The effect of different blanching treatments on the nutritional and sensory properties of oven dried carrot slices was determined. Fresh carotene type carrots with orange-red pigment were sliced and these slices were divided into nine lots of equal weight and blanched differently in hot water, 5% and 10% salt solutions at 80, 90 and 100°C respectively for 5 minutes before oven drying at 60°C. Nutritional composition of the dried carrot slices and fresh carrots was determined using standard methods. Influence of the blanching treatments on the nutritional and sensory properties of the oven dried carrot slices was determined. Nutritional composition of the carrot slices varied as follows; crude protein 1.96% (100°C, 0% salt) to 3.69% (80°C, 10% salt); β-carotene 10.01 ppm (100°C, 10% salt) to 70.44 ppm (80°C, 5% salt); crude fibre 0.74% (100°C, 0% salt) to 2.61% (90°C, 5% salt); crude fat 1.07% (90°C, 10% salt) to 2.75% (80°C, 5% salt) and ash 8.43% (100°C, 5% salt) to 10.36% (90°C, 10% salts). Fresh carrots had 69.82 ppm β-carotene, 8.01% protein, 1.89% fibre, 2.03% fat and 7.97% ash. Sensory analysis showed that carrot slices blanched at 80°C with 5% salt was the most preferred of all the samples.

Key words: Drying, carrot, food security, blanching, nutrition.

INTRODUCTION

Carrot (Daucus carota L.) is one of the important root vegetable crops that contains appreciable amounts of vitamins, minerals, dietary fibre (Doymaz, 2004) and the highest β-carotene content among human foods which is a precursor of vitamin A (Bao and Chang, 1994; Berger et al., 2008; O'Neil et al., 2001). Carotene content depends on the carrot's variety: orange type contains mostly α and β-carotene but purple, red and yellow carrots have a different carotenoid composition (Hammershoj et al., 2010). Carrots are usually orange but there are also white, black, yellow, red and purple varieties. They are seasonally available in areas that produce carrots for human consumption (Goby and Gidenne, 2008). Due to their weight and bulk, their transportation is expensive and losses during handling and storage incur additional costs. Post-harvest decay is the major factor limiting the extension of shelf-life of vegetables and nearly 17% of world's total production is deteriorated during post-harvest handling (Togrul, 2006). The keeping quality of carrots can be enhanced by blanching and subsequent drying before storage. The enzymes commonly found to have deteriorative effects in carrots are peroxidases (PODs) and catalase. In order to minimize deteriorative reactions, fruits and vegetables are heat treated or blanched to inactivate the enzymes. Blanching treatments can be performed by exposing vegetables to hot water (the most common method), hot and boiling solutions containing acids and/or salts, steam or microwaves for several seconds or minutes (Luna-Guzman and Barret 2000; Severini et al., 2004a, b). Blanching cleans the raw material and reduces bacterial load, softens plant tissue and causes shrinkage allowing greater volume of materials in the pack, helps fix colour for plants with carotenoid, improves the texture of dehydrated products, inhibits some micro-organisms and facilitates the removal of moisture during drying (Onimawo and Egbekun, 1998). Temperature range of simple blanching is between 65 to 100°C with process...
time varying between 15 s to 45 min (Negi and Roy, 2000; Passo et al., 2005). Drying is one of the oldest methods of food preservation. It can be done using traditional processing techniques like solar drying in the open (Jiokap et al., 2015). These techniques are however largely inappropriate during the rainy season when solar radiations are low, ambient air relative humidity is high and fruit production is at its peak, hence high post-harvest losses (Ngbede et al., 2014). Furthermore, drying under these time-consuming conditions gives products with pathogenic microorganisms, impurities and a dark colour that reduces the market quality of the slice-dried or milled product (Arise et al., 2012; Adegbehingbe, 2014). Meanwhile, it has been indicated that oven drying removes moisture as quickly as possible at a moderate temperature conducive for flavour, texture and colour retention (Shittu and Ogunmoyela, 1999). Carrots are dried to improve their shelf-life, lower shipping weights and minimize the loss of flavour and nutritional value (Togrul, 2006; Negi and Roy, 2000).

Dried carrots and other vegetables need to be rehydrated before use in many ready-to-eat foods (Oliveira and Ilincanu, 1999) and their advantages over fresh foods include convenience in transportation, storage, preparation and use (Lewicki et al., 1998). They can also be eaten as snacks in the dried form without rehydration. Since consumers usually tend to prefer processed rehydrated products with a firmer texture than those typically produced by a conventional (well controlled) process (Teferra et al., 2015), application of blanching prior to drying is imperative. Many studies have been carried out to process carrot by air drying (Mulet et al., 1989), sun drying (Mulet et al., 1993), convective-microwave drying (Prabhanjan et al., 1995; Sanga et al., 2002) etc. but none has tried to combine different blanching treatments prior to drying. The aim of this work was to study the effect of different blanching treatments on the nutritional quality and sensory acceptance of oven-dried carrot slices.

MATERIALS AND METHODS

Fresh carotene type carrots with orange-red pigment were purchased from a local market in Sango Ota, Ogun State.

Process of blanching

The carrots were washed properly in tap water to remove external impurities and sliced manually using a manual stainless steel slicer. These slices were divided into nine lots of equal weight and blanched differently in hot water, 5% and 10% salt solutions at 80, 90 and 100°C respectively for 5 minutes ensuring full coverage of the slices by water (Seow et al., 1992; Heredia-Leon et al., 2004). Constant temperature was maintained throughout the blanching time using water bath and the slices were cooled immediately after blanching by dipping in cold water (Teferra et al., 2015).

Drying of the blanched carrot slices

The carrot slices were dried using an oven at a temperature of 60°C. They were weighed at 2 h. interval until they attained a final moisture content of about 6%. The dried carrot slices were packed in polyethylene plastic bags and stored at room temperature until they were required for further tests.

Chemical composition of fresh and dried carrot slices

Crude protein, total ash, crude fat and crude fibre content of the dried and fresh carrot slices was determined according to the AOAC methods (AOAC, 2000). β-Carotene content of the samples was determined using the AACC techniques (Teferra et al., 2015).

Sensory evaluation

Sensory evaluation was carried out on the dried carrot slices after rehydration in distilled water at 20°C for 1 h (Janiszewska et al., 2013) using a nine point hedonic scale which ranged from like extremely for 1 to dislike extremely for 9, with 5 as neither like nor dislike (Iwe, 2010). Twenty semi-trained panellists were recruited. They were served the coded carrot slices which they assessed for colour, flavour, texture, taste and overall acceptance.

Experimental design and statistical analysis

The experiment was carried out in triplicates for all the measured parameters. Statistical Package for Social Sciences (SPSS – version 21) was used to obtain mean, standard deviation and analysis of variance (ANOVA) was done and judged for significance at p ≤ 0.05. Means were separated using Duncan’s Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Proximate and β-carotene composition of fresh carrot

The proximate compositions and β-carotene content of fresh carrot (Table 1) were, crude protein: 8.01%; fibre: 1.89%; fat: 2.03%; ash: 7.97% and β-carotene: 69.82 ppm. They are within the ranges reported in
The crude protein content of carrot samples ranged from 1.96% to 3.69% and differed significantly (P < 0.05) (Table 1). The highest protein content (3.69%) was recorded for the carrot slices subjected to the highest blanching temperature 100°C with 0% salt. The β-carotene content of the fresh carrot used in this investigation is 8.01 ppm (Table 1) which is significantly higher than the protein content of other samples and the reason could be losses due to leaching and/or variation in sensitivity of certain protein components to the drying conditions. Fana et al. (2015) observed reduced protein content for blanched sun dried orange fleshed sweet potato. It seems that the protein content was leached due to cell membrane damage at higher temperatures of blanching (Teferra et al., 2015). Reduced protein content can also occur due to protein denaturation, leaching out and prolonged drying in uncontrolled environment (Eric, 2013; Muyanja et al., 2012). Lund (1977) reported that the reduced protein contents of cooked vegetables could be attributed to the severity of thermal process during cooking (Lund, 1977). The crude protein content of carrot roots used in this investigation was close to the levels reported in earlier works by AL-Sultan (2007). No trend was observed in the protein content of the carrot slices after blanching and drying although Teferra et al. (2015) reported that percent protein content increased with increase in the osmotic strength and indicated that the osmotic treatment helps in retaining protein component on drying of carrot slices. Also, Raoult-Wack (1994) and Rastogi et al. (2002) reported that osmotic pre-treatment helps in retaining nutritional properties of dehydrated foods. On the other hand, Ajayi and Onayemi (1977) observed that blanching had no effect on the protein content of some common vegetables that they worked on.

### Table 1. Effect of different blanching treatments on the nutritional properties of carrot slices.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Salt (%)</th>
<th>β-carotene (ppm)</th>
<th>Crude protein (%)</th>
<th>Fibre (%)</th>
<th>Fat (%)</th>
<th>Ash (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh carrots BT (°C)</td>
<td>0</td>
<td>69.82±0.057&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.01±0.028&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.89±0.028&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.03±0.057&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.97±0.028&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>80</td>
<td>0</td>
<td>46.98±0.00&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.55±0.325&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.41±0.042&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.87±0.113&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.96±0.00&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>90</td>
<td>0</td>
<td>36.54±0.255&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.78±0.00&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.03±0.057&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.41±0.042&lt;sup&gt;c&lt;/sup&gt;</td>
<td>10.07±0.099&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>100</td>
<td>0</td>
<td>24.18±0.523&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1.96±0.170&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.74±0.042&lt;sup&gt;d&lt;/sup&gt;</td>
<td>1.13±0.014&lt;sup&gt;d&lt;/sup&gt;</td>
<td>9.98±2.843&lt;sup&gt;abcd&lt;/sup&gt;</td>
</tr>
<tr>
<td>80</td>
<td>5</td>
<td>70.44±0.085&lt;sup&gt;e&lt;/sup&gt;</td>
<td>3.37±0.057&lt;sup&gt;e&lt;/sup&gt;</td>
<td>2.10±0.028&lt;sup&gt;e&lt;/sup&gt;</td>
<td>2.75±0.113&lt;sup&gt;e&lt;/sup&gt;</td>
<td>9.11±0.057&lt;sup&gt;ef&lt;/sup&gt;</td>
</tr>
<tr>
<td>90</td>
<td>5</td>
<td>70.05±0.070&lt;sup&gt;f&lt;/sup&gt;</td>
<td>3.40±0.156&lt;sup&gt;f&lt;/sup&gt;</td>
<td>2.61±0.85&lt;sup&gt;f&lt;/sup&gt;</td>
<td>2.26±0.042&lt;sup&gt;f&lt;/sup&gt;</td>
<td>8.86±0.099&lt;sup&gt;ef&lt;/sup&gt;</td>
</tr>
<tr>
<td>100</td>
<td>5</td>
<td>68.46±0.198&lt;sup&gt;g&lt;/sup&gt;</td>
<td>2.36±0.099&lt;sup&gt;g&lt;/sup&gt;</td>
<td>1.94±0.00&lt;sup&gt;g&lt;/sup&gt;</td>
<td>2.29±0.00&lt;sup&gt;g&lt;/sup&gt;</td>
<td>8.43±0.071&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>80</td>
<td>10</td>
<td>31.77±0.495&lt;sup&gt;h&lt;/sup&gt;</td>
<td>3.69±0.156&lt;sup&gt;h&lt;/sup&gt;</td>
<td>1.25±0.085&lt;sup&gt;h&lt;/sup&gt;</td>
<td>2.48±0.057&lt;sup&gt;h&lt;/sup&gt;</td>
<td>9.87±0.014&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
<tr>
<td>90</td>
<td>10</td>
<td>31.00±1.58&lt;sup&gt;i&lt;/sup&gt;</td>
<td>2.64±0.057&lt;sup&gt;i&lt;/sup&gt;</td>
<td>0.84±0.028&lt;sup&gt;i&lt;/sup&gt;</td>
<td>1.07±0.014&lt;sup&gt;i&lt;/sup&gt;</td>
<td>10.36±0.127&lt;sup&gt;ij&lt;/sup&gt;</td>
</tr>
<tr>
<td>100</td>
<td>10</td>
<td>10.01±0.438&lt;sup&gt;j&lt;/sup&gt;</td>
<td>2.07±0.113&lt;sup&gt;j&lt;/sup&gt;</td>
<td>1.53±0.042&lt;sup&gt;j&lt;/sup&gt;</td>
<td>2.49±0.056&lt;sup&gt;j&lt;/sup&gt;</td>
<td>9.25±0.00&lt;sup&gt;jk&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: BT: Blanching temperature; values are mean ± standard deviation and those bearing different letters within a column are significantly different (P < 0.05).

**Proximate and β-carotene composition of the dried carrot samples**

**Crude protein**

Crude protein contents of the carrot samples ranged from 1.96% to 3.69% and differed significantly (P < 0.05) (Table 1). The highest protein content (3.69%) was recorded for the carrot samples subjected to the blanching temperature 80°C with 10% salt and the lowest protein content (1.96%) was recorded for the carrot slices subjected to the highest blanching temperature 100°C with 0% salt. The crude protein content of the fresh carrot used in this investigation is 8.01% (Table 1) which is significantly higher than the protein content of other samples and the reason could be losses due to leaching and/or variation in sensitivity of certain protein components to the drying conditions. Fana et al. (2015) observed reduced protein content for blanched sun dried orange fleshed sweet potato. It seems that the protein content was leached due to cell membrane damage at higher temperatures of blanching (Teferra et al., 2015). Reduced protein content can also occur due to protein denaturation, leaching out and prolonged drying in uncontrolled environment (Eric, 2013; Muyanja et al., 2012). Lund (1977) reported that the reduced protein contents of cooked vegetables could be attributed to the severity of thermal process during cooking (Lund, 1977). The crude protein content of carrot roots used in this investigation was close to the levels reported in earlier works by AL-Sultan (2007). No trend was observed in the protein content of the carrot slices after blanching and drying although Teferra et al. (2015) reported that percent protein content increased with increase in the osmotic strength and indicated that the osmotic treatment helps in retaining protein component on drying of carrot slices. Also, Raoult-Wack (1994) and Rastogi et al. (2002) reported that osmotic pre-treatment helps in retaining nutritional properties of dehydrated foods. On the other hand, Ajayi and Onayemi (1977) observed that blanching had no effect on the protein content of some common vegetables that they worked on.

**Beta-carotene**

Table 1 presents the β-carotene content of samples exhibiting significant (P < 0.05) variation with the blanching treatments. The highest value of β-carotene (70.44 ppm) was observed in the sample blanched at 80°C with 5% salt and this value was not significantly different from the β-carotene content of the fresh carrot- 69.82 ppm used in the study. The least amount of β-carotene- 10.01 ppm was observed in the sample treated at the highest blanching temperature 100°C with 10% salt. The β-carotene content was generally observed to decrease with the increase in the severity of the blanching treatment conditions and this might be due to the fact that β-carotenes are highly unsaturated compounds with extensive conjugated double-bond systems and they are susceptible to oxidation, isomerisation and other chemical changes during processing and storage (Shi and Maguer, 2000). The decrease in the β-carotene content might also be due to leaching of the pigments as the osmotic stress increased as a result of breakage of the cell structures (Teferra et al., 2015). The β-carotene content obtained for both fresh and dried carrot in the present study was close to the report of Bhaskarachary et al. (1995).

**Crude fibre**

The crude fibre content of the carrot slices varied significantly as summarized in Table 1. The highest value
of crude fibre (2.61%) was obtained from the carrot slices blanched at 90°C with 5% salt and the lowest value of crude fibre (0.74%) was obtained from the carrot slices that were blanched at 100°C with 0% salt. The value of crude fibre was observed to decrease with the increase of blanching temperature for carrot slices blanched with 0% salt. The same observation was made by Teferra et al. (2015). However, Ajayi and Onayemi (1977) observed that blanching had insignificant (P > 0.05) reductions in crude fibre contents of some common Nigerian vegetables that they assessed. Clear pattern in the crude fibre content of the other carrot slices subjected to varying blanching temperatures with 5% and 10% salt was not observed.

**Fat**

The different levels of blanching treatments resulted in significantly different crude fat contents of the oven-dried carrot slices (Table 1). The highest value of crude fat (2.75%) was recorded for the carrot sample which was blanched at 80°C with 5% salt and the lowest value (1.07%) corresponded to the sample that received blanching treatment at the temperature 90°C with 10% salt. This reduced fat content might be due to oxidation at increased temperature (Fana et al., 2015).

**Ash**

Ash is an important food constituent and inorganic residue after combustion at high temperature – prolonged time (Idowu et al., 2013). The ash content of the oven dried carrot slices (Table 1) was generally higher than that of the fresh carrot. Although, the means are not statistically well separated, the highest ash content (10.36%) was recorded for the sample blanched at 90°C with 10% salt and the least ash content (8.43%) was recorded for the sample blanched at 100°C with 5% salt. The different blanching temperatures with 0% salt did not significantly (P > 0.05) affect the total ash contents of carrot slices. The ash content of the oven-dried carrots was observed generally to increase with the increase in the percentage of salt used for the blanching treatment. The increase in ash content is possibly due to sodium in the solution that might have diffused into the carrot as the water migrates out, since osmotic dehydration is the simultaneous process of water and solute diffusion (Krokida and Marinos-Kouris, 2003). The low ash content of the samples blanched with 0% salt at varying temperatures might be due to the sensitivity of specific minerals to temperature at prolonged time during blanching and drying (Akubor and John, 2012).

### Table 2. Effect of different blanching treatments on the sensory properties of oven dried carrot slices.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Salt (%)</th>
<th>Colour</th>
<th>Flavour</th>
<th>Taste</th>
<th>Texture</th>
<th>Overall acceptance</th>
</tr>
</thead>
<tbody>
<tr>
<td>BT (°C)</td>
<td>0</td>
<td>3.40±1.301&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>2.99±0.806&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.78±1.711&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.31±0.594&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.33±0.198&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>4.72±0.396&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.60±0.721&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.94±1.160&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.33±0.424&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.89±0.283&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>5.78±1.711&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.23±0.226&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4.71±0.990&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.29±0.212&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.97±0.523&lt;sup&gt;abc&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>2.40±0.113&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.98±0.764&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.34±0.226&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.29±0.764&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.72±0.962&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>90</td>
<td>3.75±0.382&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>5.55±0.948&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.49±1.344&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.27±0.226&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.14±1.471&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>4.01±0.184&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.15±0.481&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.00±1.146&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.23±0.325&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4.83±0.537&lt;sup&gt;abc&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>3.95±0.396&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>3.42±0.537&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.06±0.141&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>3.38±0.608&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.56±2.008&lt;sup&gt;abc&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>90</td>
<td>4.20±0.212&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>3.19±0.679&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.64±0.552&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.34±1.202&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.90±0.382&lt;sup&gt;abc&lt;/sup&gt;</td>
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<td></td>
<td>100</td>
<td>3.86±0.523&lt;sup&gt;abc&lt;/sup&gt;</td>
<td>5.09±0.764&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.11±0.170&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.25±0.297&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.88±0.764&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: BT: Blanching temperature; values are mean ± standard deviation and those bearing different letters within a column are significantly different (P < 0.05).

Sensory acceptance of dried carrot samples

**Colour**

Generally, the colour of the pre-treated, dried and rehydrated samples was moderately liked by the consumer panel as shown in Table 2. The colour acceptance scores of the carrot samples were significantly (P < 0.05) different. The best score (2.40) was given to the sample that was blanched at a temperature of 80°C with 5% salt and the least score (5.78) was given to the sample blanched at 100°C with 0% salt. Generally, consumers tend to prefer the colour of carrot slices blanched with salt. The use of salts during blanching is a process that modifies the sensory characteristics (Bunger et al., 2003), improving colour, increasing external crispness and internal softness, adding flavour and reducing oil content along with possible changes in the structure of the starch granule due to the interaction of salts such as sodium and calcium chloride with the internal components and allowing them to be better utilised (Natalia et al., 2015). Pedreschi et al. (2009) observed that a 3% NaCl solution reduces non-enzymatic browning in potato chips by leaching the reducing sugars and reducing the acrylamide content. Likewise, Natalia et al. (2015)
reported that the use of 3% NaCl solution produced a more golden colour of french-fried potatoes.

Flavour

The mean score for flavour of oven-dried carrot slices was significantly (P < 0.05) different for the samples treated at the lowest and highest blanching temperatures (Table 2). The best flavour score (2.99 on the 9 point hedonic scale) was given to the sample subjected to the lowest blanching temperature of 80°C with 5% salt and the least score (5.55) was given to the sample blanched at 90°C with 5% salt. Generally, the flavour of the rehydrated carrot samples subjected to different blanching treatments was good and tended to be liked by the consumers despite the fact that samples were tasted after rehydration without addition of any ingredient or without sufficient cooking. This is justified by the fact that sodium is related to the populations’ eating habits (Natalia et al., 2015).

Taste

Blanching treatments of different levels used in this study produced significant differences in the taste score of the rehydrated carrot slices (Table 2). Samples blanched at 80°C with 0% salt was mostly liked by consumers (with 3.78 score) and samples blanched at 100°C temperature with 10% salt was least liked with a score of 7.11 on the 9 point hedonic scale. The taste of the carrot sample was not liked too well and the reason seems to be the fact that the carrots used in this sensory evaluation were not ready-to-serve products; they were just rehydrated and ready only for food preparation.

Texture

The differences in the texture of the dried carrot slices were not statistically significant (P > 0.05). However, the scores given by consumer panels (Table 2) suggested that the texture of the samples tended to be liked by the consumers and this is similar with the report of Quintero-Ramos et al. (1992) who reported the tendency of consumers towards dehydrated and rehydrated fruits and vegetables than fresh ones. The best score (3.23) was given to the sample blanched at 100°C with 5% salt and the lowest score (3.38) corresponded to samples subjected to blanching temperature of 80°C with 10% salt.

Overall acceptance

The sample blanched at the lowest temperature 80°C with 5% salt was the most liked and that blanched at 100°C with 10% was the least liked with scores of 1.72 and 5.88 respectively.

On the 9 point hedonic scale no clear trend in overall acceptance was noted for the oven dried carrot slices. This shows that the various treatments of blanching temperatures and salt concentrations may not bring differences in preference of the consumers to the rehydrated carrot slices.

Conclusion

Carrot slices blanched at 80°C with 5% sodium chloride presented better sensory quality for colour and overall preference. Texture of the carrot slices did not vary significantly, was acceptable and liked by consumers. Flavour and taste of carrot slices blanched at 80°C with 0% salt was the most preferred. Different blanching treatments had different nutritional implications. The present results suggests that combination of different blanching treatments and oven drying can be employed in the food industry to produce high-quality carrot slices with reduced enzyme activity and improved nutrition which can be stored and preserved for future use to guarantee food security.

REFERENCES

Lukfear SD, pp. 677-682.


