
CHAPTER-V:
SUMMARY AND CONCLUSION

CONCLUSIONS AND RECOMMENDATIONS

The assessment of nutritional status is considered to be the measure of health status and standard of living of an individual or population. It is necessary to mention that these data would be more helpful for policy planners and public health professionals to better understand the current nutritional situation in relation to food and nutrition and to improve the situation for vulnerable segments of the population. The present cross-sectional study has been conducted to assess the nutritional status of adult Rajbanshi population aged 20-49 years of North Bengal, India. The nutritional status was evaluated using different derived anthropometric measurements, dietary intake assessment and food-related habits. The socio-economic, demographic and lifestyle-related factors were also obtained to describe the possible association with nutritional status and dietary intake. The results would be very useful in the formation and/or implementation of appropriate development and nutritional supplementary programmes to promote the health condition of the population under study. The present study assessed the nutritional status of the Rajbanshi individuals utilizing different anthropometric indices that appeared to be reliable indicators for the assessment of both under-nutrition (e.g., CED) and over-nutrition (e.g., overweight and obesity) among them. The use of BMI and MUAC depicted the existence of a high prevalence of undernourishment. The results further confirmed the pronounced gender-related undernourishment. It was evident that the proportion of nutritional deprivation was the major nutritional concern among the female than the male Rajbanshi individuals.

Despite the increasing prevalence of overweight and obesity among the Indian populations the prevalence of under-nutrition continues to be a major problem in most of the rural populations in India including the Rajbanshi as documented in the present study. The existing literature further revealed that the under-nutrition was considered to be a major

problem in the low socio-economic populations than the high socio-economic populations in India. The results of the present study support the inference that in the Indian rural populations, CED remained of primary significance rather than obesity or overweight, which was in contrast with the populations of the western countries. The results further suggested that an urgent nutritional support programmes should be launched focusing to the females for reducing the magnitude of under-nutrition in the population concerned. Further studies should be conducted to determine the effects of nutritional supplementations on the anthropometric parameters and functional ability among the Rajbanshi population. The following conclusions could be derived from the present study:

5.1. ANTHROPOMETRY AND NUTRITIONAL STATUS

- The results indicated the mean weight, height, MUAC and WC were considerably higher among the male individuals when compared with the female individuals. The mean HC was observed to be slightly higher among the females (84.93 ± 6.29 cm) when compared with the males (83.52 ± 5.64 cm). The skinfold adiposity measurements of BSF, TSF, SSF and SISF were higher among the female individuals. Age variations in the anthropometric variables among these Rajbanshi individuals were found to be strongly associated with the age groups (20-29 years; 30-39 years; 40-49 years).
- The derived anthropometric indices showed that BMI and RI were higher among the females than the males. However, the male individuals had higher mean values of WHR, TUA, UMA, BFMA, FFM and FFMI than the females. In case of the nutritional and body composition variables of WHtR, CI, UFA, AFI%, PBF%, FM, FMI and PBF-BMI ratio, mean values were higher among the females than the males. When age specific effect was taken into consideration, the results indicate that most of anthropometric

variables were observed to be higher in age group of 30-39 years in case of the males and in the age group of 40-49 years in case of the females.

- The results of the Pearson's correlation analysis between the anthropometric variables showed that most of anthropometric variables were significantly correlated with each other ($p < 0.05$). Age was significantly higher correlated with WHR, WHtR, FFM, WC and CI. Height and weight were significantly correlated with all the anthropometric variables.
- Linear regression analysis showed that anthropometric and body composition variables were significantly associated with BMI, WHR, WHtR, UMA, UFA, PBF, weight, TSF, BSF, RI, STR and FFM ($p < 0.05$).
- Linear regression analysis of BMI as the dependent characteristic showed that several anthropometric and body composition characteristics is significantly associated with BMI among both the male and the female Rajbanshi individuals.
- In countries like India and the many developing countries the appropriate health care and nutritional strategies should be implemented to improve the nutritional status especially in the populations where prevalence of thinness and chronic energy deficiency (CED) were very high. This includes the Rajbanshi population of North Bengal. Utilizing the WHO (1995) proposed criteria based on BMI, it was shown that the adult Rajbanshi individuals comprised a high undernourishment group (CED $> 20\%$) and suffering from different grades of CED. The overall prevalence of overweight (BMI: $> 25 \text{ kg/m}^2$) and obesity (BMI: $> 30 \text{ kg/m}^2$) were 38 (3.67%) and 10 (0.97%) respectively. It has been observed that using BMI to assess overweight and obesity, only 4.63% of the individuals had BMI values $> 25 \text{ kg/m}^2$. The female were more overweight and obese than the males (6.97% versus 3.06%) ($p < 0.01$).

- The sex specific prevalence of different grades of under-nutrition or CED among the Rajbanshi individuals was assessed using BMI showed that most of the undernourished individuals comprised mild under-nutrition (CED Grade I: 17.37%) followed by moderate under-nutrition (CED Grade II: 4.05% and finally severe under-nutrition (CED Grade III: 1.74%) among the Rajbanshi.
- Nutritional status was also assessed using the sex specific cut-off points of MUAC <23 cm for males and <22 cm for females, as specified by James *et al.* (1994). The results are shown that the overall prevalence of under-nutrition was 40.64%. The sex specific prevalence of under-nutrition was observed to be slightly higher among the males than the females (40.97% versus 40.17%) ($p>0.05$).
- When the nutritional status of the Rajbanshi individuals were classified using the combination of MUAC with BMI, it was observed that 17.26% and 20.67% of the male and female individuals were affected by under-nutrition. The sex difference was however, found to be statistically not significant (χ^2 -value= 1.31; d.f.1; $p>0.05$).
- When regional adiposity was assessed using WC, WHR and WhtR, the prevalence of overall obesity was 6.56%, 56.76% and 21.14% respectively. The prevalence high PBF and Σ SKF were 0.87% and 2.12% among the individuals. A total of 6 male and 16 female individuals (0.97% versus 3.85 %) exhibited high skinfold thickness. The levels of adiposity were significantly higher among the females as compared to the males for all the anthropometric measures and derived indices.
- When the Rajbanshi individuals were categorized in terms of fitness status based on PBF, more than half of the individuals exhibited risky fitness status (51.93%), followed by good (20.37%), then excellent (19.59%) and finally fair fitness status (8.11%). Risky fitness status were exhibited by 64.68% and 32.93% of the males and the females ($p<0.01$). The amount of risk factor associated with PBF among the Rajbanshi

individuals showed that the majority of them had an optimal risk (76.16%). The individuals comprising the slightly overweight and lean categories were observed to be 12.26% and 7.72% respectively.

- A multinomial logistic regression analysis model was fitted on the socio-economic, demographic and lifestyle related variables to estimate the odds of being a male individual undernourished and over-nourished. The association of BMI, WHR and WHtR with the different predictor variables among the male Rajbanshi individuals indicated that several variables had significant influences in determining whether an individual was under and/or over-nourished. The results further suggested that toilet facility, household living condition and expenditure (in male) and age, income, per-capita income, family type, toilet facility, house type, socio-economic status and household living condition (among the females) were significantly ($p < 0.05$) associated with CED.
- The association of WHR and WhtR with the socio-economic, demographic and lifestyle related factors showed that several variables were significantly associated with higher level of adiposity patterns among the male and the female individuals.

5.2. DIETARY INTAKE, FOOD HABIT AND NUTRITIONAL STATUS

The dietary intakes were evaluated using 24-HR method. The dietary intake was observed to be markedly inadequate in qualitative and quantitative analyses when compared to the suggested RDA values. The consumption of different food groups tended to show reasonably inadequate intakes than suggested RDA among the Rajbanshi. The amount of food and nutrient consumptions was varied and deficiencies were more pronounced in the female than the male individuals.

- The intakes of different food groups suggest that consumption of 'meat and poultry products' and 'milk and milk products' were found to be very less in the regular diet when compared with the RDA. The consumption of fruits were very negligible than recommended RDA level.
- The dietary analysis of the consumption of essential nutrients showed that energy, protein, fat, calcium, iron, vitamin-A, riboflavin and vitamin-C were found to be grossly inadequate among both sexes when compared to the RDA. However, thiamin and niacin intakes were observed to be satisfactory to a certain extent in both sexes. The age specific consumption of foods and nutrients were observed to be higher in the early (20-29 years) and the middle (30-49 years) age groups than the higher age group (40-49 years). The age specific dietary intake food and nutrients decreased with age.
- The consumption of meat, fish, and poultry products were found very inadequate when compared to the RDA, although fish and meat products were purchased.
- The consumption of calcium, iron and riboflavin was found to be markedly deficit in both sexes compared to RDA (ICMR, 2004). A generous intake of green leafy vegetables (GLV) and milk and milk products are recommended to overcome the deficiencies of these nutrients among Rajbanshi's. The inclusion of the daily diet about 50 gm GLV is the reach source of iron, calcium, riboflavin and thiamin could help to meet a fair proportion of iron need beside providing calcium, vitamin-A and vitamin-C respectively in the regular dietary intake.

5.3. RELATION OF SOCIO-ECONOMIC, DEMOGRAPHIC AND LIFESTYLE FACTORS WITH NUTRITIONAL STATUS

- The majority of Rajbanshi individuals in the present study were from a rural region of North Bengal that lacked the basic infrastructural and health facilities. The lower consumption of food and nutrients could be attributed to low income and less affordability of adequate food stuffs.
- Rice was the predominant cereal. The food was mainly dependent on locally available agricultural products that included GLVs, roots and tubers, and vegetables. The results showed that majority of the individuals have small land holdings. The production of agricultural products was also grossly inadequate due to the practice of traditional methods of cultivation that increased the burden of higher family dependency and low level of land and per-capita yield.

5.4. RECOMMENDATIONS AND PROPOSED SUGGESTIVE MEASURES

The present study revealed a poor nutritional status among the adult Rajbanshi individuals. There are some recommendations and suggestive measures to improve the nutritional status, and therefore the health of these individuals. The recommendations or suggestive measures are as follows:

- ✓ The nutritional status should be improved by introducing the good quality of locally available foods. The supplementation of good amounts of protective food and nutrients (e.g., iron, zinc and calcium) should be introduced in the diet especially among the females.
- ✓ The supplementations of nutritional trace elements especially zinc, selenium should be provided.

- ✓ The installations of hygienic toilets are required to improve the health conditions.
- ✓ Furthermore, the Government should play a proactive role in reducing the prevalence of under-nutrition among the population under study. Nutritional intervention programmes are needed to be implemented among the adults.
- ✓ There was also the prevalence of regional and abdominal adiposity among adult Rajbanshi's. Therefore appropriate strategies should be initiated to reduce such prevalence and also improve the public health conditions by checking the manifestation of non-communicable diseases include hypertension, diabetes and chronic heart disease among them.
- ✓ Appropriate awareness should be imparted among the individuals in respect to ill-health conditions caused by thinness and CED. The individuals comprising the less educated, lower socio-economic background, poor income group and high dependency ratio family groups should be targeted. There is also a need for integrated health policy to alleviate thinness and CED.
- ✓ The health care facilities must be expanded and found to be within the reach of the individuals. The proper utilization of health care facilities should be ensured in terms of health check up camps in regular basis and health personnel should encouraged and motivated within the community. The Government and Non-Government Organizations (NGOs) should be strives hard to popularized the utilization of existing health care facilities in order to combat ill-health and under-nutrition condition.
- ✓ The rapid treatment of nutritional diseases would be helpful to minimize the nutritional burden among Rajbanshi's. Well trained health professionals and medicine practitioners should be encouraged to hold health camps.

- ✓ The necessary nutritional and health related educations should be imparted for a better understanding of the problems and adoption of redial measures.
- ✓ Proper education should be provided to make the individuals aware of the major issues relating to nutrition, health and disease.
- ✓ The effective orientation programmes relating to the importance of proper nutritional status should be organized.

5.5. GENERAL OBSERVATION AND CONCLUDING REMARKS:

Finally, the promotion of healthy diet and lifestyle to reduce the burden of under-nutrition (e.g., CED) and its consequences requires a multi-dimensional approach. The agriculture and food sector figure predominantly in this endeavor and must be given their due importance. These strategies must not merely be directed at ensuring food security for all individuals, but must also achieve the consumption of adequate quantities of safe and good quality foods that together make up a healthy diet for the community. The results have established a high prevalence of under-nutrition and inadequate dietary food and nutrients consumption among the adult Rajbanshi individuals. The results further revealed significant associations between dietary related patterns with socio-economic and demographic factors were observed. The results also showed a sex specific nutritional consumption and female nutritional deprivation. More importance should be given to improve the nutritional status of the adult females. One well-known fact is the adverse health effect of low BMI or under-nutrition has to increase the risk of low birth weight babies.

The prevalence of overweight and obesity has been increasing among the individuals belonging to the higher income and education group. So the burden of diseases associated with the higher levels of adiposity shall continue to increase. To meet this public health

challenge related to the double nutritional burden in the population, there lies an opportunity to formulate appropriate policies in respect to an integrated health improvement. Food and nutritional professionals could use this information to assess unhealthy food choices observed in the dietary patterns and to guide nutritional recommendations to help to reduce the incidence of under-nutrition and protein and energy-protein related risk factors among the Rajbanshi. Future research should aim to evaluate dietary intake utilizing the complementary methods for a better understanding of the nutrition-diet relationship.

Increasing the intake of whole grain, fruits, vegetable and dairy products and increasing physical activity could improve nutrient intakes and BMI status thereby prevalence of under-nutrition. The nutrient contribution in terms of dietary supplements increased the prevalence of nutrient adequacy for several nutrients. This study has emphasized a critical need for implementation of nutritional and health interventions in a rural community with a special attention to inadequate nutrient consumptions. The adult individuals were suffering from the lack of macronutrients, vitamins and energy intakes as compared with the RDA. The results of the present study emphasize the importance of a multi-disciplinary approach combat nutritional problem. These are the importance of empowering women through engagement and education, and of maintaining the healthy physical environment (e.g., water and sanitation). The study highlights the importance of supporting initiatives that address these issues not only for their core benefit, but also for the potential benefit to nutritional status.

The present study warrant interdisciplinary approaches from researchers, policy makers and extension health workers in popularizing the beneficial effects of vegetables and fruits, encouraging their wide use which would ensure nutritional security to rural populations. It may be concluded that to reduce the problem of under-nutrition among the

adult Rajbanshi individuals of North Bengal, both the Government and Non-Government Organizations (NGO's) should adopt initiatives so as to improve nutritional status with specific planning and policies. There is an urgent need for an attention to improve nutritional status by appropriate health and nutritional intervention programmes so as to ameliorate the under-nutrition among them.