DETERMINATION OF β-CAROTENE BIOACCESSIBILITY IN ORANGE FLESHED SWEETPOTATOES

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PRESENTATION STRUCTURE

1. BACKGROUND
2. METHODS
3. RESULTS AND DISCUSSION
4. CONCLUSION

Background

- Growing interest in OFSP as a source of provitamin A carotenoids
- Levels of β-carotene (BC) in OFSP are enough to alleviate vitamin A deficiency (VAD)
- OFSP have become central in the fight against VAD

Background

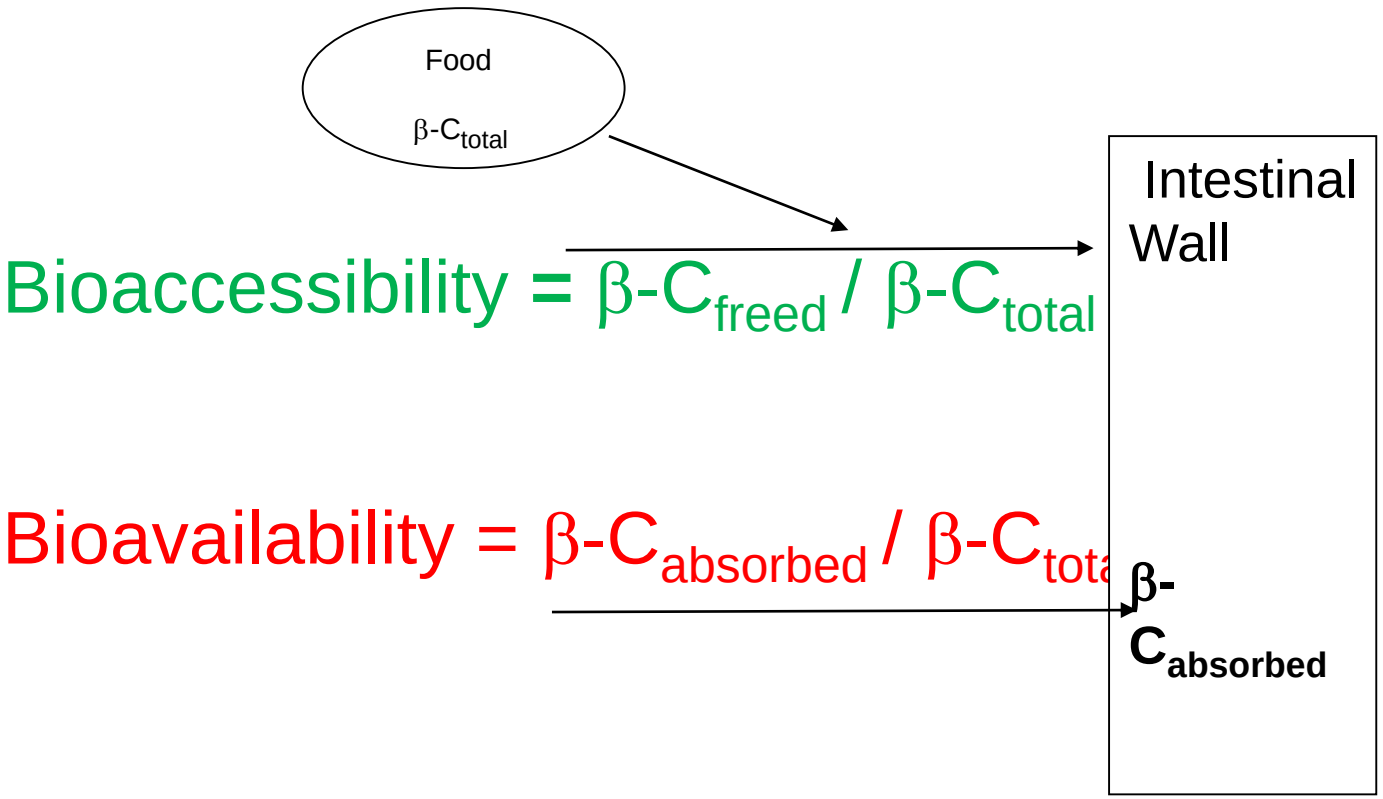
- β-carotene is affected by processing conditions e.g heat and light
- Heat treatment causes structural modification of BC
- Processing may enhance the release of carotenoids
- Need for information on processing conditions on bioaccessibility

Back ground

- Bioaccessibility refers to the amount of an ingested nutrient that is available for absorption in the gut after the process of digestion (Hedren, Diaz, & Svernburg, 2002)

- Bioavailability refers to the amount of the nutrient that is absorbed and utilised in the body (Tanumihardjo, 2002)

Illustration of bioaccessibility



- Carotenoid bioaccessibility is influenced by several factors;
  - »Matrix
  - »Presence of fat
  - »Heat treatment/processing
  - »Storage conditions
  - »Fiber co-ingested with carotenoid

Objective

To determine the influence of traditional processing methods on the OFSP microstructure and *in vitro* bioaccessibility of β-carotene

Materials and methods

- *Ejumula, SPK004/6/6, SPK004/6, SPK004* and *SPK004/1* were obtained from Luweero

- The roots were harvested at 4.5 months

- Chemicals used were procured from BDH (UK) while carotenoid standards were obtained from CaroteNature GmbH (Lupsingen, Switzerland)

Sample preparation:

Boiling: 250g of slices were boiled for 20min at 92 ^{o}C

Steaming: 250g slices steamed in banana leaves for 30min at 94^{o}C

Deep frying: 200g were immersed in 300ml of preheated oil for 10min at 170 ^{o}C

Baking: 200g of slices were baked for 15min at 180 ^{o}C

Carotenoids extraction and analysis

- Carotenoids were extracted using acetone and separation of phases was done using PE (40-60^{o}C) and analysed using HPLC (Benggston et al., 2008)
- Carotenoids were calculated on dry matter basis
- Identification was done using aunthentic standards

Determination of *in vitro* bioaccessibility

- The bioaccessibility was determined using an *in- vitro* digestion model (Hedren et al, 2000).

- This method simulates digestion in the gastro-intestinal tract .

- Micellar fraction was separated by centrifugation followed by filtration

Microscopy

- Tissues (6 x 3.4 x 3.4mm) were sectioned from the outer parts of OFSP processed roots
- Fixed in 10%formol saline solution (Rutzin, 1999)
- After processing tissues were dehydrated using a series of alcohol concentration and cleared in xylene
- Sectioning was done using a rotary microtome
- The sections were stained with PAS for 15min and passed through several changes of ethanol
- Slides were examined in light microscope

Data analysis

- Results for *in vitro* bioaccessibility values, β-carotene content were subjected to ANOVA in Stata

- Multiple comparisons of means were done using the Bonferroni method

- Image analysis of micrographs was done using AxioVision Release 4.7 software

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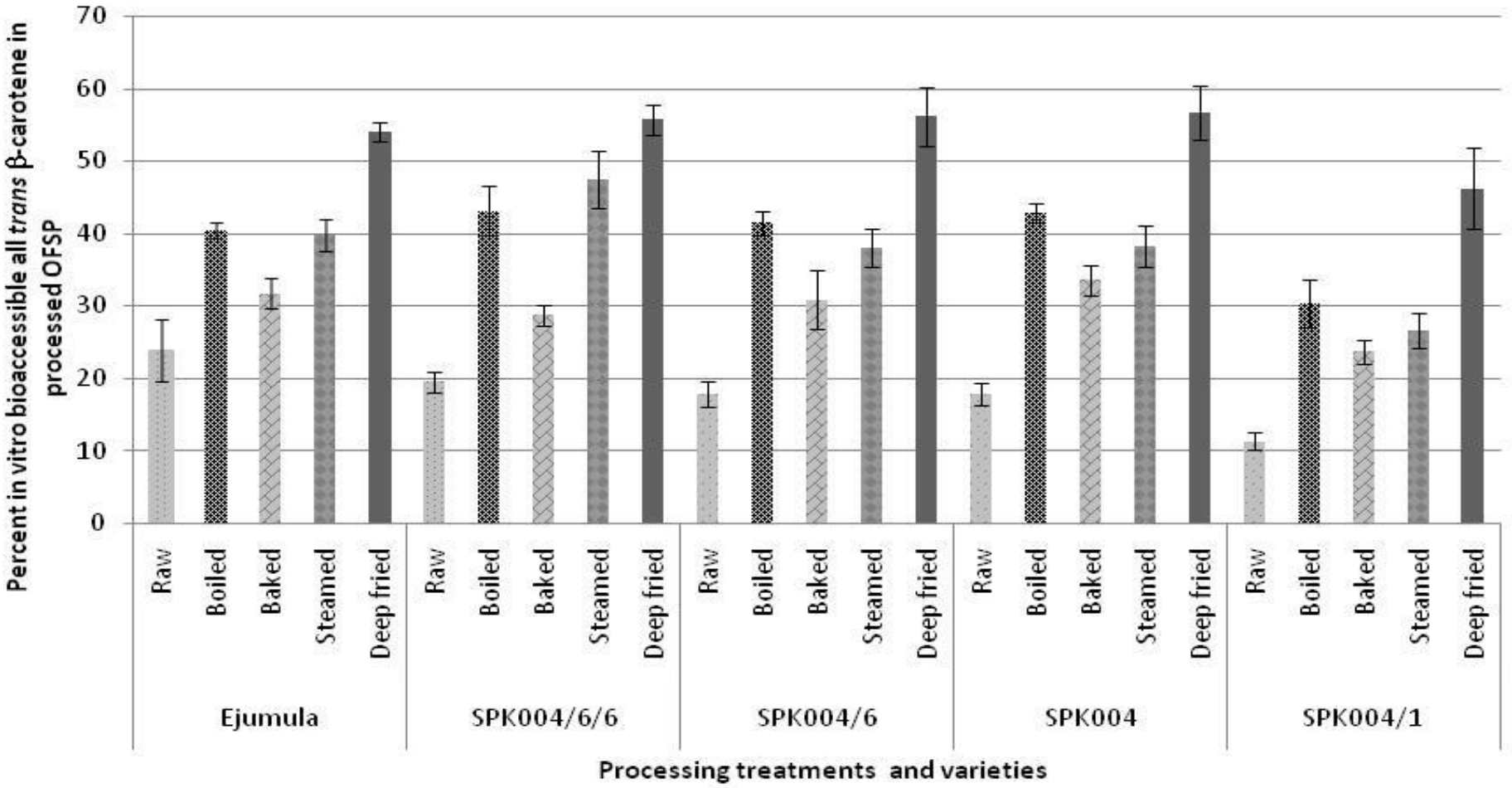
All-*trans*- β-carotene (µg/g dm) in raw and processed OFSP varieties

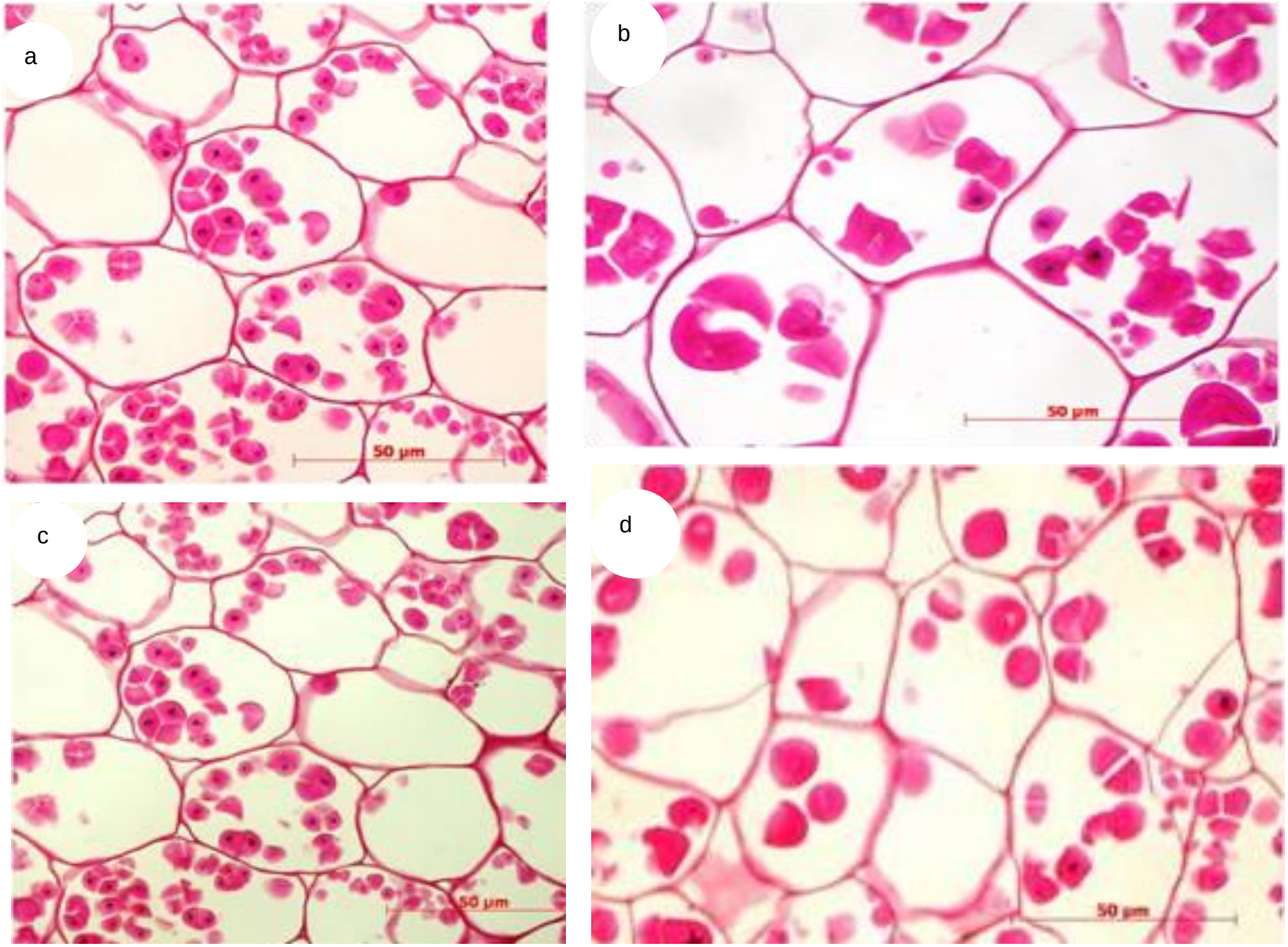
Variety	Raw	Boiled	Baked	Steamed	Deep fried
Ejumula	34.77± 10.17^{a}	106.53± 5.02^{a}	78.32± 8.14^{a}	105.79± 4.4^{a}	150.79± 9.67^{a}
SPK004/6/6	41.53± 3.51^{a}	70.74± 3.98^{b}	48.03± 5.22^{b}	64.64± 4.87^{b}	101.14± 9.67^{b}
SPK004/6	33.78± 4.38^{a}	69.25± 1.24^{b}	44.35± 2.64^{c}	49.43± 2.67^{c}	58.80± 3.94^{c}
SPK004	18.18± 2.07^{b}	37.18± 3.07^{c}	18.54± 2.51^{d}	25.34± 1.16^{d}	40.54± 3.73^{d}
SPK004/1	7.63± 1.08^{b}	18.36± 1.26^{c}	11.46± 1.33^{e}	13.48± 0.94^{e}	19.30± 1.05^{e}

The values are means ± standard deviation (n = 3). Means in the same column with different superscripts are significantly different at $p \leq 0.05$

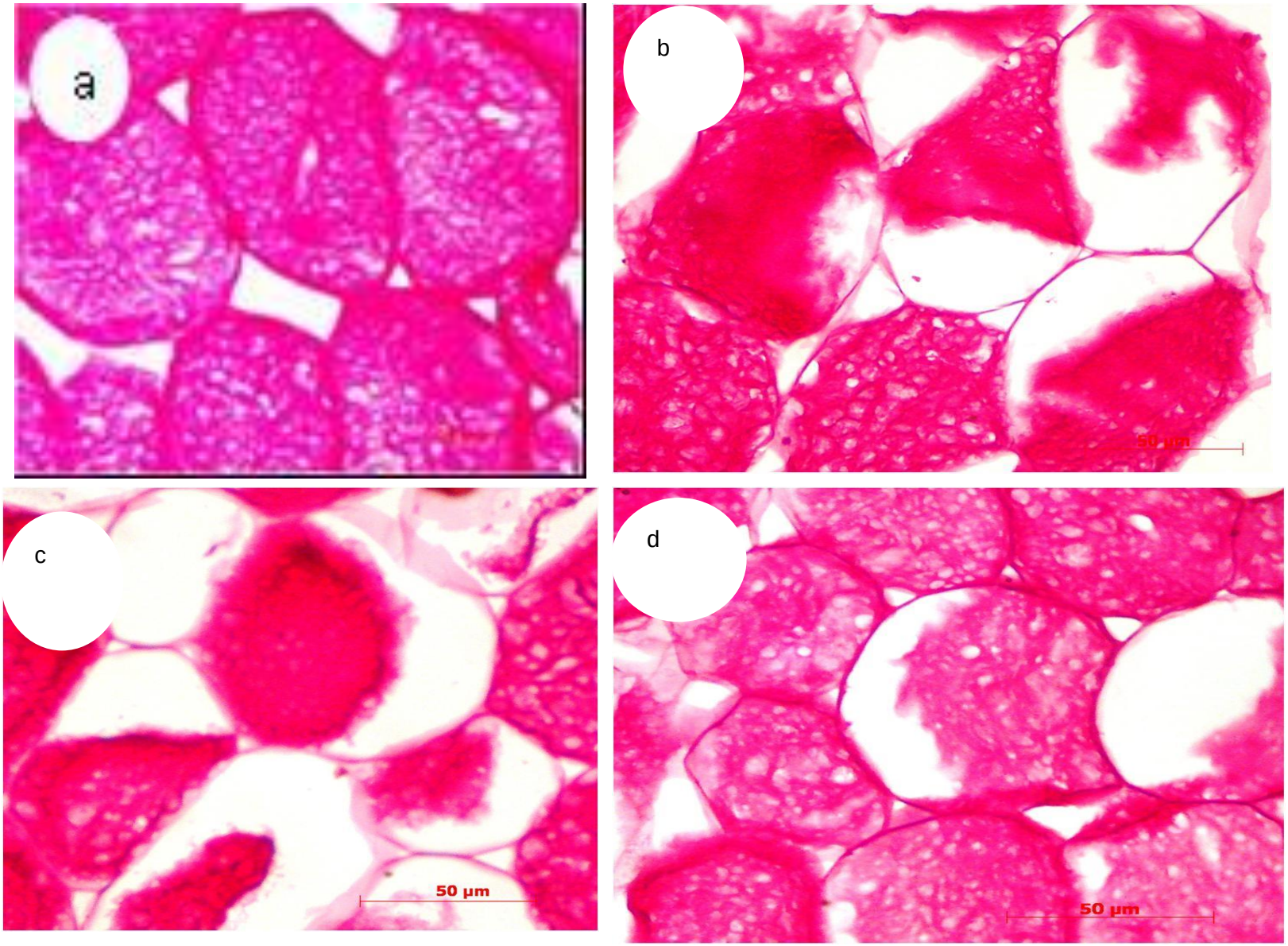
Effect of processing methods on the *in vitro* beta carotene bioaccessibility of OFSP.



Values (percent bioaccessibility) are given as mean ± SD (n= 3)



Micrographs (a-d) of storage parenchyma tissue of raw OFSP for varieties; ejumula, SPK004/6/6, SPK004 and SPK004/6



Micrographs of processed *ejumula* variety: a (baked), b (boiled), c(steamed), d(deep fried)

- *In vitro* bioaccessibility varied thus; raw< baking< steaming/steaming < deep frying
- Heat processing reduces BC content but increases bioaccessibility
- Presence of fat in diet improves the bioaccessibility of beta carotene
- Heat processing disrupts or softens plant cells

Tumuhimbise. G.A., Namutebi, A.S., & Muyonga, J.H. (2009). Microstructure and in vitro β-carotene bioaccessibility of heat processed orange fleshed sweet potatoes: *Plant Foods for Human Nutrition*; *64*: 312-318

THANKS FOR YOUR ATTENTION