Assessment of nutritional status, fitness profile and capacity building of football players of Urban Vadodara to understand food labels and healthy processed food choices using smartphone application.

Synopsis of PhD Thesis

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Introduction

Along with adequate nutrition, healthy food choices are crucial in any adolescent's life, but are exceptionally important for those associated with sports (Croll et al 2006). There is an increased energy demand for those involved in sports, however, several studies have shown that the increased energy demands and other nutrient recommendations are not being met by most of the adolescent's athletes (Croll et al 2006; Petrie et al 2004; Purcell et al 2013). Nutritional status and eating habits are important when considering young athletes, not only for optimal performance but also for optimal growth and development.

Like adults, adolescents also struggle with the same environmental factors that influence nutrient intake for instance: lack of time, travel and body image (Croll et al 2006). Especially female athletes, they tend to have inadequate dietary practices due to their desire to be lean (Cupisti, D'Alessandro, Castrogiovanni, Barale, and Morelli 2002; Maughn and Shirreffs 2007). This desire of getting lean conflicts with the fact that their energy needs are increased not only because they are involved in sports, but also for their growing bodies (Cupisti et al 2002).

It is estimated that individuals make their food choice decisions approximately 220 times a day (Wansink and Sobal 2007) and these are influenced by a both external and internal factors (Sobal and Bisogni 2009) Food choice is known to be influenced by various factors like taste, convenience, price, and cultural and/or religious beliefs (Sobal and Bisogni 2009; Furst, Connors and Bisogni et al 1996). According to Furst et al components like the influence of past experiences, individual ideals (expectations and beliefs), personal factors (food preferences and health status) and resources (skills and knowledge) helps to shape an individual's 'personal food system' which is used to make a final food decision. Several studies have been conducted to understand why people select particular type of foods (Bisogni, Jastran, and Shen et al 2007; Bisogni, Falk and Madore et al 2007). Studies have shown that eating decisions have been described as dependent on the environment, location or situation in which the food choice is being made (Bisogni, Falk and Madore et al 2007). Food choice also varies depending upon what is available and whether the individual is alone or in the presence of others (Vartanian, Herman and Wansink 2008; Herman, Roth and Polivy 2003). In conditions where meals are consumed with others, both athletes and non-athletes

reported that food choices are often influenced by what teammates chose to eat (Smart and Bisogni 2001; Contento, Williams and Michela et al 2006).

Factors important in individual food choice have been investigated using quantitative tools, such as the Food Choice Questionnaire (Steptoe, Pollard and Wardle 1995). Several factors like health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern were used to measure the food choice motives of various populations, including consumers from around the world (Prescott, Young, O'Neill et al 2002; Honkanen and Frewer 2009), however, it has not been used on athlete populations (Crossley and Nazir 2007; Share and Stewart-Knox 2012; Lockie, Lyons and Lawrence et al 2002). Overall, a greater understanding of the various approaches used to study food choice behaviors is important when investigating the factors that influence the food choices of athletes.

Confidence in food management skills, including the ability to prepare, purchase and buy food also may influence food choice (Bisogni, Jastran and Shen et al 2005). In contrast, many young athletes, faced with limited cooking skills, are challenged when they move away from home where meals were often provided by parents (Heaney, O'Connor and Naughton et al 2008). Children (from birth to 17 years old) do not typically prepare their own meals, so most food choices are dependent on what parents provide. Few studies have shown that children as young as five to six years old are able to identify healthy snacks if given the proper guidance (Baskale and Bahar 2011 and Pettigrew 2009). Recent research has examined the role of nutrition in the young athlete's (6-13 years old) diet, by looking at types of food and beverage these athletes were consuming, parental attitudes toward the food setting at sporting events, and how willing parents were to make healthier choices (Thomas, Harwood and Sztainer 2012). They found that some parents did not feel that they were capable of picking healthy snacks due to lack of knowledge and inability to decipher meaning of "healthy" snack. Study conducted by Slater et al (2011) reported that knowledge on energy balance increased when individuals had more access to healthier food choices and beverages. Thus, children are more likely to eat healthy foods if they are more readily available in the home.

Diets have changed immensely from traditional to westernized diets around the globe. Consumption of the processed foods is one of the parts of westernized diet and they are high

in unfavorable nutrients (i.e. fat, salt/sodium, sugar and trans-fat) and low in favorable nutrients (i.e. fiber, vitamins, minerals and antioxidants). Processed foods are very popular because they are convenient, having long shelf-life, involve fewer steps in preparation, fewer utensils to use, less time in supervision, have uniform taste, standardized recipes, availability of foods round the year, prevent food losses, alleviates food shortages and improves overall nutrition of population by food fortification, adds variety, easy to transport, market and distribute (Schmidt, 2009). But while purchasing processed foods attention is paid more on non-nutritional factors namely, packaging, aroma and taste, easy to cook, rare ingredients, convenience in buying, quick turnaround time, price, family preferences and discount on the product compare to nutritional factors (Vijayabaskar and Sundaram 2012; Chan et al 2005; Grunert et al 2010b; Epstein et al 2007; Drichoutis et al 2005; Annunziata and Vecchio 2012).

Despite several advantages, processed foods have some disadvantages too. They are not preferred as they contain high sodium, sugar, high fructose corn syrup (HFCS), trans fat and artificial sweeteners. They also contain artificial flavors or colors, chemicals with long and complex names which are difficult to interpret and have lower nutritional value, thereby making processed foods unhealthy to consume (Schmidt, 2009). Therefore, owing to the unfavorable composition, there are disturbing outcomes of consuming large quantities of processed foods and hence it becomes a matter of public health concern. Prevalence of obesity in children has been linked with the consumption of sugar-sweetened drinks. In Brazil, sugar and soft drinks consumption was found to be responsible for 13.4% of household energy availability and was correlated to the obesity prevalence (Lobato et. al, 2009).

Therefore, with the increasing consumption of processed foods and thereafter their ill-health effects, it has become important for the athletes to be aware of how to make healthy food choices from the wide range of processed foods available. This can be done by knowing the importance and understanding food labels.

Supplement use is a widespread and accepted practice by athletes. Many athletes in order to improve their performance, for maintaining/reaching upto the desirable weight for particular sport either by gaining weight or losing weight use ergogenic aids in the form of dietary supplements. An athlete’s dietary requirements depend on several aspects, including the

sport, the athlete's goals, the environment, and practical issues. The importance of individualized dietary advice has been increasingly recognized, including day-to-day dietary advice and specific advice before, during, and after training and/or competition.

If athletes are guided properly what to eat, when to eat and how much to eat, definitely it will help them in enhancing their performance and maintaining their energy levels throughout the different phases of sports.

Rationale

In today's modern world, due to urbanization and change in dietary habits and lifestyle pattern has itself forced the health-conscious consumers to search for an alternative treatment regime for various ailments caused by lifestyle related diseases. Food choice is dynamic, complex and continually changing and more research is needed with athlete populations where food choices are likely influenced by the demands of sport. Several studies revealed inadequate nutritional intake in both male and female soccer players (Abood, Black, & Birnbaum, 2004; Caccialanza et al., 2007; Clark et al., 2003; Garrido et al., 2007; Gravina et al., 2012; Iglesias-Gutiérrez et al., 2012; Martin et al., 2006 and Russell & Pennock, 2011). There is a clear need for further research exploring the food choice motives of athletes, preferably in conjunction with research investigating dietary intake to establish if intent translates into practice. The increasing number of FOPs leads to the confusion of consumers. There is still debate on which system is the most appropriate and effective. In order to facilitate and help making a more effective debate on the current FOPs, a clear overview of the existing FOPs is warranted. There is paucity of such type of studies among athletes. Hence, the current study is focused to understand food choices and utility of nutrient profile in making healthy food choices among the football players of urban Vadodara. With the above-mentioned background, the research will be carried out in the following sequential manner:

Objectives

Broad objective:

"To study the status of nutrient profiling on the processed foods; development and feasibility trial of smartphone application for healthy food choices among the football players of urban Vadodara."

Specific objectives:

- To assess the anthropometric status, fitness status and body composition status of the football players.
- To study the dietary profile of the football players.
- To assess the frequency and consumption of processed packaged foods among the football players.
- To analyse the variables associated with selection of processed packaged foods among the enrolled subjects.
- To analyse the factors affecting the food choices.
- To examine in detail various components of food labels of processed packaged foods and sports supplements.
- To evaluate reported various components of food labels for their compliance with Food Safety and Standards Act (FSSA) of India and Codex Alimentarius.
- To assess the ability of the football players to comprehend food labels and identify knowledge gaps.
- To carry out capacity building of the enrolled subjects towards healthy food selection by using appropriate intervention tools.
- To develop module on "Food Labelling" and "General Dietary guidelines" for football players.
- To develop smartphone application based on: Colour coded Guideline Daily Amount (GDA) labelling scheme.
- To study the impact of smartphone application and modules on knowledge and comprehension skills among the enrolled subjects.

Review of Literature

This chapter will focus on the available literature under following heads-

- Introduction to Physical Fitness and Sports
- Energy Systems
- Body Composition
- Role of various macronutrients in sports
- Role of various micronutrients in sports
- Importance of Water and Electrolytes in sports
- Dietary Supplements
- Knowledge regarding nutrition among athletes
- Food Choices
- Processed Foods
- Food Labelling and its components
- Food Labelling schemes worldwide
- Consumer awareness and use of food labels
- Prevalence of Food label use and barriers for not reading food label
- Effects of nutrition knowledge on reading food labels
- Studies on use and understanding of different types of FOP labels

Methodology

This research study was divided into 3 phases.

PHASE I: Situational analysis of football players of urban Vadodara

PHASE II: Market survey of processed foods and sports supplements

PHASE III: Football players awareness and capacity building on food labeling

PHASE I: Situational analysis of football players of urban Vadodara

A formative research was conducted to study the nutritional status of the football players of urban Vadodara. A number of 250 subjects (boys) aged 10-14 years were selected from Baroda Football Academy in Gujarat, accredited by All India Football Federation (AIFF) by purposive sampling. The targeted subjects fulfilling the inclusion criteria were chosen after taking ascent from parents. The following inclusion criteria were used to enrol the subjects in study.

Inclusion Criteria

- Subjects playing football for 1 year and more.
- Subjects 10 years to 14 years of age.
- Willing to participate
- Academy players of Baroda football academy.

Exclusion Criteria

- Subjects less than 10 years and above 14 years of age.
- Subjects suffering from any chronic diseases condition
- Differently able
- Those not willing to participate

Data on socio-demographic profile, frequency and consumption pattern of process packaged foods and factors affecting food choices was obtained with the help of a semi-structured pre-tested questionnaire. Anthropometric measurements like weight, height, waist circumference and hip circumference were taken and subsequently waist hip ratio and body mass index were calculated for assessment of the nutritional status. Details regarding the diet were obtained through the 24 hour dietary recall method. Information on dietary intake was collected on three consecutive days.

Schematic diagram representing design of Phase I

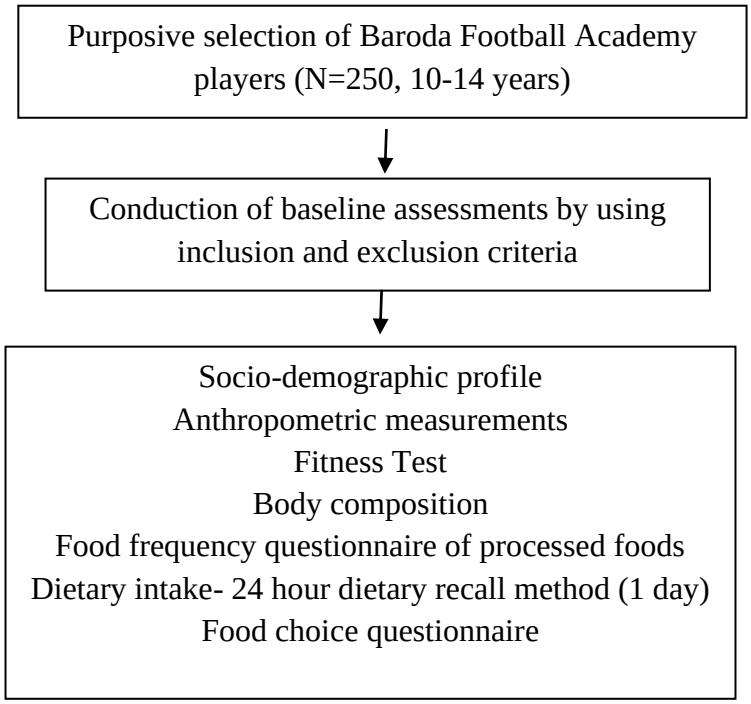


Table 1: Tools and Techniques (Phase-I)

Parameter	Indicators	Methods
Sociodemographic	-	Pre-tested questionnaire
Nutritional status	Anthropometry	Standard method for height, weight, waist circumference and hip circumference
	Body composition	Skinfold thickness
	Dietary intake	24-hr dietary recall (1 day) and semi structured food frequency questionnaire
	Food choice	semi structured questionnaire
Fitness status	Cardiorespiratory endurance	Harvard Step test modification for school children
	Flexibility	Sit and Reach Test
	Skill	SAI football skill test

PHASE II: Market survey of processed packaged foods and sports supplements

This phase of the study was carried out in two sub-phases

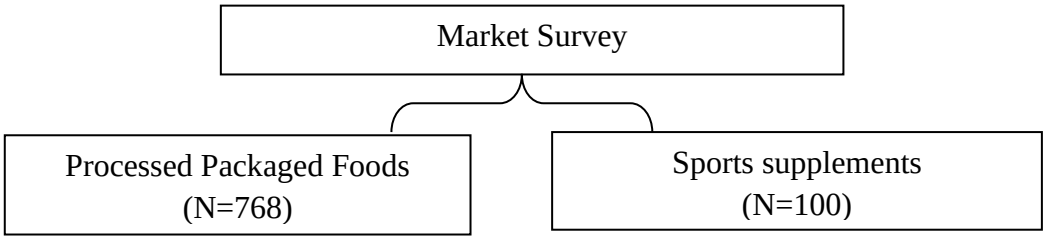
PHASE II (A): Market survey of processed packaged foods

PHASE II (B): Market survey of sports supplements

The exploratory phase of the study included market survey of processed packaged foods and sports supplements. It was carried out in the retail store in Vadodara. In total 768 processed packaged products were enlisted and were categorized into 9 food groups and further into 25 food categories based on George institute for global health. Each processed packed product was photographed and was entirely examined in detail regarding food labelling. Data on general information about the product, Nutrition Facts Panel, symbols and logos, nutrient claims, health claims, ingredient list, allergen declaration, colours, flavours and preservatives etc. were obtained by using standardized proforma.

For sports supplements, data was elicited from five retail stores from Vadodara. A total of 100 sports supplements were enlisted. Detail composition of the sports supplements was studied in terms of major nutrient present and cost. Products that did not provide Nutrition Facts Panel were excluded from the study.

Schematic diagram representing design of Phase II



PHASE III: Football players awareness and capacity building on food labeling

This phase of the study was carried out in three sub-phases

Phase III (A): Football players awareness regarding food labeling
Phase III (B): Development of intervention tools and capacity building of the subjects
Phase III (C): Impact evaluation after intervention and development of smartphone application

Phase III (A): Football players awareness regarding food labeling

The survey was done in order to elicit information regarding players knowledge and comprehension skills with respect to selection of processed packaged foods. The data was procured by using a pre-tested semi structured questionnaire. The questions in the questionnaire were based on the experimental food label. Players had to answer the questions with respect to logos, NFP, ingredient list, health and nutrition claims, etc. Another questionnaire included eight questions on front of pack label based on Guideline Daily Amount (GDA) labelling scheme and another eight questions on colour coded GDA. Players had to identify the healthy product from the given options.

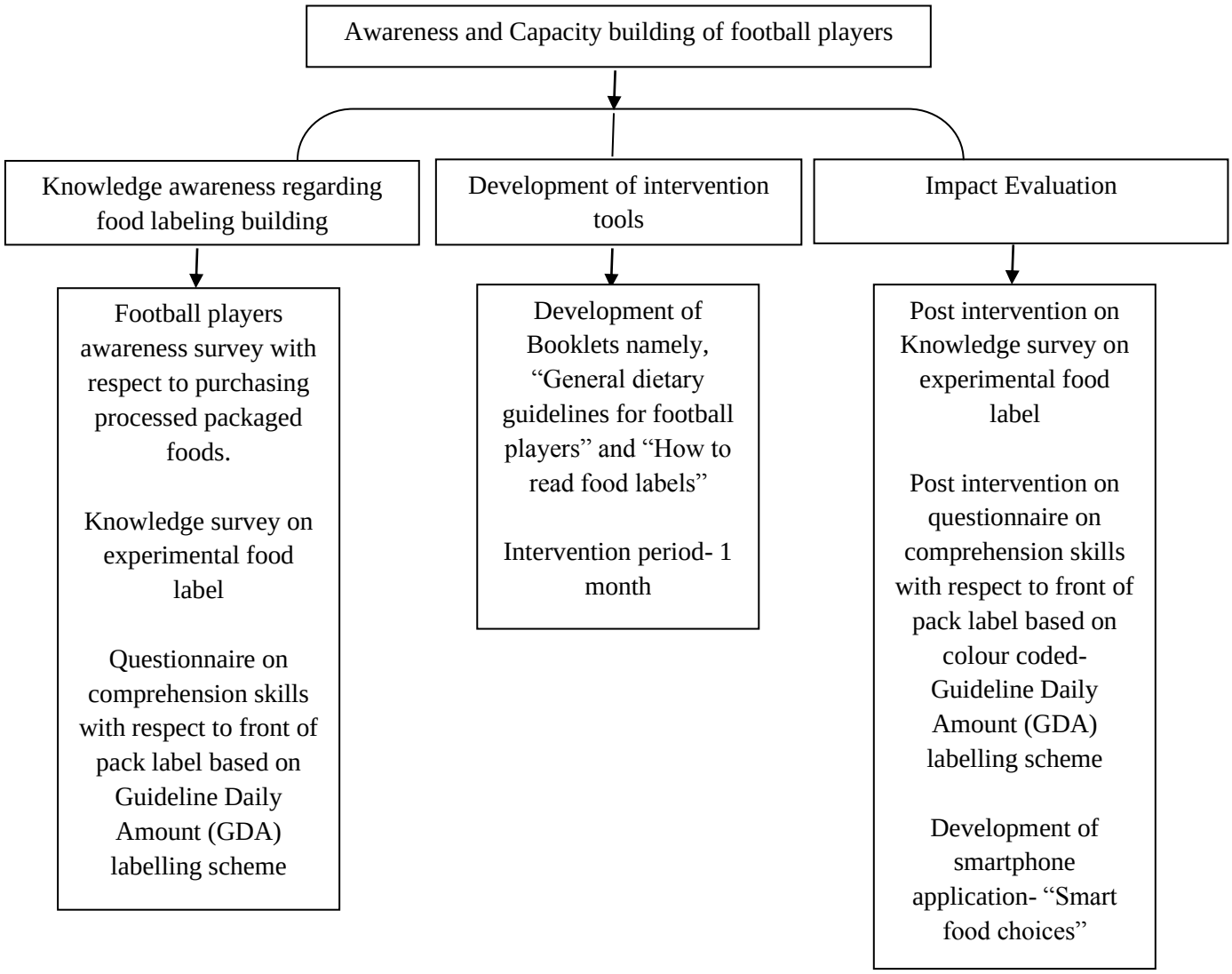
Phase III (B): Development of intervention tools and capacity building of the subjects

Booklets namely, "General dietary guidelines for football players" and "How to read food labels" were developed to carry out this intervention phase. Various aspects of food labeling namely, FOP labeling, BOP labeling, nutrition and health claims, ingredient list, NFP, allergy declaration, etc. were included.

Phase III (C): Impact evaluation after intervention

Post intervention session was conducted among the football players regarding the understanding of various aspects of food labels. Questionnaire was administered having experimental food label and data was elicited. The smartphone application was also developed with the title "Smart food choices". The content was finalized based on the data procured from Phase II.

Schematic diagram representing design of Phase III



Results and discussion

PHASE I: Situational analysis of football players of urban Vadodara

The present phase of study was carried out with the objective to generate database on nutritional status, body composition and fitness status of football players (10-14 years) of Urban Vadodara.

Description of the enrolled subjects

Subjects were selected purposely from Baroda Football Academy. Subjects meeting the inclusion criteria and those willing to participate were enrolled in the study. Two hundred and fifty male football players completed the study. Mean age of male footballers was 12 years. There were 80 footballers in younger age group (10-12 years) and 170 footballers in older age group (>12-14 years).

Background information of the subjects under study

Background information of the athletes was elicited by using a semi-structured questionnaire. With respect to education, all the players were at primary school level, 47% of them belong from nuclear family and around 46% belong to lower middle socio-economic class as per Kuppuswamy scale classification.

Nutritional status based on Body Mass Index (BMI)

Subjects were classified into various grades of nutrition using anthropometric indices namely BMI for age (WHO-Z score). Of the total subjects (N=250), 10% were underweight, 75% were classified as normal, 5% as overweight and 10% as obese.

Nutritional status based on Dietary intake

The dietary intake of the athletes was assessed by using 24-hour dietary recall method. The mean energy intake across various age groups was, 10-12 years (2199.48±563.08 kcal/day) and >12-14 years (2243.15±607.87 kcal/day) respectively. The mean protein intake across various age groups was 50.55±15.6 g/day for 10-12 years age group and 65.5±28.65g/day for >12-14 years respectively.

Food choice and processed food frequency

Sensory appeal was the major factor affecting food choice on typical day for all the players. The most popular processed food was biscuits and it was consumed by 93% of the football players.

Body Composition

Body composition was assessed by measuring skin fold thickness measurements. Data revealed that the proportion of fat was higher than normal in both the age groups, 10-12 years (41%) and >12-14 years (36%) respectively.

Fitness assessment

Various types of fitness test relevant to football players were conducted.

- Mean scores for Harvard Step test was 59.32±4.32.
- Mean scores for Sit and Reach Test was 11.24±4.11.
- Mean scores for 30 m running with football Test was 5.81±0.3 seconds.
- Mean scores for Juggling Test was 13.34±3.72.
- Mean scores for kicking Accuracy Test was 7.34±1.33

PHASE II

PHASE II (A): Market survey of processed packaged foods
PHASE II (B): Market survey of sports supplements

A): Market survey of processed packaged foods

Market survey of processed packaged foods was done in the retail store (n=1) in Vadodara, to list various types of processed packaged foods across the brands. A total 768 products were examined for nutrition labelling and were categorized into 9 food groups and further into 25 food categories based on George institute for global health.

Nutrition Facts Panel (NFP)

In the present study inconsistencies was seen in reporting type of NFP among various brands within the same food category. Majority (53%) of the processed packaged foods had NFP as "per 100g" followed by "Per serving (15%)" (table 4.1.1.2.1). Only 1 % of the total processed products reported NFP as per "Per 100 g and % DV".

Mandatory nutrients

As stated by FSSAI regulations, it is compulsory to mention energy, protein, carbohydrates, sugar and fat on NFP. If nutrition or health claim is displayed on the package, the specific nutrient for which claim has been made should also be mentioned on the NFP.

Results revealed that energy was reported on 100% of the total products and the least reported nutrient was sugar (88.4%). It was observed that "confectionery" food group reported all the five mandatory nutrients. Products of snacks foods category reported least in mentioning mandatory nutrients. Thus, results show that majority of them did not adhere in reporting basic five nutrients on NFP as per FSSAI regulations.

Reporting of basic 5s was adhered to by all the products in only confectionery (100%) food group and least adherence was seen in sauces and spreads (57%) respectively. Other important 7 nutrients were mentioned only in 5 food groups out of 9. Thirty one percent was seen in cereal and cereal products followed by snack foods (30%), convenience foods (18%), dairy (5%) and sauces and spreads (5%).

Ingredients list

According to United States Food and Drug Administration, 2009 the ingredients should be mentioned in descending order of their composition. Only 4 food groups namely, bread and bakery products (28%), convenience foods (19%), cereal and cereal products (16%) and snacks (12%) listed ingredients in descending order of weights.

Allergen information

From total products (n=123), 43% of the convenience foods contained allergen information followed by confectionery (16%), cereal and cereal products (15.8%) snack foods (14%), sauces and spreads (8%), beverages (1.2%), bread and bakery products (1%), and dairy (1%). Different types of allergen format found in 123 products. "Type A" information was seen in 36% of the products, "Type B" (34%), "Type C" (4%) and "Type D" in 26% of total products.

Nutrient claims

The highest percentage (33%) of nutrition claims was seen in cereal and cereal products which was followed by confectionery (14%), beverages (13%), convenience foods (8%), bread and bakery products (7%), dairy (4%), snack foods (3%) and sauces and spread (2%). No nutrient claim was found on fruit and vegetable-based products.

Manufacture and Expiry date

Only 52% of the total products showed manufacture and best before date together at one place. If they are not given together at a same place than it becomes difficult for consumers to comprehend it. Seventy eight percent products declared best before date in months which is again time consuming and it becomes difficult for the consumers to calculate it from the manufacture date when it is given in months.

B): Market survey of sports supplements

Total 100 products were surveyed and classified according to Australian Institute Sport Supplement program 2006. Majority of the products (96%) surveyed were under approved supplements classification followed by supplements that have no clear proof of beneficial effects (4%). The products were in form of powder (83%), bar (12%), beverages (3%) and capsules (2%). Most of the supplements in form of powder, recommended one serving to be added in 250-300 ml water or milk. They were available in various flavours and pack size.

Bars were to be consumed one at a time or some of them were meal replacement bars. The serving size for powder ranged from 25-75g, for bars (30-100g) and beverage (415-500 ml) respectively.

Phase III

Phase III (A): Football players awareness regarding food labeling
Phase III (B): Development of intervention tools and capacity building of the subjects
Phase III (C): Impact evaluation after intervention and development of smartphone application

A) Football players awareness regarding food labelling

1) Survey with respect to knowledge and practices regarding purchasing of processed packaged foods.

The survey was done in order to elicit information regarding players knowledge and practices with respect to selection of processed packaged foods and comprehension of food labels. The data was procured by using a pre-tested structured questionnaire.

Majority of the football players (86.8%) cited "variety and taste" as the top influencer for consumption of the processed foods. Since age group was young, status was given last preference for the same.

In both the age-groups, it was observed that nutritional factors like food labels, ingredient list and nutrition facts panel was not look up by the players while purchasing processed products. Only nutrition quality symbols were taken into consideration by 50% of the total players. Very few players (n=56) out of 250 players looked for food labels. The most common reason cited for was "concern about health" (55%) followed by "concern about specific nutrient" (26.7%) and "total calorie count" (17.8%).

Majority of the football players (n=106, 70%) mentioned that since many scientific terms are used on food labels, it becomes difficult for them to examine food labels.

Non- nutritional factors like taste, price and type of food that is vegetarian or non-vegetarian were preferred more while purchasing processed products in both the age-groups.

Adult age group (>12 to 14 years) were more concerned about nutrients on NFP compared to younger age group (10 to 12 years) while purchasing processed packaged products. They mostly looked for nutrients like protein (49%), followed by total fats (39%), energy (28%), sugar (18%), fibre (11%) and iron (2%).

2) Comprehension of Nutrition Facts Panel

This section dealt with assessing information on players ability to comprehend food labels. Four different types of Nutrition Facts Panel were included in questionnaire. They were different with respect to nutrient information and format. NFP-1 (Values per 100g) was easily understood by majority of the players in both the age groups. As the complexity level increased, players faced difficulty in understanding the NFPs. NFP-4 (values in form of %DV) was least understood by most of the players.

3) Survey on knowledge regarding various components of food labels

Knowledge scores regarding various components of Food labels

The knowledge regarding various components of food labels was assessed using a pre-tested questionnaire. Following were some of the components of food labels assessed under knowledge survey.

- Nutrition Facts Panel
- Nutrient, Health and Allergen related claims
- Symbols
- Preservatives
- Alternative names of unhealthy nutrients

This same questionnaire was used for post intervention to assess the improvement in the knowledge of football players.

4) Knowledge scores regarding commonly adopted and colour coded Guideline Daily Amount (GDA) labelling scheme.

The knowledge regarding commonly adopted Guideline Daily Amount (GDA) labelling scheme was assessed using a pre-tested questionnaire. This same questionnaire was used for post intervention but colour code was added to same in order to assess the improvement in the knowledge of football players.

In both the age-groups it was observed that majority of the football players had poor knowledge score on various components of food labels. Only 1% of the total players had good knowledge score which was increased to 15% after post intervention. Remarkable shift was observed from poor to average and from average to good score category post intervention. Similar shift pattern was observed for GDA colour coding scheme. None of the player fall in good category pre intervention. After colour coded GDA was introduced post intervention, 70% from (10 to 12 years) and 86% from (>12 to 14 years) age group fall in good category.

B): Development of intervention tools and capacity building of the subjects

Booklets were distributed to all the football players enrolled in the study and their coaches. After one month duration, post intervention data was collected.

C): Impact evaluation after intervention and development of smartphone application

The impact of intervention on knowledge and comprehension skills of the football players was assessed. Post data collection was elicited by using questionnaire. The filled in questionnaire were coded and statistically analysed using Microsoft Excel 2007. The results are presented in section A along with pre intervention data.

Development of Smart phone application

The smartphone application was developed with the title " Smart food choice " and published on Google Play Store. The content was finalized based on the data procured from Phase II. The application was created with the help of software engineer.

Conclusion and Recommendations

The major conclusions that emerge from the present study are,

- Data was generated on nutritional status, fitness status and body composition status of the football players of urban Vadodara.
- Data revealed that obesity and overweight was prevalent in football players.
- Sensory appeal was the major factor affecting food choices.
- There is lack of compliance in reporting of basic nutrients, in listing ingredients in descending order, in health claims, nutrient claims and allergen declaration with FSSAI guidelines.
- Inconsistencies was seen among the formats of NFP, in allergen declaration and manufacture and best before date information.
- Comprehension of the food labels by the football players can be improved through awareness generation.
- Colour coded Guideline Daily Amount (GDA) front of pack labelling scheme helped football players in selection of healthy food choices from the available option.
- There is a need of simplified food labels and decrease complexity by including colors and pictures in order to capture consumer attention.
- Thus smartphone application based on colour coded GDA was developed, which will enable football players for making healthy smart food choices.
- Various nutritional education activities can be initiated in schools and colleges in order to provide education on food labeling to promote label use for healthy food choices at young age.

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