$E_{2.5\%}$	n.d	98.6±0.1a	1.4±0.1a	n.d	77.3±0.7a	n.d	20.7±0.8a	2.1±0.1a
HB-$E_{2.5\%}$-$O_{5\%}$	0.6±0.2a	91.7±0.2ab	7.7±0.0ab	1.0±0.0a	38.3±0.8ab	8.4±0.3a	32.1±0.3b	20.2±0.2ab
HB-$E_{2.5\%}$-$O_{10\%}$	1.2±0.1ab	88.0±0.9bc	10.8±0.8bc	1.3±0.3a	33.7±1.8bc	11.4±0.6ab	28.9±0.2bc	24.8±1.2bc
HB-$E_{2.5\%}$-$O_{20\%}$	1.8±0.0b	84.7±0.0c	13.5±0.1c	1.5±0.1a	29.9±0.2c	14.2±0.1b	26.2±0.3ac	28.2±0.3c
CB-$E_{2.5\%}$	n.d	98.7±0.0a	1.3±0.0a	n.d	80.1±0.7a	n.d	18.3±0.7a	1.6±0.0a
CB-$E_{2.5\%}$-$O_{5\%}$	n.d	91.7±0.1ab	8.3±0.1ab	1.2±0.1a	36.1±0.7ab	10.5±0.2a	28.6±0.1b	23.6±0.5ab
CB-$E_{2.5\%}$-$O_{10\%}$	1.7±0.0a	86.0±0.0bc	12.3±0.1bc	1.5±0.0ab	31.0±0.3bc	13.1±0.1ab	26.7±0.1bc	27.7±0.1bc
CB-$E_{2.5\%}$-$O_{20\%}$	3.7±0.1a	78.2±0.4c	18.1±0.3c	1.8±0.0b	26.2±0.5c	16.1±0.2b	24.2±0.1ac	31.8±0.2d

n.d: not detected;

HB: hot-break tomato purees; CB: cold-break tomato purees; EVOO: virgin olive oil; HB-Et%-Om%: HB-EVOO-onion puree with t% EVOO and m% onion; CB-$E_{t\%}$-$O_{m\%}$: CB-EVOO-onion puree with t% EVOO and m% onion;

Data followed by different letters in the same column for same tomato matrix (HB or CB) are significantly different (p<0.05, Dunn test).

Table S3. Proportions (%) and bioaccessibilities (%) of phytoene (PT) and phytofluene (PTF) isomers in sale sauces (sale-h and sale-nh)

		*Z*1-PT	15*Z*-PT	all-*E*-PT	*Z*2,3-PTF	*Z*4-PTF	all-*E*-PTF	*Z*5-PTF
P(sauce)	Sale-h	2.9±0.1a	81.8±0.1a	15.3±0.1a	26.3±0.1a	15.7±0.0a	22.2±0.1a	35.9±0.1a
	Sale-nh	3.9±0.1b	82.9±0.2b	13.2±0.0b	28.1±0.1b	14.7±0.0b	22.1±0.2a	35.1±0.2b
P(micelle)	Sale-h	n.d	86.4±0.2a	13.6±0.2a	29.0±0.1a	16.2±0.2a	22.2±0.3a	32.6±0.3a
	Sale-nh	n.d	86.9±0.2b	13.1±0.2b	31.3±0.5b	15.2±0.1b	21.8±0.2b	31.7±0.3b
BioA	Sale-h	n.d	23.9±3.1a	20.8±2.4a	19.8±3.1a	18.4±2.7a	18.0±2.9a	16.3±2.4a
	Sale-nh	n.d	13.7±3.0b	13.5±3.0b	11.8±2.9b	11.0±2.9b	10.5±2.8b	9.6±2.5b

n.d: not detected;

P(sauce): Proportions (%) of phytoene (PT) and phytofluene (PTF) isomers in sale sauces;

P(micelle): Proportions (%) of phytoene (PT) and phytofluene (PTF) isomers in micelle phases;

BioA: Bioaccessibilities (%) of phytoene (PT) and phytofluene (PTF) isomers.

Data followed by different letters in the same column are significantly different (p<0.05, Kruskal-Wallis test).

Table S4. Proportion (%) of phytoene (PT) and phytofluene (PTF) in the micelle from jejunal phase of tomato-based sauces

Sauces	PT		PTF			
	15-*Z*-PT	all-*E*-PT	*Z* 2,3-PTF	*Z* 4-PTF	all-*E*-PTF	*Z* 5-PTF
HB-$E_{2.5\%}$	97.7±0.2a	2.3±0.2a	82.9±0.5a	n.d	17.1±0.5a	n.d
HB-$E_{2.5\%}$-$O_{5\%}$	94.6±0.1ab	5.4±0.1ab	51.5±0.0ab	3.8±0.3a	33.5±0.2b	11.2±0.4a
HB-$E_{2.5\%}$-$O_{10\%}$	92.4±0.1ab	7.6±0.1ab	41.0±0.1ab	8.7±0.1ab	32.2±0.0ab	18.2±0.1ab
HB-$E_{2.5\%}$-$O_{20\%}$	88.7±0.2b	11.3±0.2b	34.4±0.3b	15.8±0.2b	25.7±0.1ab	24.1±0.3b
CB-$E_{2.5\%}$	97.4±0.2a	2.6±0.2a	86.3±0.5a	n.d	13.7±0.5a	n.d
CB-$E_{2.5\%}$-$O_{5\%}$	94.9±0.2ab	5.1±0.2ab	55.7±0.4ab	3.2±0.2a	31.3±0.0ab	9.8±0.2a
CB-$E_{2.5\%}$-$O_{10\%}$	92.9±0.2ab	7.1±0.2ab	45.0±0.4ab	6.7±0.2ab	32.5±0.2b	15.8±0.4ab
CB-$E_{2.5\%}$-$O_{20\%}$	90.4±0.4b	9.6±0.4b	37.8±0.5b	11.6±0.4b	29.6±0.3ab	21.1±0.4b

n.d: not detected;

HB: hot-break tomato purees; CB: cold-break tomato purees; EVOO: virgin olive oil; HB-Et%-Om%: HB-EVOO-onion puree with t% EVOO and m% onion; CB-$E_{t\%}$-$O_{m\%}$: CB-EVOO-onion puree with t% EVOO and m% onion;

Data followed by different letters in the same column for same tomato matrix (HB or CB) are significantly different (p<0.05, Dunn test).