Veg. Sci. 37(1) : 52-55 (2010)

CONSUMER PERCEPTION AND QUALITY ASSURANCE OF TOMATO KETCHUP WITH DIFFERENT THICKENER

SUDHIR SINGH, AK SINGH AND NEERAJ SINGH
Indian Institute of Vegetable Research, P. O. Box 01, P. O. Jakkhini, Varanasi – 221305

Summary

Tomato ketchup with corn flour at 2.75% level and 1.5% acidity as acetic acid was most acceptable to judges. Tomato ketchup manufactured with cooked bottle gourd having 10% bottle gourd pulp and 1.5% acidity as acetic acid had maximum sensory score for flavour, consistency, colour and appearance and overall acceptability score. Cooked pumpkin pulp (7%) and 1.5% acidity as acetic acid in tomato ketchup was most acceptable to judges. However, tomato ketchup manufactured with the chemical thickener, CMC at 0.7% and 1.5% acidity as acetic acid was also most acceptable to judges. The vegetable based bottle gourd thickener and pumpkin in manufacture of tomato ketchup yielded maximum serum separation of 2.2-3.0 ml while negligible serum separation was obtained in tomato ketchup with corn flour and CMC stabilizer. Maximum (50.71 mg/100g) ascorbic acid in tomato ketchup was obtained with bottle gourd thickener which was followed by 42.3 mg/100g in tomato ketchup with pumpkin as thickener

सारांश

टमाटर की चटनी में मक्के का आटा 2.75 प्रतिशत तथा एसटिक एसिड 1.5 प्रतिशत डालने पर ज्यादा पसंद किया गया। लौकी पल्प 10 प्रतिशत तथा एसटिक एसिड 1.5 प्रतिशत डालने पर ज्यादा सुगन्धित एवं पसंद किया गया। 7.5 लौकी उबालकर तथा 1.5 एस्टि एसिड मिलाने पर सबसे अधिक पसंद किया गया। लौकी का थिकनर कद्दू के थिकनर से ज्यादा अच्छा पाया गया।

Introduction

Food processing now allows increasingly sophisticated control of processing conditions to achieve the aim of reduction in processing costs as well damage to the sensory and nutritional quality of food. India is world's second largest producer of fruits and vegetables. The varied agro-climatic diversity in India resulted into growing all types of temperate, sub-tropical and tropical fruits and vegetables. Due to poor post harvest management, storage and lack of processing facility fruits and vegetables to the extent of 20-30% are lost which is valued at Rs. 230 billion as per the estimate of Planning Commission (Mangaraj and Singh, 2008). Among the vegetables, tomato is high valued crops with maximum losses of 16-50% (Singh and Singh, 2003). Enhanced bioavailability of lycopene from processed products and increased antioxidant activity after processing further advocates consumption of processed tomato products (Singh *et al*. 2008). The extracted tomato juice is also good source of vitamin A, D, E and K (Davies and Hobson, 1981).

More than 80% of tomatoes produced in world are consumed in the form of processed products such as tomato juice, paste, puree, ketchup and salsa sauce. Thermal and mechanical treatments are often involved in processing of tomato which affects the tomato product quality to a greater extent (Kaur *et al*. 2004). Among the tomato processed products, tomato ketchup is very popular in fast food restaurants in India and abroad (Thakur *et al*. 1996). However, the quality of tomato ketchup varies from manufacturer to manufacturer. The natural loss of pectin during processing greatly results in reduced consistency as a result more serum is separated during storage which affects the acceptability of tomato ketchup. There has been wide variation towards the sensory perception of tomato ketchup from manufacturer to manufacturer. The variation exists in terms of flavour, consistency, sourness, colour and appearance and overall acceptability score. The manufacturers use various thickeners in the form of polysaccharides such as starch, gum etc. to improve the consistency and overall acceptability of tomato ketchup (Sidhu *et al*. 1997). Furthermore the acceptability of tomato ketchup depends on the desired acid and sourness level. Among the various organic acids, acetic acid is very cheap, easily available and it increases the palate due to its unique flavour which greatly increases the acceptability of tomato ketchup (Singh *et al*. 2005). The present has been undertaken towards the selection of chemical thickener, carboxy methyl cellulose

(CMC) stabilizer and natural plant based thickener such as cooked bottle gourd, cooked pumpkin and corn flour along with desired level of acidity from acetic acid for manufacture of acceptable tomato ketchup.

Materials and Methods

In the present study, two levels each of four variables such as corn flour (1.5-4.0%), cooked bottle gourd (5-15%), cooked pumpkin (4-10%), CMC (0.4-1.0%) and acidity level(1.25-1.75%) as acetic acid, were standardized for the development of acceptable tomato ketchup. Fully ripened red colour hybrid tomato "Sartaj" was collected from vegetable research farm of IIVR, Varanasi. Forty kg harvest tomatoes were washed thoroughly in running water. The fruits were cuts into small pieces and were subjected to the cooking time of 10 minutes in 75 litre capacity of steam jacketed kettle. The cooked and softened tomatoes were passed through tomato pulper to remove the seed and peel of tomato. Similarly bottle gourd and pumpkin were peeled, sliced and seeds were removed from the pulp. The bottle gourd and pumpkin pulp were separately cooked to 3-4 minutes with steam under pressure and cooked pulp were blended in blender for 1 minute. Tomato ketchup was prepared with 13 formulations each from corn flour, bottle gourd, cooked pumpkin and CMC stabilizer and acetic acid levels using D6 Hoax Response Surface Methodology (Thompson, 1982). Tomato ketchup manufactured with varying levels of corn flour, bottle gourd, pumpkin and CMC stabilizer with varying acid levels were subjected to sensory and physic-chemical analysis. Sensory evaluation was carried out by a panel of 10 trained judges on flavour, consistency, colour and appearance and overall acceptability score on 9 point Hedonic scale (Lawless and Haymann, 1998).

The total soluble solid in tomato ketchup was determined by ERMA hand refractometer (0-32%) and the values were expressed as percentage. The pH of the finished ketchup was measured by digital pH meter. Serum separation in tomato ketchup was measured by centrifuging tomato ketchup (10g) samples in 25 ml graduated centrifuge at 3000 rpm for 10 min in refrigerated centrifuge. The supernatant (ml) in the centrifuge tube was reflected as serum separation. The content of ascorbic acid was estimated as per the method of Sadasivam and Manickam, 1996. The estimation of total carotenoids and lycopene in tomato ketchup was carried out as per the method of Ranganna (1997).

Results and Discussion

Sensory score of tomato ketchup with different thickener: The sensory score of tomato ketchup with different thickeners from 13 different trials each thickener was subjected to sensory evaluation. It was observed that tomato ketchup with corn flour formulation of 2.75% corn flour level and 1.5% acidity as acetic acid was most acceptable to judges. Tomato ketchup manufactured with cooked bottle gourd having 10% cooked bottle gourd pulp and 1.5% acidity as acetic acid had maximum sensory score for flavour, consistency, colour and appearance and overall acceptability score. Cooked pumpkin pulp (7%) as vegetable thickener and 1.5% acidity as acetic acid in tomato ketchup was also most acceptable to judges. However, tomato ketchup manufactured with the chemical thickener, CMC at 0.7% and 1.5% acidity as acetic acid was also most acceptable to judges.

The comparative sensory score of most acceptable tomato ketchup with each thickener is presented in Table 1. Tomato ketchup manufactured with 10% cooked bottle gourd and 1.5% acidity as acetic acid was most acceptable in terms of maximum (8.3) flavour score in response to other thickeners for the manufacture of tomato ketchup (Table 1). However, tomato ketchup with cooked pumpkin pulp as thickener was least preferred to judges with minimum (7.6) flavour score. Judges expressed the perception of vegetable flavour with cooked pumpkin as thickener which has resulted into least flavour score. The maximum (8.6) consistency score in tomato ketchup was reported with CMC thickener by the judges and minimum (7.1) consistency score was obtained with tomato ketchup manufactured with cooked pumpkin pulp followed by 7.9 consistency score with cooked bottle gourd pulp (Table 1). Sidhu *et al*. (1997) also

Table1. Consumer sensory score of tomato ketchup with different thickeners*

Attributes	Thickener			
	Corn flour	Bottle gourd	Pumpkin	CMC
Flavour	7.8 ± 0.3	8.3 ± 0.7	7.6 ± 0.3	7.8 ± 0.7
Consistency	8.2 ± 0.2	7.9 ± 0.3	7.1 ± 0.5	8.6 ± 0.8
Sourness	7.5 ± 0.4	7.4 ± 0.6	8.1 ± 0.3	7.7 ± 0.6
Colour and appearance	7.5 ± 0.5	7.4 ± 0.8	7.9 ± 0.4	8.2 ± 0.7
Overall acceptability	7.75 ± 0.3	7.75 ± 0.4	7.68 ± 0.5	8.08 ± 0.9

· Each value represents the mean ± SD

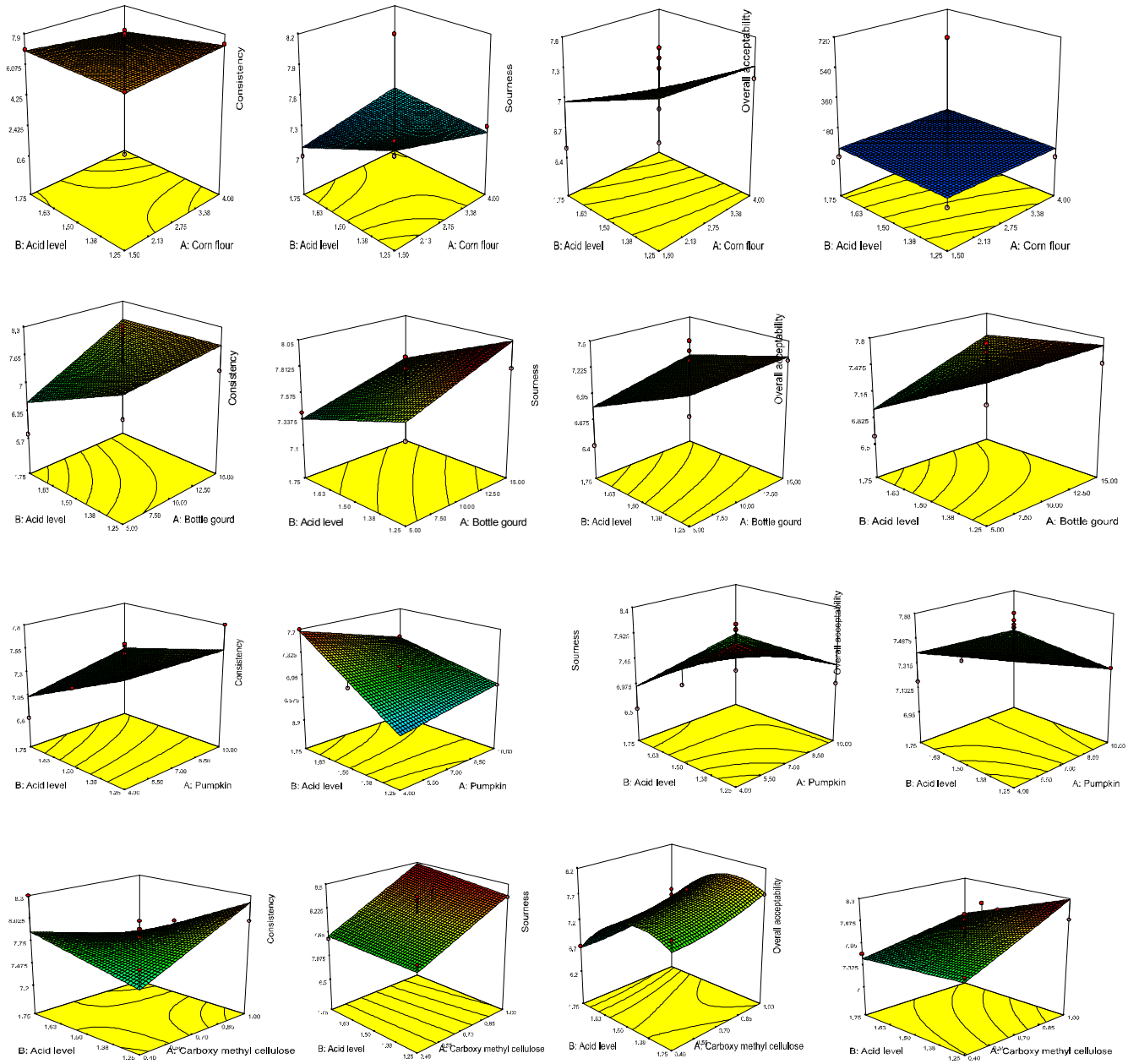

Fig. 1. Response surface plot of sensory score with different thickeners

highlighted the importance of hydrocolloids in the manufacture of tomato ketchup. Response surface plot of different thickeners towards sensory score of tomato ketchup showed the better acceptance to the judges in terms of flavour, consistence, sourness, colour and appearance and overall acceptability score (Fig.1). The lower consistency score with pumpkin and bottle gourd pulp in the manufacture of tomato ketchup can be reflected due to less moisture retention in tomato ketchup. Judges had shown most preference towards colour and appearance score of 8.2 to tomato ketchup manufactured with CMC chemical stabilizer and minimum (7.4) preference was shown with bottle gourd as thickener (Table 1). Tomato ketchup with CMC stabilizer was most preferred to judges in overall acceptability score of 8.08 whereas, judges expressed similar overall acceptability score for tomato ketchup manufactured with corn flour and bottle gourd with overall acceptability score of 7.75 (Table 1).

Physico-chemical properties of tomato ketchup with different thickener: The TSS level in tomato ketchup with different thickener varied between 26-27%.

Table2. Physico-chemical properties of tomato ketchup with different thickeners

Attributes	Thickener			
	Corn flour	Bottle gourd	Pumpkin	CMC
TSS (%)	27±0.4	26±0.3	26±0.6	26±0.7
pH	4.06±0.5	4.07±0.3	4.06±0.2	4.25±0.8
Serum separation (ml)	0.0	2.2±0.1	3±0.1	0.0
Ascorbic acid (mg/100g)	26.96±0.8	50.71±0.4	42.3±0.6	38.48±0.4
Total carotenoids (mg/100g)	1.09±0.3	3.06±0.9	1.41±0.7	2.2±0.3
Lycopene (mg/100g)	0.534±0.6	1.84±0.8	0.76±0.5	1.17±0.7

· Each value represents the mean ± SD

Maximum (27%) TSS was obtained in tomato ketchup with corn flour whereas, tomato ketchup manufactured with bottle gourd, pumpkin and CMC thickener exhibited TSS level to 26% (Table 2). Tomato ketchup manufactured with corn flour, bottle gourd and pumpkin thickener had similar pH level (4.06-4.07) while the pH level of tomato ketchup with CMC stabilizer had higher pH level of 4.25. It is interesting to observe that vegetable based bottle gourd thickener and pumpkin in manufacture of tomato ketchup yielded maximum serum separation of 2.2-3.0 ml while negligible serum separation was obtained in tomato ketchup with corn flour and CMC thickener. The occurrence of negligible serum separation with corn flour and CMC stabilizer can be reflected with more water binding capacity as compared to vegetable based thickener of bottle gourd and pumpkin. Maximum (50.71 mg/100g) ascorbic acid in tomato ketchup was obtained with bottle gourd thickener which was followed by 42.3 mg/100g in tomato ketchup with pumpkin as thickener (Table 2). Higher ascorbic acid content can be attributed with introduction of vegetable based thickener. The total carotenoids ranged 1.09-3.03 mg/100g in tomato ketchup manufactured with different thickener. Lycopene content in tomato ketchup was maximum 91.84 mg/100g) with bottle gourd thickener followed by CMC (1.17 mg/100g), pumpkin (0.76 mg/100g) and corn flour (,0.534 mg/100g), respectively (Table 2).

It can be concluded that bottle gourd and pumpkin as thickener can serve as good source of thickening materials in tomato ketchup. However, CMC as thickener was recognized as best thickening materials in terms of sensory and physic-chemical analysis.

References

Davies JN and Hobson GE (1981). The constituents of tomato fruits: The influence of environments, nutrition and genotypes. Crit. Rev. Food Science Nutrition 15: 205-208.

Kaur, Charanjeet, George B, Deepa, N, Singh B and Kapoor HC. (2004). Antioxidants status of fresh and processed tomato-A review. J Food Science and Technology 41(5): 479-486.

Lawless HT and Haymann H (1998). Consumer field tests and questionnaire design. In: Sensory evaluation of food, Chapman and Hall, N.Y., pp. 480-518.

Mangaraj S. and Singh, R. (2008). Status of food processing industry in india and its future outlook. Indian Fd Industry 27(3):35-42.

Ranganna S (1997). Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata Mc Graw-Hill Publishing Company Ltd., New Delhi. p **9**- 10.

Sidhu, JS, Bawa, AS and Singh, N. (1997). Studies on the effect of hydrocolloids on the consistency of tomato ketchup. J Food Science and Technol.34(5):423-424.

Singh, AK, Singh, Sudhir, Rai, Mathura and Verma, Ajay (2005). Optimization of thickener and acid level in tomato ketchup. Veg Sci. 32(2):162-165.

Singh Jagdish and Singh KP (2003). Current status of vegetable production, productivity, export and post harvest losses. In: Post harvest management of vegetables. IIVR, Varanasi, pp 2-6.

Singh, Sudhir, Singh, J and Rai Mathura (2008). Nutritional attributes of processed tomato. Comprehensive Rev in Food Science and Food Safety, 7: 335-339.

Thakur, BR, Singh, RK and nelson, PE (1996). Quality attributes of processed tomato products: A review. Food Rev. Int. 12: 375-401.

Thompson D. (1982). Response surface experimentation. J. Food Process Preservation. 6: 155-188.