**Supplementary Materials**

Article

Non-sensory perception and sensory appeal of *Zamnè*, *pseudoZamnè*, traditionally cooked *Senegalia erythrocalyx* seeds, and tempeh by Burkinabe consumers

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| **Table S1.** Sensory appeals and overall perceptions (mean scores ± standard deviation) of the products | | | | | | | | |
|  | Products | | | | | | | |
| Attribute | TCZ | CSs | CSe | RZ | fST | fZT | dZT | p-value^ |
| Sensory appeal | | | | | | | |  |
| Aroma | 6.8 ±1.9a | 6.2 ±2.1ab | 5.4 ±2.0bc | 4.4 ±2.3c | 4.5 ±2.1c | 5.0 ±2.3c | 5.3 ±2.5bc | <0.001 |
| Appearance | 6.5 ±1.8a | 7.0 ±1.9a | 5.2 ±2.1b | 5 ±2.1bc | 4.8 ±2.2bc | 4.7 ±2.1bc | 4.1 ±2.1c | <0.001 |
| Texture/mouthfeel | 6.7 ±1.7a | 6.9 ±1.7a | 4.9 ±2.1bc | 4.8 ±2.1bc | 5.4 ±2.1c | 4.9 ±2.1bc | 4.2 ±2.1b | <0.001 |
| Taste | 6.4 ±1.8a | 6.0 ±2.0ab | 3.4 ±2.3c | 3.4 ±1.8c | 5.0 ±2.3bd | 4.9 ±2.2d | 4.6 ±2.1d | <0.001 |
| Aftertaste | 6.2 ±2.0a | 6.0 ±2.2a | 3.1 ±2.1b | 3.8 ±2.2bc | 5.5 ±2.2ad | 5.3 ±2.0ad | 4.7 ±2.2cd | <0.001 |
| Overall appeal (whole panel, N = 77) | 7.0 ±1.5a | 6.5 ±1.8a | 4.0 ±2.3bc | 3.8 ±2.0b | 5.2 ±2.0d | 4.9 ±2.0cd | 4.8 ±2.3cd | <0.001 |
| Overall appeal (cluster 1, n = 40) | 6.6 ±1.4a\* | 6.4 ±1.7aΩ | 3.3 ±1.9bΩ | 3.6 ±1.6bΩ | 5.8 ±1.5acΩ | 5.3 ±1.4cΩ | 5.9 ±1.6ac\* | <0.001 |
| Overall appeal (cluster 2, n = 25) | 7.2 ±1.7a\* | 6.1 ±2.0aΩ | 4.1 ±2.4bcΩ | 2.7 ±1.3bΩ | 3.4 ±1.6dΨ | 3.1 ±1.7cdΨ | 2.5 ±1.4cdΩ | <0.001 |
| Overall appeal (cluster 3, n = 12) | 7.7 ±0.9a\* | 8.1 ±1.0a\* | 6.3 ±2.1ab\* | 7.0 ±1.0ab\* | 7.2 ±1.2ab\* | 7.3 ±1.0ab\* | 5.6 ±2.7b\* | 0.009 |
| p-value^^ | 0.037 | 0.008 | 0.003 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001Σ |
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| Overall perceptions | | | | | | | | |
| Willingness to buy | 4.1 ±1.0a | 4.0 ±1.1a | 2.27 ±1.37bc | 2.2 ±1.3b | 3.0 ±1.3d | 2.8 ±1.2bcd | 2.8 ±1.5cd | <0.001 |
| Willingness to eat if "last resort" | 4.6 ±0.6a | 4.4 ±0.8a | 2.94 ±1.46b | 2.9 ±1.4b | 3.58 ±1.2c | 3.6 ±1.2c | 3.6 ±1.3c | <0.001 |
| TCZ, CSs, and CSe refer to the traditionally cooked *Zamnè* (*Senegalia macrostachya* seeds), *pseudoZamnè* (*Senegalia senegal* seeds), and *Senegalia erythrocalyx* seeds, respectively. RZ, fST, fZT, and dZT refer to the blanched green *Zamnè*, fresh soy tempeh, fresh *Zamnè* tempeh, and *Zamnè* tempeh crisps, respectively. The clusters were identified by performing K-mean clustering based on the scoring of the aroma, appearance, texture, taste, aftertaste, and overall sensory appeals of the products. The sensory appeals were scored between 1 = “dislike extremely” and 9 = “like extremely”, and the overall perceptions were scored between 1 = “certainly will not buy/eat even if last resort” and 5 = “certainly will buy/eat if last resort”. The p-values were derived from ANOVA (with Σthe product and the cluster as interacting factors, and the ^product and the ^^cluster as independent factors). Scores in the same row and with different letter (a-d) superscripts were considered significantly different at p < 0.05 (Tukey range test). The scores of the overall appeal in the same column and with different symbols (\*, Ω, Ψ) were considered significantly different at p < 0.05 (Tukey range test). | | | | | | | | |

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| **Table S2.** Frequencies (%) of use of the sensory descriptors by the participants (N = 77) | | | | | | | | |
|  | Products | | | | | | | |
| Descriptors | TCZ | CSs | CSe | RZ | fST | fZT | dZT | p-value^ |
| Unique taste | 34a | 32a | 53ab | 59b | 47ab | 43ab | 36a | <0.001 |
| Tasteless | 53a | 54a | 14b | 11b | 42a | 45a | 36ab | <0.001 |
| Nutty | 9a | 11a | 8a | 11a | 9a | 32b | 8a | <0.001 |
| Soumbala-like taste | 0a | 3a | 5a | 0a | 3a | 3a | 39b | <0.001 |
| Fish-like taste | 0a | 5a | 1a | 5a | 11a | 9a | 12b | 0.004 |
| Potash/alkaline taste | 24a | 13ab | 28a | 4b | 9b | 5b | 12ab | <0.001 |
| Soapy taste | 5a | 12a | 12a | 4a | 20a | 18a | 12a | 0.019 |
| Sour | 0a | 3a | 5a | 51b | 8a | 4a | 8a | <0.001 |
| Bitter | 0a | 1a | 26b | 16ab | 5a | 4a | 9ab | <0.001 |
| Astringent | 3 | 1 | 11 | 9 | 5 | 4 | 3 | 0.073 |
| Persisting after taste | 11a | 9a | 33b | 18ab | 14ab | 17ab | 25ab | 0.003 |
| Dull appearance | 63a | 30b | 70a | 18b | 58a | 28b | 72a | <0.001 |
| Appealing appearance | 32ab | 59c | 17a | 67c | 30ab | 54bc | 13a | <0.001 |
| Soumbala appearance | 50a | 49ad | 28bc | 11bc | 28bc | 4b | 30cd | <0.001 |
| Soft | 62a | 54ab | 37ab | 22b | 57a | 46ab | 7c | <0.001 |
| Greasy | 9a | 12a | 34b | 9a | 11a | 13a | 0a | <0.001 |
| Hard | 4a | 11ab | 4a | 21bc | 4a | 5a | 47c | <0.001 |
| Dry | 3a | 0a | 0a | 5a | 3a | 1a | 53b | <0.001 |
| Crispy | 11ab | 7a | 5a | 12ab | 4a | 5a | 25b | <0.001 |
| Grainy/earthy | 8ab | 8ab | 14ab | 18a | 14ab | 13ab | 0b | 0.006 |
| TCZ, CSs, and CSe refer to the traditionally cooked *Zamnè* (*Senegalia macrostachya* seeds), *pseudoZamnè* (*Senegalia senegal* seeds), and *Senegalia erythrocalyx* seeds, respectively. RZ, fST, fZT, and dZT refer to the blanched green *Zamnè*, fresh soy tempeh, fresh *Zamnè* tempeh, and *Zamnè* tempeh crisps, respectively. ^The p-values were derived from Cochran-Q test with the product as the factor. The frequencies in the same row but with different letter (a-d) superscripts were considered significantly different based on Bonferroni-corrected p-values (Dunn test). | | | | | | | | |

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| **Table S3.** Differences between the clusters in the frequencies (%) of use of the sensory descriptors | | | | | | | | | | | | | | | |
|  | TCZ | | |  | CSs | | |  | CSe | | |  | RZ | | |
| Descriptors | C2~ | C3~ | p-value^ |  | C2~ | C3~ | p value^ |  | C2~ | C3~ | p-value^ |  | C2~ | C3~ | p-value^ |
| Unique taste | 34 | 28 | 0.406 |  | 37 | 24 | 0.215 |  | 61 | 40 | 0.080 |  | 61 | 48 | 0.219 |
| Tasteless | 41 | 64 | 0.064 |  | **44** | **72** | **0.024** |  | 15 | 20 | 0.404 |  | 10 | 16 | 0.351 |
| Nutty | 10 | 12 | 0.538 |  | 17 | 12 | 0.428 |  | 5 | 4 | 0.681 |  | 7 | 16 | 0.239 |
| Soumbala-like taste | 0 | 0 |  |  | 2 | 4 | 0.14 |  | 5 | 4 | 0.681 |  | 0 | 0 |  |
| Fish-like taste | 0 | 0 |  |  | 2 | 4 | 0.14 |  | 0 | 4 | 0.379 |  | 2 | 8 | 0.319 |
| Potash/alkaline taste | **37** | **12** | **0.026** |  | 20 | 8 | 0.404 |  | **15** | **36** | **0.045** |  | 2 | 4 | 0.14 |
| Soapy taste | 2 | 4 | 0.14 |  | 15 | 4 | 0.173 |  | 17 | 8 | 0.256 |  | 5 | 4 | 0.681 |
| Sour | 0 | 0 |  |  | 2 | 4 | 0.14 |  | 5 | 4 | 0.681 |  | 54 | 44 | 0.306 |
| Bitter | 0 | 0 |  |  | 2 | 0 | 0.621 |  | 34 | 20 | 0.171 |  | 15 | 16 | 0.572 |
| Astringent | 0 | 4 | 0.379 |  | 0 | 4 | 0.379 |  | 12 | 8 | 0.462 |  | 7 | 8 | 0.633 |
| Persisting after taste | 10 | 12 | 0.538 |  | 7 | 4 | 0.510 |  | 29 | 32 | 0.513 |  | 20 | 16 | 0.495 |
| Dull appearance | 66 | 48 | 0.121 |  | 34 | 28 | 0.406 |  | 68 | 64 | 0.461 |  | 17 | 20 | 0.505 |
| Appealing appearance | 24 | 44 | 0.094 |  | 56 | 60 | 0.170 |  | 10 | 24 | 0.114 |  | 63 | 64 | 0.234 |
| Soumbala appearance | 46 | 52 | 0.424 |  | 39 | 60 | 0.080 |  | 17 | 32 | 0.136 |  | 7 | 16 | 0.239 |
| Soft | 66 | 56 | 0.294 |  | 54 | 44 | 0.306 |  | 41 | 28 | 0.201 |  | 20 | 20 | 0.648 |
| Greasy | 10 | 8 | 0.59 |  | 12 | 16 | 0.464 |  | 29 | 44 | 0.170 |  | 12 | 4 | 0.256 |
| Hard | 2 | 8 | 0.319 |  | 10 | 16 | 0.351 |  | 2 | 4 | 0.14 |  | 22 | 28 | 0.393 |
| Dry | 2 | 0 | 0.621 |  | 0 | 0 |  |  | 0 | 0 |  |  | 2 | 8 | 0.319 |
| Crispy | 2 | 16 | 0.064 |  | 2 | 8 | 0.319 |  | 2 | 12 | 0.148 |  | 10 | 8 | 0.59 |
| Grainy/earthy | 10 | 4 | 0.367 |  | 10 | 4 | 0.367 |  | 10 | 12 | 0.538 |  | 17 | 24 | 0.352 |
| (continued next page…) | | | | | | | | | | | | | | | |

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| **Table S3.** Differences between the clusters in the frequencies (%) of use of the sensory descriptors (…continued) | | | | | | | | | | | |
|  | fST | | |  | fZT | | |  | dZT | | |
| Descriptors | C2~ | C3~ | p-value^ |  | C2~ | C3~ | p value^ |  | C2~ | C3~ | p-value^ |
| Unique taste | 46 | 52 | 0.4236 |  | 41 | 36 | 0.4301 |  | 29 | 40 | 0.2638 |
| Tasteless | **34** | **60** | **0.0361** |  | 39 | 48 | 0.323 |  | 27 | 36 | 0.3029 |
| Nutty | 10 | 8 | 0.5901 |  | 34 | 28 | 0.4055 |  | 10 | 0 | 0.1405 |
| Soumbala-like taste | 5 | 0 | 0.3823 |  | 5 | 0 | 0.3823 |  | 46 | 28 | 0.1107 |
| Fish-like taste | 10 | 12 | 0.5381 |  | 7 | 12 | 0.4307 |  | **5** | **28** | **0.0119** |
| Potash/alkaline taste | 5 | 8 | 0.4897 |  | 5 | 8 | 0.4897 |  | 12 | 16 | 0.4644 |
| Soapy taste | 27 | 8 | 0.05687 |  | 17 | 20 | 0.5048 |  | 7 | 24 | 0.06291 |
| Sour | 5 | 8 | 0.4897 |  | 2 | 4 | 0.14 |  | 2 | 12 | 0.1484 |
| Bitter | 5 | 8 | 0.4897 |  | 2 | 0 | 0.6212 |  | 15 | 4 | 0.1732 |
| Astringent | 10 | 0 | 0.1405 |  | 0 | 12 | 0.05026 |  | 2 | 0 | 0.6212 |
| Persisting after taste | 17 | 16 | 0.5963 |  | 17 | 20 | 0.5048 |  | 29 | 20 | 0.2963 |
| Dull appearance | 56 | 48 | 0.3499 |  | 27 | 20 | 0.3747 |  | 66 | 76 | 0.2787 |
| Appealing appearance | 29 | 36 | 0.3806 |  | 54 | 56 | 0.5284 |  | 15 | 12 | 0.5356 |
| Soumbala appearance | 22 | 24 | 0.4236 |  | 5 | 4 | 0.6809 |  | 34 | 24 | 0.2787 |
| Soft | 63 | 52 | 0.2552 |  | 44 | 40 | 0.4796 |  | 5 | 4 | 0.6809 |
| Greasy | 5 | 20 | 0.06588 |  | 15 | 16 | 0.5722 |  | 0 | 0 |  |
| Hard | 0 | 4 | 0.379 |  | 2 | 4 | 0.1401 |  | 51 | 40 | 0.2643 |
| Dry | 2 | 0 | 0.6212 |  | 0 | 0 |  |  | 51 | 56 | 0.4515 |
| Crispy | 2 | 8 | 0.319 |  | 5 | 4 | 0.6809 |  | **100** | **24** | **<0.001** |
| Grainy/earthy | 12 | 16 | 0.4644 |  | 15 | 12 | 0.5356 |  | 0 | 0 |  |
| TCZ, CSs, and CSe refer to the traditionally cooked *Zamnè* (*Senegalia macrostachya* seeds), *pseudoZamnè* (*Senegalia senegal* seeds), and *Senegalia erythrocalyx* seeds, respectively. RZ, fST, fZT, and dZT refer to the blanched green *Zamnè*, fresh soy tempeh, fresh *Zamnè* tempeh, and *Zamnè* tempeh crisps, respectively. The clusters were identified by performing K-mean clustering based on the scoring of the aroma, appearance, texture, taste, aftertaste, and overall sensory appeals of the products. C2 and C3 refer to cluster 2 (40 participants) and cluster 3 (25 participants), which had substantial numbers of participants for the statistics. Frequencies in bold were considered significantly different at p-value < 0.05 (Fisher exact test). The RV coefficients between the product configurations and between the descriptor configurations were 0.928 (p = 0.009) and 0.794 (p-value <0.001), respectively. | | | | | | | | | | | |

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| **Table S4.** Inter-relationships between the sensory attributes and the overall appeal of the productsΩ | | | | | | | |
|  | Appearance | Texture | Taste | Aftertaste | Over. appeal | Wtb | Wte |
| Aroma | 0.77\* | 0.75 | 0.74 | 0.55 | 0.82\* | 0.84\* | 0.83\* |
| Appearance |  | 0.96\*\*\* | 0.65 | 0.52 | 0.77\* | 0.79\* | 0.73 |
| Texture |  |  | 0.80\* | 0.70 | 0.88\* | 0.88\* | 0.84\* |
| Taste |  |  |  | 0.96\*\*\* | 0.98\*\*\* | 0.97\*\*\* | 0.98\*\*\* |
| Aftertaste |  |  |  |  | 0.91\*\* | 0.89\* | 0.91\*\* |
| Ω Seventy-seven (77) participants scored the products, and the Pearson correlation coefficients between the scores were determined. Over. appeal, Wtb, Wte, and the texture refer to the overall appeal, the willingness to buy, the willingness to eat if the products were the last resort (*i.e.*, during a famine), and the mouthfeel, respectively. The correlation coefficients (r) with \*, \*\*, and \*\*\* had p-values below 0.05, 0.01, and 0.001, respectively. | | | | | | | |