Effect of clarification on physical-chemical properties and nutrients of pressed and blended cashew apple juice

Angela Aluko, Edna Makule, Neema Kassim
Dept. of Food Biotechnology and Nutritional Sciences (FBNS),
Nelson Mandela African Institute of Science and Technology (NM-AIST), Tanzania

Introduction

- Cashew apple (CA) is an important health fruit; contain five-times more vitamin C compared to that of citrus fruit
- CA is highly underutilized in Tanzania due to its high perishability ,astringency and inadequate postharvest value addition technologies.[1]
- This study was designed to optimize clarification of CA juice using gelatin, and assess the effect of clarification on physical chemical properties and nutrients.

Methodology

- CA value added product: Cashew Apple Juice (CAJ) by pressing and blending method
- Clarification: by using gelatin
- Analysis of total phenolic and tannin content: folin ciocalteau method and spectrophotometric determination[2]
- Analysis of ascorbic acid ,beta-carotene and sugar : spectrophotometric method[2]

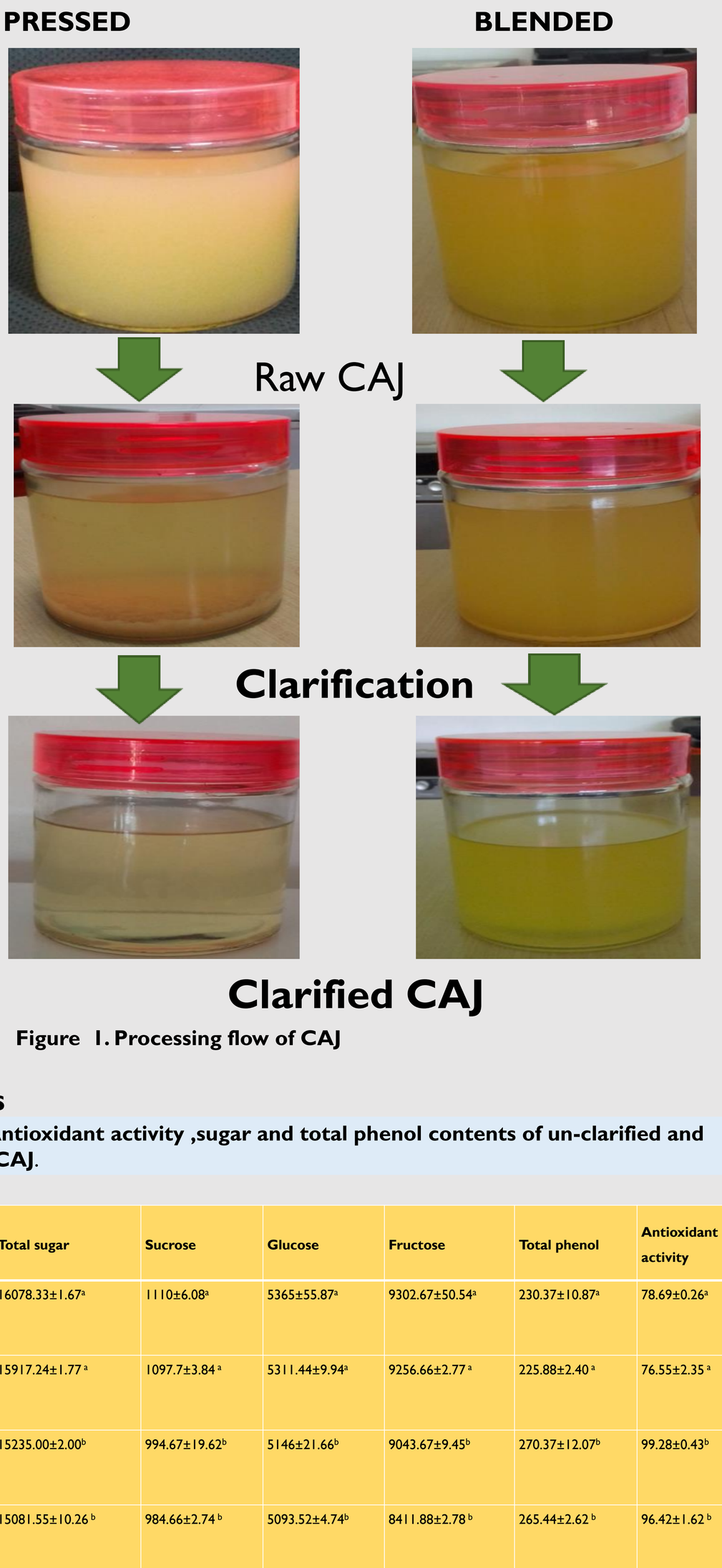

Figure 1. Processing flow of CAJ

Results

Table 4.Antioxidant activity ,sugar and total phenol contents of un-clarified and clarified CAJ.

CAJ (mg/100ml)	Total sugar	Sucrose	Glucose	Fructose	Total phenol	Antioxidant activity
UPCAJ	16078.33±1.67[a]	1110±6.08[a]	5365±55.87[a]	9302.67±50.54[a]	230.37±10.87[a]	78.69±0.26[a]
CPCAJ	15917.24±1.77[a]	1097.7±3.84[a]	5311.44±9.94[a]	9256.66±2.77[a]	225.88±2.40[a]	76.55±2.35[a]
UBCAJ	15235.00±2.00[b]	994.67±19.62[b]	5146±21.66[b]	9043.67±9.45[b]	270.37±12.07[b]	99.28±0.43[b]
CBCAJ	15081.55±10.26[b]	984.66±2.74[b]	5093.52±4.74[b]	8411.88±2.78[b]	265.44±2.62[b]	96.42±1.62[b]

Whereas; Mean value (n=3) ± SD wet basis; UPCAJ, Un-clarified pressed cashew apple juice; UBCAJ, Un-clarified blended cashew apple juice; CPCAJ, clarified pressed cashew apple juice; CBCAJ, Clarified blended cashew apple juice. The same superscript letter within the row has no significant difference p>0.05

Table 1. Reduction of tannin from pressed CAJ using gelatin (mg/100ml TAE)

Gelatin concentration (g/L)	Time (h)							
	0	1	2	4	6	8	10	12
0	217.6±5.2[a1]	177.6±1.5[b1]	152.6±5.2[c1]	132.6±5.8[d1]	132.1±0.7[d1]	131.7±2.6[d1]	131.5±2.7[d1]	131.4±1.9[d1]
0.025	217.6±5.2[a1]	127.6±1.3[b2]	102.6±1.68[c2]	102.2±0.7[c2]	102.0±0.6[c2]	102.0±3.0[c2]	101.8±1.5[c2]	101.7±1.3[c2]
0.05	217.6±5.2[a1]	102.6±1.4[b3]	66.2±2.43[c3]	65.8±2.093[c3]	65.6±3.04[c3]	65.5±4.99[c3]	65.4±1.87[c3]	65.3±0.92[c3]
0.1	217.6±5.2[a1]	97.6±1.4[b4]	48.7±4.41[c4]	48.3±1.42[c4]	48.1±0.87[c4]	48.0±2.90[c4]	47.9±3.29[c4]	47.8±1.38[c4]
0.2	217.6±5.2[a1]	87.6±0.8[b5]	24.6±4.1[c5]	24.2±2.59[c5]	24.0±4.42[c5]	23.9±2.62[c5]	23.8±1.97[c5]	23.7±2.27[c5]
0.3	217.6±5.2[a1]	91.6±1.3[b6]	29.6±1.3[c6]	29.2±0.8[c6]	29.0±2.1[c6]	28.9±1.8[c6]	28.8±0.9[c6]	28.7±1.8[c6]
0.4	217.6±5.2[a1]	94.6±2.3[b7]	34.6±0.9[c7]	34.2±3.3[c7]	34.0±5.0[c7]	33.9±4.0[c7]	33.8±4.5[c7]	33.7±2.2[c7]

Mean value (n=3) ± SD on a wet basis; TAE, tannic acid equivalent; the same superscript letter within the row has no significant difference p>0.05, whereas the same superscript number within the column has no significant difference p>0.05.

Table 2. Reduction of tannin from blended CAJ using gelatin (mg/100ml TAE)

Gelatin concentration (g/L)	Time (h)							
	0	1	2	4	6	8	10	12
0	258.0±8.9[a1]	211.0±2.1[b1]	193.0±3.2[c1]	181.0±1.1[d1]	180.5±1.0[d1]	180.1±1.8[d1]	179.9±3.6[d1]	179.8±1.7[d1]
0.025	258.0±8.9[a1]	158.0±0.3[b2]	142.6±0.8[c2]	142.2±2.0[c2]	142.0±2.3[c2]	141.9±1.4[c2]	141.8±0.3[c2]	141.7±2.1[c2]
0.05	258.0±8.9[a1]	143.0±1.6[b3]	106.6±4.0[c3]	106.2±1.9[c3]	106.0±4.1[c3]	105.9±0.6[c3]	105.8±2.4[c3]	105.7±2.6[c3]
0.1	258.0±8.9[a1]	138.0±1.9[b4]	78.0±1.8[c4]	77.6±0.6[c4]	77.4±0.8[c4]	77.3±1.9[c2 c4]	77.2±1.3[c4]	77.1±2.3[c4]
0.2	258.0±8.9[a1]	129.0±0.8[b5]	55.0±3.7[c5]	54.6±1.5[c5]	54.4±2.8[c5]	54.3±0.9[c5]	54.2±2.9[c5]	54.1±1.4[c5]
0.3	258.0±8.9[a1]	128.0±0.6[b6]	65.0±3.8[c6]	64.6±1.5[c6]	64.4±2.8[c6]	64.3±0.9[c6]	64.2±0.9[c6]	64.1±1.4[c6]
0.4	258.0±8.9[a1]	127.0±0.7[b7]	70.1±0.2[c7]	69.7±1.2[c7]	69.5±0.7[c7]	69.4±1.9[c7]	69.3±0.5[c7]	69.2±2.6[c7]

Mean value (n=3) ± SD on a wet basis; TAE, tannic acid equivalent; the same superscript letter within the row has no significant difference p>0.05, whereas the same superscript number within the column has no significant difference p>0.05.

Table 3. Minerals, Vitamin C and B-carotene content of un-clarified and clarified CAJ

CAJ (mg/100ml)	Ca	K	P	Zn	Fe	Mg	Vitamin C	β-carotene
UPCAJ	19.90±0.2[a]	244.00±4.0[a]	0.8±0.2[a]	0.2±0.13[a]	1.66±0.06[a]	40.30±0.30[a]	289.39±19.49[a]	0.65±0.4[a]
CPCAJ	18.9±2.9[b]	237.16±3.5[b]	0.67±0.0[b]	0.18±0.0[b]	1.56±0.0[b]	37.76±1.9[b]	263.51±9.9[b]	0.62±0.0[b]
UBCAJ	24.50±0.1[c]	265.00±5.0[c]	2.0±0.3[c]	0.80±0.05[c]	1.92±0.2[c]	30.70±0.20[c]	322.94±4.85[c]	1.76±0.13[c]
CBCAJ	22.80±1.4[d]	254.43±4.6[d]	1.6±0.4[d]	0.72±0.1[d]	1.77±0.1[d]	27.94±2.3[d]	290.72±2.3[d]	1.65±0.0[d]

Whereas; Mean value (n=3) ± SD wet basis; UPCAJ, Un-clarified pressed cashew apple juice; UBCAJ, Un-clarified blended cashew apple juice; CPCAJ, clarified pressed cashew apple juice; CBCAJ, Clarified blended cashew apple juice. The same superscript letter within the row has no significant difference p>0.05.

Discussion

- High nutritional content of blended CAJ is caused by crushing the fruit with the skin, whereas the skin contains much nutrients.[3]
- Tannin was reduced during clarifiacation due to complex formation between gelatin and tannin.[4]
- Vitamin C reduction during clarification was due to oxidation , and this was facilitated by presence of oxygen, light, & temperature.[5]

Conclusion

- Both blending and pressing followed by clarification process retained substantial amount of key nutrients contributing to food and nutrition security
- These technologies can be employed at households and small-medium scale processing.

Reference
1. Dimoso N., Aluko A., Makule E., Kassim N. (2020): Challenges and opportunities toward sustainable consumption and value addition of cashew apple in Tanzania. Outlook on Agriculture: 1-9.
2. AOAC. (1980): Official methods of analyses. Washington, DC 20044: The Association of Analytical Chemists (AOAC), 738-739.
3. Czech, A., Zarycka, E., Yanovych, D., Zasadna, Z., Grzegorczyk, I., & Kłys, S. (2020). Mineral content of the pulp and peel of various citrus fruit cultivars. *Biological Trace Element Research*, *193*(2), 555-563.
4. Prommajak, T., Leksawasdi, N., & Rattanapanone, N. (2019). Tannins in fruit juices and their removal. *Chiang Mai University Journal of Natural Sciences*, 19(1), 76-90.
5. Lee, S. K., & Kader, A. A. (2000). Preharvest and postharvest factors influencing vitamin C content of horticultural crops. *Postharvest Biology and Technology*, 20(3), 207–220.

With support from
Federal Ministry of Food and Agriculture
by decision of the German Bundestag