CHAPTER 6

SUMMARY AND CONCLUSION

Nutritional status and eating habits are important when considering young athletes, not only for optimal performance but also for optimal growth and development. 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. 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).

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. 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.

Consumption of the processed foods has increased. 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). 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. Keeping this in mind the present study was undertaken as, **" 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."** 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

The results and the major highlights of all the phases under study trial have been summarized as follows:

5.1 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. 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.

Salient features of the Phase I

5.1.1: Socio-demographic characteristics of the subjects

- Majority of football players were Hindus (68%).
- Mean age of the male football players was 13 years.
- There were 80 footballers in younger age group (11-12 years) and 170 footballers in older age group (>12-14 years).
- With respect to education, all the players were at primary school level, 47% of them belong from nuclear family and remaining (53%) were living in joint family.
- Almost 46% of the subjects belong to lower middle socio-economic class.

5.1.2: Duration and level of participation in football competition of the subjects

- All football players were actively playing since past 1-2 years and the amount of time spend in specific training in a day was more than 1 hour.
- All of them spend around 5-7 days in week in playing football. From the total subjects, around 15% of the players had played at district level and 10% of them had played at interschool level.

5.1.3: Anthropometric profile of the subjects

- The football players had mean Body Mass Index (BMI) of 21.22. BMI of group 2 (older age group) was significantly higher ($p<0.001$) than younger age group.
- With respect to the hip circumference, there was insignificant difference amongst both the groups. Both waist circumference and hip circumference were higher in younger age group compare to older age group.
- From the total subjects (N=250), 10% fall in thinness, 75% were classified as normal, 5% as overweight and 10% as obese according to WHO-Z score.

5.1.4: Fitness profile of the subjects

- Data for step test revealed that almost half (48%) of the players in group 1 had poor cardiorespiratory endurance whereas half (48%) football players in group 2 had good cardiorespiratory endurance.

- Around 74% players in group 1 and 58% players in group 2 had good flexibility respectively.

- For 30 m test, in the age group 11-12 years, 54% players were in poor category, 21% players in average and 25% players in good category and for the age group >12-14 years, 34% players were in poor, 30% players in average and 36% in good category.

- For juggling test, in group 1, 38% players were in poor category, 31% players in average and 31% players in good category and for the group 2, 31% players were in poor, 32% players in average and 37% in good category.

- With respect to kicking test, in group 1, 54% players were in poor category, 21% players in average and 25% players in good category whereas in group 2, 34% players were in poor, 30% players in average and 36% in good category.

5.1.5: Body composition profile of the subjects

- The mean values for biceps, triceps, subscapular and suprailiac were 7.89±0.75 mm, 12.49±0.79 mm, 9.26±0.78 mm and 10.25±0.89 mm respectively in total subjects.

- In group 1 the mean value of body fat percentage was 16.09±1.17 % and in group 2, 16.6±0.38 % respectively.

- Statistically significant difference between age groups with respect to body composition was observed. Group 2 have significantly higher body composition compared to group 1. However, triceps had no significant difference between age groups.

5.1.6: Factors affecting food choices during purchasing processed packaged products

- Data reveals that factors like health, price of the product, sensory appeal and familiarity of the product were extremely important factor while purchasing the products.
- Factors like convenience, natural content, weight control and ethical concern were not the major factor of concern while buying the products.
- Age groups were statistically significant with respect to food choice. Age group >12-14 were more concern about food choice i.e. health (p = 0.007) and mood (p<0.001). However, age group 11-12 were more concern about food choice i.e. convenience (p<0.001) and sensory appeal (0.001).

5.1.7: Nutritional status of the subjects by 24 hour recall

- The mean energy intake was 2199 calories/day for group 1 and for group 2 it was 2244 calories/day.
- Mean nutrient intake of protein was found to be very low (66 gm and 84 gm) and fat consumption was also found less than the RDA (78 gm and 74 gm) in group 1 and 2 respectively.
- Calcium and iron consumption was also found less than RDA.

5.1.8: Food Frequency for processed food consumption among football players

- Data revealed that around 52% of total subjects used to consume cold-drink once in week, 36% of total subjects consumed fruit juices once in month.
- Soup was consumed occasionally (58%) by majority of the players. Sweet biscuits (53%) were more preferred by subjects once in week compare to salt biscuits (22%).
- Jams/ jellies (30%) were consumed more frequently that is once in 3 days followed by chocolates (32%) once in week. Wafers/ Kurkure (44%) were also frequently consumed by subjects once in week.

Generation of database on nutritional status, fitness status, body composition status and consumption of processed foods among the football players of urban Vadodara.

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

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

PHASE II (B): Market survey of sports supplements

Salient features of the Phase II

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.

5.2.1: 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%)". Only 1 % of the total processed products reported NFP as per "Per 100 g and % DV".

- 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%).

- Of the total products that reported energy value (n=719), 47.5% (n=365) of the products were high in energy and 40% (n=354) of the products were high in fat. Fifteen percent of snack foods were high in energy followed by bread and bakery products (14.8%), convenience foods (7%), cereal and cereal products (4.5%), confectionery (4%) and dairy (2.2%). Similarly in case of fat, snack foods category showed highest contribution (12%), followed by convenience foods (11.2%), bread and bakery products (7.4%), confectionery (3.2%), dairy (3.1%). cereal and cereal products (2.3%), and sauces and spreads (0.8%). None of the products in fruit and vegetables and beverages category were high in energy and fat as per US-FDA, 2004 criteria.

- According to UK-FSA criteria, from the total products surveyed, 29% of them were high in fat, 45% products were high in SFA, 42% products were high in sugar and 20% were high in sodium. Snack food group was highest in fat (12.36%) and SFA (19.22%) amongst various remaining food groups. Bread and bakery products had highest content of sugar (11.79%) Convenience food group (16.23%) was highest in sodium content among the surveyed products.

- Fruits and vegetable products contain almost negligible amount of various nutrients like fat, salt, sugar and SFA. According to the criteria, food group like dairy, bread and bakery products and confectionery were categorised into low content of fat.

5.2.2: 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.

5.2.3: Allergen declaration

- 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.

5.2.4: Health Claims and Nutrient Claims

- Out of 9 food groups, only 4 food groups declared health claims on food label. Only 3.4% of the total products mentioned health 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.

5.2.5: Symbols and Logos

- Majority of the products surveyed were vegetarian. Vegetarian symbol was present on 94% of the products, followed by FPO (21%), ISO (11%), 100% Natural (7%), HACCP (3%), non-vegetarian symbol (2%), healthy choice (2%), ISI (0.2%) and AGMARK (0.1%).

5.2.6: Manufacture and Best Before Date

- Fifty two percent of the products mentioned both manufacture and best before date together. Around 78% of products mentioned best before in months. Seventy two percent of total products displayed manufacture and best before date which were stamped and mentioned on same place whereas only 19% of total products that were stamped but mentioned on different place. Inconsistency was seen among various types of format even in similar food group.

B): Market survey of sports supplements

- A total 100 products were examined and were categorized into 4 categories based on forms available. Majority of supplements were in form of powder (n=83), followed by bar (n=12), beverages (n=3) and capsules (n=2). Serving

size varied from 25-75 g for powder, 30-100 g for bar and 250-500 ml for beverages.

- From total 100 supplements 61% of supplements contain protein as a major nutrient followed by Branched chain amino acids (14%), Creatine monohydrate (13%), Coenzyme Q10 (9%) and beta-hydroxy-beta-methylbutyrate (3%).

- The most common flavours were chocolate, mango, and vanilla. Majority of the products surveyed were from Muscleblaze, Optimum nutrition and ultimate nutrition. Cost of the products varied from brands to brands and pack size of the supplements.

- Different types of Nutrition Facts Panel (NFP) were displayed on sports supplements. The most common type of NFP displayed was Per 100 g, Per serving and % DV (68%), followed by per serving and % DV (13%), per 100 g (9%), Per 100 g and % DV (7%) and per serving (3%). Inconsistencies was seen among various types of NFP.

> Data was generated on various types of processed foods and sports supplements available in market.

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

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

Salient features of the Phase III

A) **Football players awareness regarding food labelling**

Standard questionnaire was used to elicit information on food labels. Football players were interviewed one by one to understand the knowledge and practices regarding purchasing of processed packaged foods.

5.3.1: Reason for consumption of processed packaged foods among football players

- Majority of the football players (87%) cited "variety and taste" as the top reason for consumption of the processed packed foods followed by convenience (8%) and do not know how to cook (5%).

5.3.2: Frequency of reading food labels, ingredients list, nutrition facts panel and quality symbols among the subjects.

- Data revealed that in both the age-groups, it was observed that food labels, ingredient list and nutrition facts panel were never seen by the players while purchasing processed products.

- Only nutrition quality symbols were taken into consideration by 50% of the total players. Around 78% football players were never reading food labels, 82% of them never read ingredient list, 88% of them never read nutrition facts panel.

- Frequency of reading food label was more in older age group (18%) compare to younger age group (16%).

- 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.

5.3.3: Reasons for examining food labels among the subjects

- Very few players (n=56) out of 250 players looked for food labels. The most common reason cited for reading food labels by total football players was "concern about health" (55%) followed by "concern about specific nutrient" (26.7%) and "total calorie count" (17.8%). Older age group were more concerned about health compared to younger age group (27%).

5.3.4: Reasons for not examining food labels among the subjects

- Majority of the players (n=194) were not examining food labels and the reason cited for same were they did not understand food label (55%), followed by do not have time to look at food labels (35%) and not interested (11%).

- Around 16% in younger age group reported that they think its useless to read food labels compare to older age group (8%).

- 66% of total subjects out of 106 players reported that many scientific terms were used on food labels which become difficult for them to comprehend followed by don't know what to look for exactly on food labels (31%) and the print on label is too small (3%) to read.

5.3.5: Common factors considered while purchasing processed packaged foods among football players

- The most commonly cited information was taste (100%) irrespective of the age-group, followed by price (90%, group 1) and (93%, group 2), type of food (92%, group 1) and (95%, group 2) and manufacturer and best before (82%, group 1) and (93%, group 2).

- Group 2 gave more preference to information like attractive package (23% vs. 16%), its popularity (43% vs. 7%), advertisement (62% vs. 55%), recommended by someone (34% vs. 15%), discount on product (52% vs. 36%), ingredient list (7% vs. 4%), nutritional panel information (5% vs 0%) and information about allergens (2% vs 0%) in comparison with group 1. Whereas group 1 gave more preference to brand (45% vs. 39%) and nutrition quality symbols (22% vs. 13%) in comparison to group 2.

5.3.6: Types of information looked on NFP while purchasing processed packaged products by football players.

- Group 2 were more concerned about nutrients on NFP compared to group 1 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%) on NFP. Group 1 used to look only for 3 nutrients on NFP i.e, Energy (15%), total fats (11%) and protein (20%).

5.3.7: Understanding of Nutrition Facts Panels (NFP)s among the football players

- Four types of Nutrition Facts Panels (NFP-1: Values per 100g, NFP-2: Values per 100g and per serving, NFP-3: Values per 100g, per serving and % DV and NFP-4 values in form of % DV) were administered through questionnaire.

- NFP-1 (Values per 100g) was easily understood by majority of the players in both the age groups (group 1, 80% and group 2, 100%). 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 (group 1, 100% and group 2, 84%). NFP-1 was understood by 33% of total subjects and NFP-4 by 89% of total subjects.

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

5.3.8 Pre and post intervention knowledge scores on various components of food labels among football players

- The knowledge regarding food labels and commonly adopted Guideline Daily Amount (GDA) labelling scheme was assessed using a pre-tested questionnaire. 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.

5.3.9 Pre and post intervention knowledge scores on GDA labelling scheme among football players

- 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 group 1 and 86% from group 2 fall in good category.

Development of Smart phone application

- Since colour coded GDA (traffic light colour scheme) was introduced, players were able to comprehend GDA labels easily. They were able to select healthy product from the given options efficiently. This clearly indicates that if football players are given knowledge on food labels repeatedly, they may select healthy processed products from varieties of available products. Food labels are somewhat complex in nature and difficult to comprehend, but results clearly indicate that colour coded GDA labelling scheme can be easily comprehend. Thus smartphone application was developed having colour coded GDA labelling scheme which can enable players to comprehend food labels easily.

- 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.

- 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.