Composition and quality characteristics of some processed tomato concentrates

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SUMMARY

The physical and chemical quality characteristics of 11 brands of processed tomato concentrates consisting of nine foreign and two local brands were studied. It was shown that of the foreign brands, five were of high quality, one was satisfactory and the remaining three were sub-standard. The two local products were sub-standard.

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RÉSUMÉ

EYESON, K. K.: *Composition et caractéristiques de quelques marques manufacturées de concentrés de tomates.* Les caractéristiques physiques et chimiques de 11 marques manufacturées de concentrés de tomates, comprenant 9 marques étrangères et 2 locales, ont été étudiées. Parmi les marques étrangères, il a été observé que 5 étaient de haute qualité, une était juste suffisante et les 3 dernières étaient en dessous des normes. Les 2 marques locales étaient aussi en dessous des normes.

Introduction

Processed tomato concentrate commercially known as tomato paste or purée is an important ingredient in Ghanaian soups, stews and various sauce preparations. It is also used in other parts of the world to prepare products such as tomato ketchup, canned and dehydrated tomato soups, canned and bottled tomato juice, canned beans in tomato sauce, canned sphagetti and macaroni in tomato sauce, brown sauces and tomato chutney (Blanchfield, 1967).

Consumption of tomato concentrate rises each year in Ghana during the off-season for fresh tomatoes (Schurmann, 1967). Of the total amount of concentrate consumed in Ghana, only a small proportion is produced locally. In 1966, Ghanaian canneries could provide only 3% of the country's total consumption of tomato products (Apte *et al.*, 1969).

Schurmann (1967) reported on the difficulties facing the tomato processing industry. Nevertheless, Reusse (1968) and Mclean (1970) have stated that the tomato concentrate has better market prospect than any other fruit and vegetable canned in Ghana. The present study was made on the compositional and quality characteristics of some of the common brands of tomato concentrate on the market.

Materials and methods

All samples analysed were in 70 g cans and were purchased from the major markets and department stores in Accra. Of the 11 brands studied, two were produced locally and the rest imported from Italy, Bulgaria, Hungary, Spain, France and Romania.

Physical examination

Before opening each can, the label was examined and the declared total soluble solids content, net weight and the name and address of the manufacturer recorded. The net weight was determined by weighing the full can and subtracting from this the weight of the washed and dried empty can.

Visual examination was carried out on the general appearance and the colour of the contents

of each can immediately after opening. Examination for texture, presence of black specks, pieces of skins, seeds and fibres was carried out according to the method of Dickinson & Goose (1955) and that for colour using the Lovibond Tintometer as described by Goose & Binsted (1964).

Chemical analyses

Total soluble solids. The total soluble solids content was determined as follows:

The less heavy concentrates were strained through a piece of muslin and a drop of filtrate placed on a refractometer prism. The refractive index was read and the necessary correction made at 25 °C. The corresponding soluble solids figure was read from the 'Tomato products tables' (Bigelow, *et al.*, 1950).

The heavier concentrates were diluted in the ratio of one part by weight of concentrate to three parts by weight of distilled water, mixed well and filtered. The filtrate was allowed to drip for 10 min before a drop was placed on the refractometer prism, and the total soluble solids content was determined using a bench type Abbé refractometer with a unitherm water bath attachment.

Titratable acidity and pH value. 10 cm³ filtrate from a 1 : 3 dilution by weight of the concentrate was transferred to a 250 cm³ Erlenmeyer flask. 50 cm³ of recently boiled distilled water was added, followed by 1 cm³ of 1% phenolphthalein indicator, and the whole titrated with 0·1*N* sodium hydroxide.

The acidity was calculated as citric acid monohydrate and expressed as a percentage of the total soluble solids. The *p*H was determined directly on the concentrate using a Direct Reading EIL *p*H meter.

Salt. 10 cm³ filtrate from a 1 : 3 dilution was further diluted with distilled water to about 75 cm³. After addition of a chip of marble to neutralize excess acid, the solution was titrated against 0·1*N* silver nitrate, using 5% potassium chromate as internal indicator. The salt content was calculated as sodium chloride and expressed as a percentage of total soluble solids.

Reducing sugars. 10 cm³ filtrate of the dilution, prepared as above, was made up to exactly 100 cm³ in a volumetric flask. This solution was used for the determination of reducing sugars by the Lane–Eynon method as described by Pearson (1970).

Results and discussion

To protect the identity of the brand names of the products, a special coding system has been used to describe them (Table 1). However, L refers to local and F to foreign brands.

The results of physical examination showed that apart from L_1, L_2 and F_8, the brands had desirable appearance, an attractive red colour, smooth texture and uniform flavour. L_1 showed a relatively wider variation in all the properties studied than the other samples. The brand F_8 showed large quantities of black and brown specks which was an unfavourable factor in assessing the quality of the product. The brands F_1, F_2, F_4, F_5, F_6 were found to be very satisfactory.

In general, the values for the net weights for almost all the brands did not show much variation from the declared net weight of 70 g, except L_1 which showed a much wider variation (range 64·4–81·3 g), indicating less effective weight control (Table 1).

Two types of concentrates have been stipulated in the *Draft international standard for processed tomato concentrate* by the Codex Committee on Processed Fruits and Vegetables (1969). The concentrate containing not less than 8% but less than 24% natural soluble tomato solids is termed 'tomato purée', whilst the concentrate with 24% solids or more is described as 'tomato paste'. This standard agrees in salient parts with the 1958 Comité International Permanent de la Conserve (CIPC) standard on tomato concentrate (Goose & Binsted, 1966), which was for sometime the most up-to-date standard on such products. The local brands, L_1 and L_2 can, according to the Codex nomenclature, be designated as "tomato purée', whilst the term 'tomato paste' would apply to many of the foreign brands.

The ranges of total soluble solids values for L_1 (16·6–21·2%), L_2 (18·2–23·6%) and F_3 (27·2–34·8%) are rather wide.

The United Kingdom Manufacturers Federation (FMF) Trade Specification for Tomato Purée, Paste and Concentrate, stipulates 10% as the maximum titratable acidity (as hydrated citric acid), expressed as a percentage of the total soluble solids for a standard quality product (Blanchfield, 1967). The figures for L_1, L_2 and F_6 were much higher than the value stated. The

TABLE 1

Analytical Data for Brands of Tomato Concentrate

Code system for samples	*Number of samples*	*Determined net weight (g)*	*Total soluble solids (by refracto-meter) %*	*Titratable acidity %*	*pH value*	*Salt %*	*Reducing sugars %*
L_1	10	73·7±1·35 (64·4–81·3)	19·4±0·41 (16·6–21·2)	10·8±0·82 (6·7–15·3)	4·1±0·08 (3·8–4·7)	4·3±0·32 (2·7–5·9)	45·1±2·04 (32·5–50·9)
L_2	12	77·4±0·50 (74·6–80·8)	20·4±0·51 (18·2–23·6)	11·3±1·34 (4·7–21·9)	4·0±0·02 (3·9–4·1)	4·8±0·43 (3·0–7·6)	44·4±1·51 (35·4–56·2)
F_1	10	71·5±0·37 (69·0–73·3)	30·4±0·15 (30·0–31·4)	7·0±0·04 (6·8–7·3)	4·1±0·00 (4·0–4·1)	9·2±0·28 (8·0–10·8)	49·6±0·28 (47·5–52·7)
F_2	9	71·8±0·54 (69·4–74·0)	31·8±0·18 (30·4–32·2)	9·5±0·15 (8·3–9·9)	4·1±0·02 (4·1–4·2)	18·2±1·01 (8·1–19·1)	52·7±0·73 (49·4–56·8)
F_3	15	73·0±0·88 (69·1–81·0)	29·6±0·51 (27·2–34·8)	8·3±0·39 (6·0–4·1)	3·9±0·03 (3·7–4·1)	10·3±0·76 (5·8–15·9)	44·1±0·98 (38·2–54·1)
F_4	11	71·3±0·42 (69·8–74·1)	29·0±0·20 (28·0–30·1)	9·1±0·29 (6·8–10·0)	4·2±0·03 (3·9–4·2)	7·1±0·46 (5·2–9·5)	50·7±1·51 (39·2–55·8)
F_5	13	72·3±0·79 (69·0–77·8)	29·1±0·32 (27·2–31·5)	7·3±0·39 (3·9–9·9)	4·1±0·03 (3·9–4·3)	5·3±0·58 (2·7–10·6)	55·0±0·70 (50·2–59·9)
F_6	10	72·8±0·27 (71·0–73·8)	30·3±0·08 (30·0–30·7)	12·1±0·50 (10·0–14·0)	4·0±0·02 (3·9–4·1)	15·1±0·55 (13·1–18·1)	45·3±0·33 (44·3–46·7)
F_7	4	73·0±0·73 (71·2–74·4)	18·6±0·11 (18·5–19·0)	9·2±0·28 (8·2–9·6)	4·2±0·02 (4·1–4·2)	9·0±0·18 (8·5–9·5)	47·7±0·38 (46·4–48·4)
F_8	12	80·7±1·36 (70·3–86·5)	29·2±0·43 (26·4–31·2)	9·9±0·38 (7·8–12·4)	4·0±0·03 (3·8–4·2)	5·7±0·60 (2·8–9·1)	49·8±1·63 (43·1–62·1)
F_9	4	82·1±0·86 (79·5–83·7)	30·9±0·41 (29·8–31·8)	9·2±0·50 (7·7–10·5)	3·8±0·03 (3·8–3·9)	10·1±0·13 (9·7–10·4)	45·9±1·21 (44·0–50·0)

The figures represent Mean ±SE. The figures in parentheses are the range values.

The letter L is the code for samples produced locally, while F is that for imported samples.

range of values for L_2 was very wide, indicating the use of unstandardized raw tomatoes for processing (Apte *et al.*, 1968; Eyeson, 1970).

The *p*H values for all the brands were within the range considered normal for such products (Blanchfield, 1967).

While the brands L_1, L_2 and F_5 did not contain added salt, the foreign products F_2 and F_8 contained appreciable quantities of it. The salt content of the local brands indicates, that the total solids content was largely due to the natural soluble tomato solids. This is good manufacturing practice which must be maintained, since it conforms to the new product description for tomato concentrates being developed by the FAO/WHO Codex Alimentarius Commission, Committee on Processed Fruits and Vegetables (1969).

The minimum reducing sugar content (as invert sugar), expressed as percentage of the total soluble solids as stated by the FMF Trade Specification for Tomato Concentrate (Blanchfield, 1967) is 45% and all the brands satisfy this specification.

The results of physical examination confirmed reports (Schurmann, 1967) that the locally produced tomato concentrates fall below the standard of most foreign brands with regards to colour, texture, smell and taste. It was observed, however, that three of the foreign brands (F_1, F_8 and F_9) were also below the physical quality specifications stated by the FMF Trade Specification for Tomato Concentrate (Blanchfield, 1967). With respect to the presence of black specks, seeds and fibres, these brands were worse than the local products. It is suggested that efforts be made by government to stop the importation of such sub-standard products into the country. The problem can be tackled by co-operation between the National Standards Board, the

Ministry of Health and the Ministry of Trade.

Results of chemical analyses showed that the local concentrates contained higher acidity than the foreign brands. This is an undesirable organoleptic property which calls for effective processing control. A good concentrate can be achieved by blending tomatoes of high acidity with those of low acidity. Preferably, only tomatoes with low acidity should be selected for processing.

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