

Consumer satisfaction and nutrient profile of reformulated dry soups

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ABSTRACT

The aim of this study was to reformulate 6 commercial dry soups available in the Egyptian market into healthy sensory and nutritional profile. Commercial dry soups (CDS) were sensory and chemically evaluated. The sensory test included 50 people; male and female equally divided (25-50y), in order to identify consumers' acceptability for the commercial and reformulated dry soups (RDS) on a 9-point hedonic scale. The RDS were simulated to commercial soup ingredients but with adding more herbs, fibre, salt replacer, no hydrogenated fats or flavour enhancers were added. Results showed that the CDS have higher fat, sodium (>0.2 g/100g) and total *trans* fatty acids (TFA) (>0.2 g/100g) than RDS. However, the RDS indicated to zero total TFA, reduction of total fat and sodium and increased protein, complex carbohydrates and fibres compared to CDS. Sensory evaluation results indicate that the RDS increased the liking attributes in males significantly ($F = 38.34$, $P < 0.0001$) for appearance, colour, flavour and total acceptability.

Key words: acceptance test, commercial dry soup, reformulated dry soups, total *trans* fatty acid, sodium

INTRODUCTION

There has been much attention on the role of the food industry in helping consumers to eat healthy and sustainable food products (Lund, 1989). Reformulation would provide a solution that can contribute to individuals' healthy choices (Rowe et al. 2011). Soups are consumed for nutritive benefits and also by patients whose intake of solids is considerably reduced due to several pathological reasons. Dehydrated soup mix is a convenient product due to its less volume and long storage life at ambient temperatures (Rekha et al. 2010).

One of the challenges the food industry faces is balancing the provision of what consumers want to buy (the industry exists to make a profit) with what is important from a public health perspective, recognising that there is often a tension between consumers' desire for choice and choice editing by manufacturers, retailers and the food service sector (Judith 2013).

Selection of new food products may be related to attitudinal behaviours after gaining product information. Creating awareness about health benefits of healthy natural soups may change attitudes toward reformulated soup consumption (Manickavasagan et al. 2013).

The importance of soups/liquids in a meal to decrease weight was studied by (Rolls et al. 1999) as they used water into a meal as a soup and found a decrease of energy intake among lean women, but the mechanisms and impact on gastric emptying were not clearly defined. Specifically, dry soup mixes could be as a protection from enzymatic and oxidative spoilage and flavour stability at room temperature over long periods of time (6-12 months). Also, they do not need refrigerator and had quite nutritive value, particularly as a source of protein (Luh and Woodroof 1975).

Reformulation of food and drink products would be of prime nutrition policy importance. It justifies 'public-private partnerships' at which agreements concerning product formulation are made. Reformulation that reduces the amount of fat, sugar and salt, or that increases the amount of dietary fibre, vitamins, minerals or other bioactive compounds, will improve the nutrient profile of processed products. Therefore, it would result in healthier food supplies and dietary patterns, and help to control and prevent obesity and chronic non-communicable diseases, as specified at the General Assembly of the United Nations (Monteiro and Cannon 2014).

The "pro-team for reformulation" have published striking approximation of reductions in morbidity and mortality from different diseases that could result from reductions in trans fats, saturated fats, sugar or salt, in processed products and thus in food supplies (Aburto et al. 2013; He et al. 2013).

Reformulation of commercial dried soups, to include healthy ingredients is a novel approach to reducing salt, fat and trans fatty acid and increasing marketing of these product category. Selection and acceptance of a reformulated, traditional product depends on many factors, including consistency and sensory evaluation (Shepherd and Sparks 1989).

The aim of this study was to reformulate 6 commercial dry soups available in the Egyptian market into healthy option ingredients to improve nutritional profile and sensory properties to meet mid and higher income consumers.

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MATERIALS AND METHODS

Sources of samples

Six commercial dry soups (CDS) were purchased from local market in Cairo Egypt. The 6 reformulated dry soups were prepared in the laboratory. Tomato soup with crouton (B-hs), 11 vegetable soups (M-N1), lentil soup (K-U), chicken noodle soup, (M-N2), and Excellence soups such as chicken soup with corn (M-N3) and mushroom soup (M- N4).

Preparation of reformulated dry soups

The ingredients used to make the RDS were purchased from local market; include fresh tomatoes, onions, garlic, bread, dill, vegetables. Vegetables were dried in a vacuum dryer (Remplissage evacuation, Arthermo Gessate MI, temperature and density guide, Italy), at 28°C from 2-7 days, depending on the type of food For example, basil leaves and upper part of stalk of green coriander were dried at 28°C, for 3h then broken into small pieces by hand and left in the vacuum dryer for about 27 hours until dried.

Proximate analysis

Three samples (5g) from each vegetable were examined for protein, lipid, carbohydrate, crude fibre and sodium based on the dry matter. The fat content was determined using the ether extraction technique according to the procedure described in the Official Method of the Association of Official Analytical Chemists (AOAC 2005). Food samples were milled and the lipid was extracted for 16 h with petroleum ether (boiling range 30-60°C) in a Soxhlet apparatus. The lipid percentage was determined by weight difference. Nitrogen contents were determined according to the AOAC methods 27.009 and 27.007, respectively (AOAC 1980). Sodium was performed by incineration in a muffle furnace (Nabertherm, D2804, lilenthial-Bremen, W-Germany) at 525°C. The carbohydrate content was estimated by calculating its difference from the other components using the following formula (Mestrallet et al. 2004): carbohydrate content = 100% - (% protein + % lipid + % ash).

Fatty acid analysis

Fatty acid was analysed according to (Bligh and Dyer 1959). The isolated fat was trans-esterified using 200 µL of 2 M methanolic sodium methoxide to form fatty acid methyl esters (FAME). The FAME profile was determined using a capillary gas chromatograph equipped with a 100 m x0.25 mm x0.2 µm column (Supelco SP 2560) split ratio 50:1, injector temperature 250°C) and a flame ionisation detector (hydrogen 30 ml/minute, air 400 ml/minute, temperature 260°C) with helium used as a carrier gas (43.51 PSI at 170°C). The temperature programme was 40°C for 2 min, increased by 3 °C/min to 215°C and held for a further 33 min. Quantification and identification of the individual FAME was achieved by the use of external standards (qualitative and quantitative (FAME multi-standard C4–C25. The limit of quantification for each fatty acid was 0.02% (normalised as a percentage of the total peak area). Total TFA was calculated as the sum of t7-C18:1 (trans-7-octadecenoic acid), t9-C18:1(*trans* elaidic acid), t11-C18:1(*trans* vaccenic acid), t12-C18:1(trans-12-octadecenoic acid) and t9, t12-C18:2 (trans linolelaidic acid).

Reformulation of soups

There are 6 types of CDS which were made such as tomato soup with croutons (CTSc), 11 vegetable soup (11 CVS), lentil soup (CLS) and excellence soups such as chicken noodle soup (CCNS), chicken soup with corn (CCSc) and cream of mushroom soup (CCMS). For example to prepare the reformulated 11 vegetable soup; vegetables such as carrot, onion, peas, courgettes, celery, potato, leek, tomato, red bell pepper, and lovage, parsley, coriander, dill, basil, were dried and flaked in a pint flask. Garlic powder, white pepper, bulgar wheat, yeast extract and olive oil powder were added to the mixture. In some reformulated soups, for example tomato soup, the ingredients were blended finely to powder.
In the reformulation soups ingredients were freshly dried, no hydrogenated fat, sodium or flavour enhancers were added. Boiled tap water was added to dried mixture and the preparation was heated to 95°C for 5 minutes in a stainless steel vessel with continuous stirring. Soups were transferred to coded serving plates and served at 70°C.

Commercial dried tomato soup with croutons (CTSc)

Tomato powder (20%), modified potato starch, croutons (15%) (wheat flour, sunflower oil, yeast, salt), maltodextrin, salt, whey powder (8%), sugar, sunflower oil, flavour enhancer (monosodium glutamate E621), flavours (tomato, hot pepper, oregano), onion powder, hotscaled pepper, garlic powder, bay leaf, acidity regulator (citric acid E330).

Reformulated dried tomato soup with croutons (RTSc)

Tomato powder 20%, modified potato starch, croutons 15% (wheat flour, potassium chloride) maltodextrin, red pepper, potassium chloride, whey powder (8%), sugar, olive oil powder (a mix of 60% olive oil to 40% potato maltodextrin), oregano, red onion powder, garlic powder, bay leaves, carrot, white pepper and yeast extract.

Commercial dried vegetable soup (CVS)

Vegetables (carrot, onion, parsnip, peas, celery, potato, leek, tomato, red bell pepper, parsley, garlic), modified potato starch, iodised salt, maltodextrin, hydrogenated palm fat,

yeast extract, flavour enhancers (monosodium glutamate, disodium inosinate, disodium guanylate), garlic, spices (turmeric, coriander), contains traces of milk, celery.

Reformulated dried vegetable soup (RVS)

Vegetables (carrot, onion, garlic, peas, courgettes, celery, celery, lovage, potato, leek, red and green bell peppers, parsley, coriander, dill, white pepper), modified potato starch, potassium chloride bulgur wheat, olive oil powder, yeast extract, spices (turmeric, coriander) and yeast extract.

Commercial dried lentil soup (CLS)

Red lentil flour-modified potato starch-croutons-cream powder (hydrogenated palm oil, lactose, sodium caseinate), salt, flavour enhancer (monosodium glutamate), palm oil, sugar, spice extract (fenugreek, lovage), onion powder, yeast extract, garlic, carrot, cumin, turmeric, white pepper, vegetable soup extract (lovage, fenugreek, nutmeg).

Reformulated dried lentil soup (RLS)

Red lentil flour-modified potato starch-croutons-cream powder (olive oil powder, lactose, olive oil powder, sugar, spice extract (fenugreek, lovage), onion powder, yeast extract, garlic, carrots, cumin, turmeric, white pepper, dried orange juice, yellow pepper potassium chloride and yeast extract.

Commercial dried chicken noodle soup (CCNS)

Pasta (strong semolina wheat), salt, iodized salt, dried chicken, dried onion dried parsley, curcumin, spices, corn starch, white pepper, nutmeg, coriander, garlic, traces of celery and milk, hydrogenated palm oil, cardamom, caramel, flavour enhancers (monosodium glutamate, disodium inosinate, disodium guanylate), chicken flavour similar to natural flavour.

Reformulated dried chicken noodle soup (RCNS)

Pasta (strong semolina wheat), potassium chloride, dried chicken, dried onion dried parsley, curcumin, spices, corn starch, white pepper, nutmeg, coriander, garlic, celery and traces of milk, olive oil powder, cardamom, yeast extract, bay leaves, ground mastic resin, pieces of chicken was cooked in a pressure cooker then spread on the tray of the dryer at 145° C for 8 hours and stored at -20°C.

Excellence soups

Commercial chicken soup with corn (CCSc)

Modified corn starch, creamer (Palm oil, lactose, milk, protein), wheat flour, sweet corn kernel, iodised salt, chicken fat & chicken meat, flavour enhancers: monosodium glutamate, disodium inosinate, disodium guanylate), hydrogenated palm fat, nature identical chicken flavour, sugar, onion, garlic, emulsifiers (guar gum E472e of plant origin), spices, traces of celery, egg.

Reformulated of chicken soup with corn (RCSc)

Modified corn starch, creamer (lactose, milk and protein), wheat flour, sweet corn kernel, potassium chloride, chicken meat, olive oil powder, sugar, onion, garlic, emulsifiers (guar gum), white pepper, celery, yeast extract cardamom, and bay leaves.

Commercial cream of mushroom soup (CCMS)

Modified corn starch, creamer (palm oil, lactose milk protein, mushroom, natural extract & slices, wheat flour, maltodextrin, iodized salt, hydrogenated palm fat, flavour enhancer, monosodium glutamate, disodium inosinate, disodium guanylate, sugar, yeast extract, skimmed milk, emulsifier, guar gum & E472 of plant origin, spices, nature identical mushroom flavour, parsley, traces of egg, celery.

Reformulated cream of mushroom soup (RCMS)

Modified corn starch, low fat milk powder, dried powder and slices of mushroom, wheat flour, maltodextrin, potassium chloride, dry olive oil, white pepper, sugar, yeast extract, emulsifier, guar gum, parsley, celery and yeast extract.

Acceptance test

Untrained male and female panellists (**n** = 50) age 25-50y were selected. Before the informed sensory test, panellists were given an explanation of the ingredients in the products and information about unhealthy effects of additives, flavour enhancers and *trans* fatty acids and health benefits of naturally product ingredients. Panellists were not given the actual names of each sample (commercial *vs* reformulated in the informed sensory test).

A sensory evaluation sheet was developed, including an initial session to collect demographic information (gender, age, educational qualification and native place) and explain the hedonic sensory scale (9 – like extremely, 8 – like very much, 7 – like moderately, 6 – like slightly, 5 – neither like nor dislike, 4 – dislike slightly, 3 – dislike moderately, 2 – dislike very much, 1 – dislike extremely). In the second session, panellists were asked to test 7 attributes of the products and provide a score (9 marks) using the hedonic scale as reference. At the end of the second session, panellists were asked to write their comments about the product (voluntary).

The number of panellists was decided based on sensory evaluation guidelines (IFT 1981). The panellists were from Faculty of Home Economics and Gezira Club Cairo, Egypt. They were recruited according to the following criteria: (1)

ages from 25-50 years (2) people without food allergies and (3) people who consumed soups or dry soups at least twice a week. Panellists were chosen on the basis of their willingness and commitment to participate in the sensory evaluation, and familiarity with soups, in general or dry soups in particular. There was no evaluation fees offered to the panellists.

During the test day of soups, 12 samples were presented to the panellists in consecutive order commercial followed by reformulated soups. The soups that served to the panellists were tomato soup with crouton (CTSc) (B-hs), lentil soup (CLS) (K-U), vegetable soup (CVS) (M-N1) and Excellence soups (M-N2) such as chicken noodle soup (CCNS), chicken soup with corn (CCSc) and cream of mushroom soup (CCMS). All samples were presented with water and paper questionnaire on a plastic tray. The panellists were instructed to consume the whole sample and then rinse their mouths with water between samples to minimize any residual effect (Grosso and Resurreccion 2002).

Procedure for serving soups to panellists

Sample soups were three- digits coded, about 60-mL of each soup was served in a 65-mL soup plate with plastic table spoon. One sample was served at a time. Panellists were discouraged from conferring among one another during the analysis. The samples were approximately 60°C to 70°C at the time of tasting.

Scoring of samples

The panellists were instructed to score (9) for their maximum acceptance for each attribute (7) of the soups: appearance, consistency, colour, aroma, taste, flavour and overall acceptability. Where a panellist did not clearly comprehend the meaning of a certain attribute, explanation was provided. The panellists scored their acceptance of the attributes using a 9-point hedonic scale.

Statistical analysis

Means and standard deviations ±SD were calculated. Two-Way Analysis of Variance (ANOVA) and the critical values for the Tukey HSD Test were used. http://vassarstats.net/index.html. The effects of gender on the attributes colour, flavour, appearance and total acceptability of the reformulated and commercial soups were determined statistically by Vassar Stats 2(rows) x4 (columns) factorial ANOVA for independent samples standard weighted-means analysis. It was considered significance if the rows between males and females was ($P < 0.0001$). The analyses were completed using the Statistical Analysis System software (SAS, version 8.02, SAS Institute, Inc., Cary, NC).

Table 1. The chemical analysis of commercial and reformulated soups (100 mL/soup)

Soups	*Energy (Kcals)*	*Protein (g)*	*Carbohydrates (g)*	*Fibre (g)*	*Sodium (g)*	*Total Fat (g)*	*Total TFA (g/100g)*
CTSc^{L}	32.77	0.76	6.52	ND	ND	0.41	ND
CTSc^{S}	51.3±3.7	0.60±2.2	6.6±1.2	Traces	0.7±2.5	2.50±3.6	0.268±1.1
RTSc	33.0±3.2	0.9±3.5	7.2±1.4	0.4±4.5	0.2±3.9	0.8±2.8	0
CVS^{L}	17.6	0.40	3.28	ND	0.336	0.32	ND
CVS^{S}	44.2±4.3	0.35±2.4	3.5±1.1	1.84±5.2	0.675±4.1	3.2±1.7	1.06±1.4
RVS	69.93±3.1	1.57±2.7	8.42±2.3	3.66±4.6	0.13±4.3	3.33±1.5	0
CLS^{L}	69.0	2.2	11.5	0.7	0.5	1.7	ND
CLS^{S}	70.5±3.5	1.3±3.0	11.9±1.8	0.4±5.2	0.8±2.1	2.3±1.1	0.40±0.9
RLS	68.20±3.2	3.25±3.1	12.0±1.7	1.2±4.9	0.2±3.2	0.8±1.7	0
CCNS^{L}	20.44	0.72	3.76	ND	0.32	0.28	ND
CCNS^{S}	25.26±2.4	0.70±4.2	3.77±3.8	Traces	0.46±1.2	0.82±2.6	0.25±1.6
RCNS	28.10±2.7	1.20±4.3	3.90±3.7	0.25±4.3	0.10±1.5	0.90±2.8	0
CCSc^{L}	42.2	0.84	4.76	ND	ND	2.2	ND
CCSc^{S}	51.34±4.0	0.76±4.1	5.10±3.1	0.15±4.6	0.28±1.4	3.10±2.1	0.93±2.2
RCSc	47.12±3.7	0.810±5.1	6.02±2.6	0.42±3.1	0.27±1.1	2.20±3.4	ND
CCMS^{L}	23.48	0.92	3.96	ND	0.288	0.44	ND
CCMS^{S}	32.76±4.1	0.71±2.3	3.88±2.1	0.2±3.3	0.35±1.5	1.6±2.9	0.7±3.1
RCMS	28.5±4.5	0.8±1.6	5.2±2.5	0.3±1.8	0.16±1.9	0.50±3.7	ND

CTSc commercial tomato soup with croutons; RTSc reformulated tomato soup with croutons; CVS commercial vegetable soup; RVS reformulated vegetable soup; CCNS commercial chicken noodle soup; RCNS reformulated chicken noodle soup; CCSc commercial chicken soup with corn; RCSc Reformulated chicken soup with corn; CCMS Commercial cream of mushroom soup; RCMS Reformulated cream of mushroom soup ^{L} label content of chemical analysis of products with no statistics, ^{S} study chemical analysis; ND: not determined, TFA: Total trans fatty acids was calculated as the sum of t7-C18:1 (trans-7-octadecenoic acid), t9-C18:1(trans elaidic acid), t11-C18:1(trans vaccenic acid), t12-C18:1(trans-12-octadecenoicacid) and t9,t12-C18:2 (trans linolelaidic acid). Total fat: means, sfa, tfa and ufa

Table 2. Male sensory evaluation of commercial and reformulated dry soups (9 marks, based on 9-point hedonic scale)

Samples	*Appearance*	*Colour*	*Consistency*	*Flavour*	*Aroma*	*Taste*	*Overall acceptability*
CTSc	[a]7.0±1.0[b]	6.50±1.5	7.0±1.8	7.0±1.00	7.25±1.9	7.0±3.7	7.0±2.2
RTSc	7.75±1.6	7.50±1.1	6.5±2.1	8.25±1.6	8.0±2.8	8.25±2.0	8±4.2
CVS	6.75±1.8	7.25±3.0	6.0±3.6	6.5±2.8	7.0±1.3	6.5±1.9	7.0±2.5
RVS	7.50±2.3	8.0±3.5	6.5±3.4	7.25±2.3	7.75±2.1	7.75±3.1	7.75±2.1
CLS	7.0±1.6	7.25±1.6	6.75±1.6	7.0±1.6	7.0±1.6	7.0±1.6	7.25±1.6
RLS	7.75±2.3	8.25±3.5	7.0±3.4	8.0±2.3	8.0±2.2	7.75±3.1	8.25±2.1
CCNS	6.5±1.7	7.0±1.5	7.0±1.7	6.25±1.8	7.0±1.6	7.25±1.6	7.0±2.4
RCNS	7.25±1.4	7.75±1.5	7.75±1.8	7.75±1.7	8.25±0.8	8.0±3.7	7.75±2.2
CCSc	7.25±1.6	7.5±1.4	7.0±2.1	7.5±1.6	6.25±2.8	7.0±2.0	7.5±4.2
RCSc	8.25±2.8	7.75±3.0	7.25±3.6	8.25±2.1	7.75±1.1	7.75±1.9	8.25±2.5
CCMS	6.5±2.3	6.5±3.5	6.5±3.4	7.0±2.3	7.25±1.4	7.0±3.1	7.5±2.1
RCMS	7.5±1.75	7.25±1.5	7.5±2.3	8.25±1.6	8.0±1.9	7.75±1.6	8.25±2.4

[a] scores of 9 point hedonic scale out of 9 marks; [b] ±SD; CTSc commercial tomato soup with croutons; RTSc reformulated tomato soup with croutons; CVS commercial vegetable soup; RVS reformulated vegetable soup; CCNS commercial chicken noodle soup; RCNS reformulated chicken noodle soup; CCSc commercial chicken soup with corn; RCSc Reformulated chicken soup with corn; CCMS Commercial cream of mushroom soup; RCMS Reformulated cream of mushroom soup

Table 3. Female sensory evaluation of commercial and reformulated dry soups (9 marks based on 9-point hedonic scale)

Samples	*Appearance*	*Colour*	*Consistency*	*Flavour*	*Aroma*	*Taste*	*Overall acceptability*
CTSc	[a]6.0±2.0[b]	6.5±1.8	6.0±1.1	6.50±2.3	6.5±1.3	6.5±1.3	6.0±2.4
RTSc	7.25±1.4	8.0±2.1	6.5±1.5	7.50±2.5	7.25±1.6	8.0±1.3	7.75±1.5
CVS	6.5±2.6	6.25±3.2	5.0±2.5	5.75±1.3	6.0±1.1	5.5±1.6	6.75±1.7
RVS	6.75±2.1	6.5±2.4	5.5±1.4	6.25±2.2	6.25±1.4	6.75±2.2	6.50±2.6
CLS	5.75±1.3	5.5±2.5	5.5±2.7	6.0±1.9	6.0±2.3	6.0±1.7	6.0±1.3
RLS	6.75±2.6	7.5±1.9	7.75±3.6	6.75±1.2	7.0±2.2	8.0±2.1	7.5±1.8
CCNS	5.5±1.9	6.0±1.7	6.0±2.1	5.75±1.7	7.0±1.7	6.75±2.2	6.25±1.6
RCNS	6.25±1.7	6.75±2.6	6.75±1.5	6.0±2.6	7.25±1.9	6.50±1.5	6.75±2.2
CCSc	7.0±2.2	6.5±2.3	6.0±1.8	6.5±1.4	5.75±1.3	6.0±2.0	6.5±1.4
RCSc	7.25±2.8	6.75±1.6	5.5±2.3	5.0±2.6	6.0±2.8	6.5±2.3	7.25±1.9
CCMS	5.75±1.8	5.5±2.4	5.5±1.3	5.5±1.1	5.0±1.4	5.0±1.2	5.5±1.3
RCMS	6.5±2.5	6.25±1.9	6.5±2.6	7.50±1.4	6.5±2.1	6.5±1.9	7.5±1.8

[a] scores of 9 point hedonic scale out of 9 marks; [b] ±SD; CTSc commercial tomato soup with croutons; RTSc reformulated tomato soup with croutons; 11 CVS 11 commercial vegetable soup; 11 RVS 11 reformulated vegetable soup; CCNS commercial chicken noodle soup; RCNS reformulated chicken noodle soup; CCSc commercial chicken soup with corn; RCSc Reformulated chicken soup with corn; CCMS Commercial cream of mushroom soup; RCMS Reformulated cream of mushroom soup.

RESULTS AND DISCUSSION

The chemical analysis of commercial and reformulated soups

Results (Table 1) show the chemical analysis of soups in commercial and reformulated soups used in this study. From this table the nutritional value of the RDS were higher in nutrients such as protein and carbohydrate, fibres and lower in sodium, total fats with no TFA compared to the RDS.

It can be noticed also that the analysed nutrients of CDS in this study was different than on the product labels. Most CDS labels did not mention the amount of TFA and fibre. The maximum amounts of total TFA were found in CVS, CCSc and CCMs; 1.06, 0.93, and 0.70 (g/100g) respectively. The average analyses of sodium for CDS found to be 0.8, 0.70 and 0.67 for CLS, CTSc and CVS soups respectively. The reformulated vegetable soup was improved in terms of TFA from 1.06 to 0 g/100 g, and also increased the nutritional value in terms of protein, complex carbohydrates and fibres. Clearly all the reformulated soups have zero TFA. It could be noted the increase of fibre from 0.4 (CLS) to 1.2 g (RLS), similarly sodium was decreased from 0.8 g to 0.2 g.

Soups acceptance test

Results (Table 2) show the average values of each attribute in the 9-point hedonic scale for male sensory evaluation of commercial and reformulated dry soups**.**

For appearance RCSc achieved the best appearance for RDS (8.25±2.8) compared to the rest of the soups. While for the colour of RLS attained the top colour for RLS (8.25±3.5) compared to the rest of the soups. Consistency of the RCNS reached the highest mark (7.75±1.8) for the RCNs, then (RCMs) 7.5±2.3 (RCMS) and (7.25±3.6) for RCSc. Flavour in the RCMS, RTSc and RCSc achieved (8.25) while recorded (8.0±2.3) in RLS compared to the rest of soups.

RCNS accomplished the best aroma (8.25±0.8) while achieved (8.0) in RTSc. RLS and RCMS. The taste in the RTSc 8.25±2.0 and 8.0±3.7 in RCNS compared to the rest of soup. The overall acceptability are valued 8.25 for (RLS, RCSc and RCMS) and 8±4.2 in RTSc compared to controls.

Results (Table 3) show the values of each attribute in the 9-point hedonic scale for female sensory evaluation of commercial and reformulated dry soups.

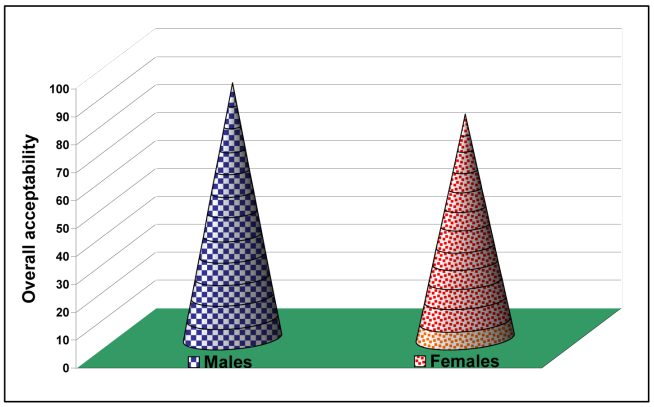

Figure 1. The overall acceptability of the all the soup studied between males and females

Consistency in the RLS reached the highest value (7.75±3.6), and (6.75±1.5) in RCNS. Flavour in the RCMS and RTSc achieved the greater flavour (7.5). RTSc and RCNS accomplished the best aroma value (7.25), while aroma achieved value (7.0±2.2) in RLS.

The taste in the RTS and RLS achieved the best value (8.0). The overall acceptability was 7.75±1.5 in RTS while achieved (7.5) in RLS, RCMS respectively.

The aim of this study was to reformulate 6 commercial dry soups (CDS) into healthy soups in terms of sensory acceptance and nutritional profile. The CDS were evaluated for sensory and chemical parameters. The reformulated dried soups (RDS) have resemblance to CDS in sensory attributes such as appearance and taste. However, in this study the acceptance sensory scores for the soups were higher in the acceptability for appearance, colour, consistency, flavour, aroma, taste, and overall satisfactoriness. The RDS may be defined in this study as "reformulated dried soups made from natural sources but have similarity of the CDS in basic vegetable ingredients, with adding some herbs and other vegetables, olive oil, salt replacer therefore they are low in total saturated fats, total TFA, and sodium contents but higher in fibre.

Interestingly, soups are healthy appetizer, but they can do the reverse role if the total saturated fat, TFA and sodium are increased simultaneously with low fibre as we found in this study.

The chemical analysis of CDS indicates that the total level of TFA and sodium were higher than those found in the RDS and relatively lower amounts of fibre also. The maximum amounts of total TFA were found in CVS, CCSc and CCMs; 1.06, 0.93, and 0.70g/100g CDS respectively. The values analysed from this study were quite different from what the CDS nutritional labels claimed.

Consumption of RDS that have zero total TFA agrees with The UK Department of Health (1994) recommended that TFA consumption should not increase beyond 5 g/day or 2% of food energy (Department of Health, 1994).

Moreover, the TRANSFAIR study of European intakes (1995/96) estimated that average consumption of TFA in 14 countries was 0.5–2.1% of total energy intake in men and 0.8–1.9% in women (Ulshof et al. 1999). Although the average intakes were below or close to recommended intake limits the concern that significant proportions of the population may have been consuming high amounts of TFA result in interventions to decrease intake in some countries (L'Abbe et al. 2009).

The pre-packaged dry soup mixes can provide a nutritious part of a meal or snack due to the short preparation time. Reformulated soups are safer in terms of the no added colours and preservatives. Commercial soup mixes often add preservatives like monosodium glutamate (MSG), disosdium inosinate, and disodium guanylate. The advantages of these recipes are endless with dry soup mixes, and can be stored for up to 6 months to 1 year. The commercial dehydrated soups contain hydrogenated palm oil in addition to flavours enhancers or E numbers although the manufactures claim that they are natural" and containing no preservatives.

In general, replacing of sodium, hydrogenated fat and flavour enhancer with natural additives does affect the nutritional profile of dry soups and the sensory attributes (appearance, taste, colour, flavour, aroma, and overall acceptability) of panellists. These results are favourable with regard to increasing consumption by reformulated products made with natural ingredients.

The scores for colour of RTSc and RLS were higher than the commercial products (CTSc and CLS). The addition of selective red colour tomatoes, red pepper and red onion might affect the colour preference for the panellists and it may be sufficient to exert a significant effect on appearance preference as well. However, female panellists gave lower scores for most attributes except for appearance and colour for only RTSc and RLS than their counterpart.

The average results of sensory attributes were higher for RLS; this is may be due to the colour of natural vegetables added to the RDS such as yellow pepper and orange juice. The consistency and taste was also higher among females for RLS than males.

The overall acceptability score for the CDS and RDS were significant (P<.0001) in males as considered in the rows. Probably women prefer to make soups by themselves and have more experience in tasting than males, but is that related to gender? The answer may be explained by a North American

Survey of 411 people to determine favoured comfort foods, and quantified the preferences for these foods across gender and age groups using a stratified sample of 1005 additional people. Males preferred warm, hearty, meal-related comfort foods (such as steak, casseroles, and soup), while females preferred comfort foods that were more snack related (such as chocolate and ice cream) (Brian et al. 2003).

Aroma is based on the volatiles perceived by the olfactory system, with the amount of volatiles released from food determined by the nature of the food product and the temperature. More volatiles are released from soft and porous surfaces than from hard and smooth surfaces (Meilgard et al. 2007). Fresh natural products have been shown to improve sensory rating scores for the aroma of RDS. Panellists showed the highest preference for the aroma of product RCNS (8.25) and (7.25) for males and females respectively. This is may be due to the addition of cardamom, bay leaves, and ground mastic resin that have high concentration of aromatic components.

Although the dry soups are struggling in the Egyptian market, but creating awareness about nutritional profile and sensory qualities may be beneficial, as other researchers have found that providing information about the taste as an example of unfamiliar foods had a positive response effect on selection of these foods by adults (Schickenbergvan et al. 2011).

CONCLUSIONS

The replacement of refined ingredients with freshly dried soups was noted as an important sensory acceptance. However, the current study demonstrated that it may be easier to increase intake of dry soup by using products that are reformulated in the form of adding (removed to partially substitute with) natural herbs and freshly dried vegetables and with regard to heath benefits as explained previously.

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Zadovoljstvo potrošnika in prehranski profil preoblikovanih koncentriranih juh

IZVLEČEK

Cilj te raziskave je bil oblikovati 6 komercialnih instant juh, ki so na voljo na egiptovskem trgu v bolj zdrav senzorični in hranilni profil. Komercialne instant juhe (CDS) so bile senzorično in kemijsko ovrednotene. V senzoričnipreskusje bilo vključenih 50 ljudi; moški in ženske so bile enakovredno razdeljene glede na spol in starost (25-50y) z namenom, da se opredelijo sprejemljivost preoblikovanih instant juh (RDS) za potrošnika s pomočjo 9-točkovne »hedonske« lestvice. Preoblikovane ali instant RDS juhe so dodali komercialnim instant juham več zelišč, prehransko vlaknino, nadomestilo soli in dodane so biletudi hidrogenirane maščobe ali pa ojačevalci arome. Rezultati so pokazali, da imajo instant CDS juhe v svoji sestavi več maščob, natrija (> 0,2 g / 100 g) in skupnih trans maščobnih kislin (TFA) (> 0,2 g / 100 g) kot preoblikovane RDS juhe. RDS juhe so imele vrednost nič skupnih TFA, zmanjšane skupne maščobe in natrija ter povečano vsebnost beljakovin, ogljikovih hidratov in vlaken v primerjavi s CDS juhami. Senzorični rezultati ocenjevanja so pokazali, da imajo RDS juhe značilno več atributovnaklonjenostipri skupini moških ($F = 38,34$, $p < 0,0001$) za videz, barvo, okus in skupno sprejemljivost.

Ključne besede: test, instantna juha, preoblikovana instantna juha, skupne tran maščobne kisline, natrij