

ABSTRACT

Abstract

The links between diet, nutrition and chronic diseases are well-established. There is a growing demand of processed foods in both high income Asian countries (Japan, Korea, Taiwan) and low income Asian countries like India. Lifestyle changes like urbanization, nuclear families, increasing number of working women, increasing disposable income, changes in taste/variety and less time for cooking are leading to increased demand of convenience foods. Such lifestyle changes are the major driving forces in the growth of processed food in India. Processed foods are characterized as energy dense, high in fat, high sodium/salt and sugar and low in fiber, vitamins and minerals. The unhealthy nutrient composition of processed foods is one of the leading causes of Diet Related Non-Communicable Diseases (DR-NCDs). Therefore, the increasing consumption of processed foods and the resultant adverse health effects create a need for consumer awareness regarding healthy food selection from the wide range of processed foods available in the market. This can be achieved by knowing the importance and understanding of nutrition labeling on food packages. Nutrition labeling is a medium which helps the producers to communicate the nutritional properties of the food to the consumers. On one hand, it is a tool to promote and protect public health by providing nutritional information to the consumers while on the other hand it acts as an instrument of marketing and product promotion for the producers. To make use of the nutrition labels it is very important for the consumers to understand and comprehend the given information on the product label. The information on the label is given at the front-of-pack (FOP), back-of-pack (BOP) and/or side-of-pack (SOP) according to the kind of package. Therefore, the present study was carried out with the objective to study food labels, their compliance with Food Safety and Standards Act (FSSA) of India and Codex Standards, composition of processed packaged foods and to understand the consumer knowledge, attitude and practices towards consumption of the same.

The study was carried out in four phases. Phase-I of the study was a situational analysis regarding processed packaged food consumption among 807 consumers (aged ≥ 15 years) from the free living population of Urban Vadodara. Phase-II included "Market Survey" of processed packaged foods ($n=1,020$) for assessing various components of food labeling namely, symbols and logos, nutrition and health claims, ingredients list, allergen declaration, Nutrition Facts Panel (NFP), information about colors, flavors and preservatives, manufacture and best before date and other miscellaneous information. The market survey was carried out in supermarkets ($n=4$)

and grocery stores (n=4) of Vadodara. Of the 1,020 processed packaged foods, 101 foods products were purposively selected for Nutrient Analysis in Phase-III, wherein estimation of sodium, potassium, sugar, dietary fiber and fatty acid profile was carried out by standardized methods and the results were compared with the reported values to assess under/over-reporting. Phase-IV, “Consumer awareness and capacity building on food labeling” survey dealt with assessing consumer awareness, knowledge and practices regarding processed packaged food selection among consumers from the same population that was surveyed for processed food consumption in Phase I. Phase-IV intended to identify the grey areas of food labeling and thereby, an education session was conducted among adolescents (n=230) and post data was collected to evaluate the impact of intervention.

The results of Phase-I revealed that the most popular foods (consumed by majority of the consumers) were sweet biscuits, salty biscuits (83%), ketchups and sauces (74%), butter and cheese (72%), noodles, pasta and macaroni (72%), papads (67%), namkeens and savories (64%), soups (61%), chips (58%), cakes (58%) and pickles (51%). However, most frequently consumed foods (≥ 5 times a month) were sweet biscuits, papads, salty biscuits, namkeens, pickles, ketchups and sauces, butter and cheese, soups, chips, jam, marmalades and jellies, noodles, pasta and macaroni, juices, cornflakes, oats and muesli, soft drinks, popcorn, spreads and dips, cakes and sweet cream wafers. Mean processed packaged food consumption was found to be higher in males than females for salty biscuits, sweet biscuits, cornflakes, oats and muesli, jam, marmalades and jellies, ketchups and sauces, butter and cheese, noodles, pasta and macaroni, soups, cakes, pickles, chips, popcorn and soft drinks. Processed packaged food consumption was highest among adolescents and females than their counterparts. Processed packaged food consumption was associated with medical condition of the subjects, however no association of processed packaged food consumption was observed with education, profession and family type.

Phase-II, Market survey of the study revealed that 61% of the food products had NFP as “per 100g”, 19% of the products displayed NFP as “per 100g and per serving” and 2% of the products displayed NFP as “per serving” and 8.4% of the products reported NFP as “per 100 g, per serving and % DV” which provide complete information and reference values to compare among brands. Serving sizes varied over a large range in all the product categories. Non-compliance was observed in reporting of five mandatory nutrients as per FSSA. Energy was reported in 99.8% of the products followed by carbohydrates (99.5%), protein (99.1%), fat (97.8%) and sugar (87.1%).

Snacks and Food adjuncts complied least in reporting of all five mandatory nutrients. Total number of nutrients reported on food products varied over a large range from 0 to 48 nutrients. According to the United States Food and Drugs Administration (USFDA) criteria, 46.4% of the products were high in energy (≥ 400 Kcal/100g) and 42.8% of the products were high in fat ($\geq 35\%$ of the total energy from fat). Snacks, bakery products, ready-to-cook/eat products and confectionery products were the top four food groups with high energy and fat content. According to United Kingdom-Food Safety and Standards Act (UK-FSA) criteria, 30% of the products were high in fat content, 46% were high in SFA content, 45% were having high sugar content and 22% had high sodium content. Ready-to-cook/eat products were found to be among the top 3 food groups that were high in fat, SFA, sugar and sodium content according to the UK-FSA criteria. Of the total food products ($n=1,020$) only 365 products reported complete fat profile on NFP. Of those that reported complete fat profile ($n=365$), 90% of the products reported lower fat content as compared to the calculated values. According to the criteria laid down by Food Safety and Standards Act (FSSA) of India, of 1,020 products, only 337 products listed ingredients in descending order of percentage weights. Of the 10 food groups, only 4 namely, bakery products (26%), ready-to-cook/eat products (20%), wheat and oats based products (18%) and snacks (14%) had more than 10% of the products that complied with the FSSA guidelines for listing ingredients. More than 50% of the products had multiple sources of ingredients of concern namely, sugar, fat, salt/sodium and mono-sodium glutamate (MSG) in ingredients list. Twenty seven percent of the products had more than one source of sugar in ingredients list, followed by 11%, 11% and 4% of the products with multiple sources of fat, salt/sodium and MSG, respectively. When MSG (a source of sodium) and salt were considered together, ready to cook/eat products were found to have highest percentage (4.5%) of Salt+MSG. Of the 61% of the products that contained fat sources, 19.6% ($n=200$) had trans fat sources in ingredients list with various alternative names like cocoa butter, bakery shortening, margarine, hydrogenated vegetable edible oil, ghee, white butter, butter, chicken fat, mutton fat, hydrogenated vegetable fat, vanaspati, milk fat etc. Poor substantiation of the presence of trans fat by NFP was observed. The substantiation by NFP was found in 42% of the products that reported ($n=200$) trans fat sources in ingredients list. Allergen advisory/precautionary declaration was found in 21.4% of the products. Of the total products ($n=1,020$), 802 products did not carry any allergen information as advisory/precautionary statements. Of the 802 products that did not carry advisory/precautionary declaration, 492 had one or more allergenic ingredients in ingredients list. Allergenic substance was present either in ingredients list or as an

allergen advisory/precautionary declaration on the food labels. Majority of the food products had allergen advisory/precautionary declaration related to “treenuts and nuts” (n=148), followed by “milk and milk products” (n=107), “cereals containing gluten” (n=97), “Peanuts, soybeans and their products” (n=79), “sesame” (n=43), “mustard seeds (n=23), “gluten free (n=12), “celery (n=5), “corn” (n=3), “sulphite” (n=2), “eggs and products” (n=1), “contains no milk or milk derivatives” (n=1). None of the products had crustaceans and fish and their products related advisory/precautionary declaration. Of the 218 products having allergen information, “Type A” (e.g. contains nuts and milk) allergen declaration was present in 39% of the products, “Type B” (e.g. may contain soy) in 31.7% of the products, “Type C” (e.g. gluten free) in 2.8% of the products and “Type D” (e.g. contain nuts, gluten free) in 26.6% of the products. Health claims were present on 8.3% of the total products and 80% of the total products had nutrient claims. Majority of the products (98.6%) had either vegetarian or non-vegetarian symbol followed by FPO (22.6%), ISO (12.4%), 100% natural (0.1%), HACCP (5%), Healthy Choice (2.2%), ISI (0.6%) and AGMARK (0.2%). Only 58% of the products declared manufacture and best before date together at the same place. Majority of the products (81%) declared best before date in months (i.e. best before in nine months, or best before within 12 months etc.). Twenty two percent of the products printed the terms “manufacture date” and “best before date” at one place on the food label and stamped the actual dates elsewhere on the label.

Results of Phase III, “Nutrient analysis of selected processed packaged foods” revealed that of the 101 products selected for nutrient analysis, 98% of the products reported fat content, followed by sugar (86%), fiber (40%), sodium (40%) and potassium (13%). Though reporting of “sugar” is mandatory according to FSSAI, yet it was not reported in 14% of the products. Under-reporting (reported values <10% of the analyzed values) was common for fiber (98%), potassium (54%) and sugar (51%) while over-reporting (reported values >10% of the analyzed values) was most prevalent in fat (91%) and sodium (53%). Products that did not sodium values on NFP contained the same in the range of 40 to 6000 mg/100g when analyzed. Similarly, potassium content ranged from 0 to 1600 mg/100g, sugar from 1.8 to 38.5 g/100g, fiber from 4 to 41 g/100g and fat from 0.2 to 7.1 g/100g when analyzed. Statistically significant difference between reported and analyzed values of sodium was observed in namkeen and savories ($p \leq 0.05$, $t = 2.678$). Soups which are marketed as healthy were found to have the highest sodium content (reported=6698 mg/100g, analyzed=5333 mg/100g). The reason for “not reporting” of sodium,

potassium and fiber values is that their declaration on NFP is not mandatory by the food laws. Namkeens and savories showed significant difference ($p \leq 0.01$, $t = 4.572$) between reported (4g/100g) and analyzed (7.34g/100g) sugar content. The present investigation revealed that the reported values were that for the “crude fiber” content while analyzed content were for “dietary fiber.” Food categories namely, cornflakes, oats and muesli ($p \leq 0.001$, $t = 7.270$), noodles, pasta and macaroni ($p \leq 0.001$, $t = 6.686$) and namkeen and savories ($p \leq 0.05$, $t = 2.407$) showed a significant difference between reported and analyzed values for fiber. Food categories namely, cornflakes, oats and muesli ($p \leq 0.01$, $t = 3.211$), noodles, pasta and macaroni ($p \leq 0.05$, $t = 2.263$), sweet biscuits ($p \leq 0.001$, $t = 4.854$), chocolates ($p \leq 0.01$, $t = 3.436$), ready to use spice mixes ($p \leq 0.05$, $t = 0.027$), namkeens and savories ($p \leq 0.001$, $t = 3.991$) and chips ($p \leq 0.01$, $t = 3.291$) showed a significant difference between reported and analyzed values for total fat. The study showed that SFA (58%), MUFA (63%), PUFA (63%) and TFA (56%) were not reported by majority of the food products. Statistically significant difference was observed between the mean reported and analyzed values of SFA in chips ($p \leq 0.001$, $t = 10.275$). Of the 59 food products that did not report SFA values, 43 products contained substantial amount of analyzed SFA content which ranged from 1.28 to 5.73 g/100g of food). A statistically significant difference between reported and analyzed MUFA values was observed in sweet biscuits ($p \leq 0.01$, $t = 3.738$), namkeens and savories ($p \leq 0.05$, $t = 2.414$) and chips ($p \leq 0.01$, $t = 4.563$). Of the 64 products that did not report MUFA values, 45 products contained substantial amount of MUFA that ranged from 1.4 to 4.7g/100g. A statistically significant difference between reported and analyzed PUFA content was observed in cornflakes, oats and muesli ($p \leq 0.05$, $t = 2.231$), sweet biscuits ($p \leq 0.05$, $t = 2.818$) and namkeen and savories ($p \leq 0.001$, $t = 4.786$). Of those products that did not report PUFA values ($n = 64$) substantial amount of the same was found in 22 products which ranged from 1.4 to 3.9 g/100g. Of the total 101 products analyzed, 44 products reported TFA content on NFP. Reported TFA content ranged from 0 to 2.7 g/100g. However, when analyzed it ranged from 0 to 17.2 g/100g. Majority of the products were high in sugar and sodium as compared to total fat and saturated fat as per UK-FSA criteria. Food products that were high in 3 nutrients namely, “Sodium, Total fat and SFA” were butter and spreads while chocolates were high in “Sugar, Total fat and SFA” content. These products were also found to contain multiple sources of fat, sugar and sodium in ingredients list. Fatty acid composition the food products revealed that majority of the fatty acids found in the food products constitute SFA (Palmitic acid, Arachidic acid, Stearic acid, Capric acid, Lauric acid, Myristic acid, Butyric acid, Caproic acid, Caprylic acid and Behenic acid). Oleic acid and erucic acid constitute MUFA, linoleic acid constitute PUFA and elaidic and linolelaidic acid

constitute TFA. Therefore, a large number of food products had SFA content. The first three fatty acids with highest percent means of total fatty acids belonged to SFAs (Butyric acid and Caproic acid) and TFAs (Linolelaidic acid) and thus indicate that products had reasonably high amount of SFA and TFA content. Majority of the food categories declared the source of fat in ingredients list as “edible vegetable oil.” Only a few foods specified sources of fat such as margarine, palmolein oil, cocoa butter, butter, sesame oil, peanut oil and corn oil.

Phase IV of the study revealed that variety and taste (73%) and convenience (33%) were the most common cited reasons by all age-groups and gender for processed packaged food consumption. Self-reported behavior of the consumers showed that the factors namely, taste (53%), brand (52%) and type of food (vegetarian/non-vegetarian) (45%) were the predominant factors that consumers kept in mind while purchasing processed packaged foods. The most commonly considered nutritional factors for purchase of processed foods were manufacture and best before date (57%), ingredients list (34%), symbols and logos (25%), NFP (21%), medical need (13%) and allergen information (7%). Of the 634 consumers that looked up nutrition labels, 64% were females and 35% were males. Fifty one percent of the adolescents reported reading food labels, followed by adults (36%) and elderly (12%). Consumers examined food labels due to the “concern about overall health” (51%), followed by “general knowledge” (34%), “concern about certain nutrients” (17%) and “calorie count” (12%). Reasons for not examining food labels by consumers were, “do not understand” (34%), “do not have time” (26%), “not interested” (25%) and preference for “specific brand” (18%). Of the three major sources of information namely ingredients list, NFP and symbols and logos, majority of the consumers (93%) used ingredients list for product information followed by NFP (83%) and symbols and logos (73%). However, the knowledge about the utility of the same ranged between 24% to 34% for each component. Sixty four percent of the consumers reported looking for energy values on NFP followed by vitamins (57%), protein (55%), total fats (52%), cholesterol (50%), sugar (43%), iron (43%) and fiber (41%). Undesirable nutrients namely, calories from fat (20%), TFA (19%), SFA (18%) and sodium (18%) were less often looked at for product selection. The most familiar and understood symbols and logos were vegetarian (64% and 57%) and non-vegetarian symbol (59% and 54%). The same were the major influencers among all symbols and logos during product purchase by the consumers. Familiarity among consumers towards other symbols namely, AGMARK (52%), FPO (35%), Healthy Choice (29%), Smart Choice (23%) and HACCP (9%) was average and the understanding about the same was below average. Of the four NFPs the best comprehended NFP was NFP-2 (Nutrients given

in two tabular formats. One table detailed micronutrients with their significance and second table listed four mandatory nutrients. The information was given as “per 100 g” of the product) and it was understood by 82% of the consumers. Each NFP was better understood by adolescents and females as compared to their counterparts. “Nutrients of concern” namely, cholesterol, sugar, TFA and sodium were considered by less than 10% of the consumers. “International Unit” (I.U.) was the least understood terminology (37%) among consumers which was followed by “% Daily Value” (25%), PUFA (24%), MUFA (24%), microgram (usually symbolized as µg) (21%), TFA (18%), KJ (Kilo Joule) (16%), of which sugars/saturates (11%), per serving (10%), sodium (7%) and calories from fat (6%).

Post intervention results on consumer awareness revealed an increase of 50% in the scores for symbols and logos and NFP. However, post intervention scores did not improve for ingredients list. A statistically significant difference in the pre and post intervention mean knowledge scores of symbols and logos was observed among adolescent consumers. Awareness about “smart choice”, “FPO” and “HACCP” rose from 3% of the consumers to 78%, 4% to 54% and 1% to 19%, respectively. Post intervention scores for nutrient claims increased by 44% for “Zero Trans fat” claim, 42% for “zero cholesterol”, 36% for “low sodium”, 22% for “no MSG” claim and 18% for “no preservatives”. Post intervention, health claims were understood by 80% of the consumers followed by 58% consumers understood information about colors and flavors and 45% understood allergen information.

Therefore, it can be concluded that the presence of medical condition affects processed packaged food consumption. Consumers with medical condition are more cautious while selecting food product for consumption. Processed packaged food consumption is high among adolescents. Therefore, they should be the primary target group for creating awareness. Lack of compliance in presenting nutrition information namely, nutrition and health claims, ingredients list, allergen declaration and NFP is common. Presence of multiple sources of “ingredients of concern” namely, fat, salt/sodium, sugar and MSG with alternative names is common in majority of processed packaged foods. There is inconsistency in the formats of NFPs used on food labels. Variation in reported and analyzed values of “nutrients of concern” namely, sugar, sodium, potassium, fiber, total fat, SFA and TFA is prevalent in processed packaged foods. Consumer awareness initiatives have positive effect on consumers understanding and interpretation skills about food labels and thereby help in making healthy food choices.