SUMMARY AND CONCLUSION

The latest available global estimates indicate that about 795 million people in the world, continue to be food insecure and chronically undernourished in 2014–16 (FAO, 2014) including Southern Asia with the highest burden of hunger (FAO, 2015). While India achieved success in combating transient food insecurity caused by droughts or floods, it miserably failed to make much dent in chronic food insecurity (Reddy, 2002) as reflected in the low energy intake and high incidences of malnutrition reported by NFHS 4. Adopted in 2015 the SDGs call for major transformations in agriculture and food systems in order to end hunger, achieve food security and improve nutrition by 2030.

Thus, there is need for integrated approaches to improve food and nutrition security which can lead to improve nutritional outcomes for mother and child in areas where agricultural produces are in abundant. Innovative approaches are needed to strengthen existing systems. A positive deviant approach can be used, as these are workable in limited resources within similar setups in a community (Marsh & Schroeder, 2002; Sethi et al, 2003; Nambiar & Desai, 2012). Positive deviance (PD) refers to a phenomenon that exists in many resource-poor communities (Lapping et al, 2002). "It is often seen that in communities there are a few 'deviant' individuals whose uncommon behaviors or practices enable them to outperform their neighbors with whom they share the same resources" (Sethi et al, 2003). Identification of these positive behaviors and enrollment of these individuals who are practicing those behaviors staying in the same community can be effective against food and nutrition insecurity.

FNS is broadly characterized by three pillars: availability, accessibility, and absorption (nutritional outcomes). In an effort to attain these, it is almost certain that it will be necessary to innovate and consider out-of-the-box policy options. The role of various stakeholders and partnerships among them will be critical. IFPRI recommended public–private investment in rural development that could reduce rural poverty and malnutrition, can foster structural transformation, and improve food security and nutrition (IFPRI, 2019). Therefore, multisectoral planning was introduced including

positive deviance approach and public-private partnership to tackle food insecurity and make sustainable change in rural India.

The *broad objective* of the present study was to improve Food and Nutrition Security (FNS) in rural households with mother-child pairs using public private partnership. The *specific objectives* were 1) Situational analysis of the food and nutrition security of the mother-child pairs in a rural setup. 2). Identification of the positive deviant behaviors depending on 4 attributes (weight for age score of children, Household dietary diversity score, IYCN score and Hygiene and sanitation score) and capacity building and infrastructure development to improve food and nutrition security through interventions as a part of public-private partnership.

Based on the objectives, the study was conducted in two phases among 4 clusters selected purposively in rural Vadodara after necessary ethical clearance (IECHR/2015/16) with Department of Foods and Nutrition, The Maharaja Sayajirao University of Baroda, Gujarat; Department of Women and Child Development, Department of Health and Department of Agriculture, Government of Gujarat; Collectorate office, rural Vadodara and CSR cell of TSIPL (Transpek Silox Industries Private Limited), Vadodara. *Phase I:* In this cross-sectional study, all households (HHs) in the study area with mother-child (<5y) pairs (n=160) registered in ICDS and all ICDS workers (n=3) were enrolled (n=160). Situational analysis of the food and nutrition security was done following IFPRI (2015) guidelines. Qualitative and quantitative tools such as semi-structured questionnaires, direct observations, food frequency questionnaire, anthropometric measurement and biochemical assessment were used for data collection using the indicators of availability, accessibility, affordability, utilization and stability. Major predictors of undernutrition were calculated using linear regression analysis. *Phase II*: In this case-control interventional community trial to improve food and nutrition security, based on the situational analysis results of the previous phase from 4 clusters of rural Vadodara, the experimental group (n=96, 2 clusters) comprised on the mothers with positive deviant behaviors (PDBs) and control group (n=64, 2 clusters) with negative deviant behaviors (NDB) using 4 different attributes and score cards :- a). Household Dietary Diversity (HDD) score (FAO, 2010), b) Infant and Young Child Nutrition (IYCN) score (UNICEF, 2013), c) Hygiene and Sanitation (H&S) score (UNICEF, 2013) and d) weight for age z score (WHO, 2006)

of children. One-year intervention trial included promoting Positive deviant Behaviors (PDB) by mothers for capacity building of ND mothers at micro and meso level using techniques such as personal counseling or group counselling, group discussions and reinforced using electronic and print media, quiz and extempore competitions. At the macro and exo levels intervention was done by the project partners (village level upgradation of roads, water, electricity, nutrition sensitive agriculture, sensitization of local community workers, plantation program, brainstorming session with local leaders, improving food aid through ICDS and skill development programs for empowering mothers). All data collected before and after intervention were entered in MS Excel and statistically analyzed using SPSS 23 software.

The results of **phase** I revealed that Food and nutrition insecurity existed in the study area. Of all the indicators of FNS food availability was present in form of agriculture, livestock, shops, markets and food aids. But agricultural practices were not satisfactory, as more people were involved working in various industries instead of agricultural farms. Among 160 households, 58% possess field, but only for 18.75%, agriculture was the main source of income. Among the fathers of the <5y old children, only 13.13% were farmers and among mothers only 23.75% involved in farming in their own land. There was unsatisfactory cultivation of crops which was not sufficient both for income generation of the family as well as self-dependency regarding daily diet of the family. Main cultivated crops in the study area were bajra and grass. Very little cultivation of brinjal, ladies-finger, bottle gourd, drumstick, cauliflower, cluster beans, and fenugreek were recoded. Livestock mainly buffalos were available in 74% of the enrolled households. More unhealthy packaged foods were available in local shops rather than healthy and local produces. Food aid in form of ICDS was present in the study area yet, supplementary nutrition coverage through ICDS to its beneficiaries was not 100%. Though packets of supplementary nutrition were distributed (85%) in the area, mothers and children did not receive all the packets (only 17% receive), and also they (57%) did not consume them all even after receiving due to various reason mainly because of lack of sensitization regarding the importance of the supplementary nutrition which indicates also lack (65%) of nutrition and health education to mothers by AWWs as well as no home visits for NHE purpose. Food accessibility was satisfactory as physical access to various food sources like shops, nearby markets, agricultural fields and *anganwadi centres* was not a major concern as road and vehicles like cycles or two

wheelers were available in the clusters. Apart from one cluster, easy access to drinking water was present. Almost 55% households had family income less than 5000 and only 3.75% had family income more than 15000 indicating poor food affordability in the area. Though per capita income was extremely low in the study area, but economic access to local staple foods, local low cost green leafy vegetables or fruits was possible and ensures food affordability. Poor household dietary diversity (56.88%) was recorded. Majority of the population were vegetarian consuming only basic staple foods along with very low and unsatisfactory consumption of milk products, green leafy vegetables, fruits, nuts and oilseeds. Very less protein consumption recorded in the area. Around 68% households daily consume only *tuver dahl (red gram dahl)* which is not a very high-quality protein. Majority of the population was vegetarian and only 56% consume milk daily. Around 26% consumed green leafy vegetables daily, only 13% fruits daily and 65% vegetables daily, GLVs were mainly coriander leaves and curry leaves which was used mainly for garnishing purpose and in a very less quantity. Bajra and rice were consumed mainly as staple food by 90% of the households. Poor IYCN score (51.3%) was recorded as Only 52% initiated breastfeeding within an hour after child's birth. 65% fed colostrum, 36% administered pre-lacteals, 61% provided water and 17.5% provided top milk within the 1st 6 months after birth, only 33% practiced exclusive breastfeeding for 1st 6 months and 68% initiated complementary feeding after completion of 6th month, 59% children were breastfed up to 2 years of age or more and 85% continued breastfeeding during illness of mothers or children. Feeding monitoring was done in case of 89% children. Poor hygiene and sanitation score (68.1%) was recorded, as hand wash with soap during food handling was practiced by only 41% mothers 21% purified drinking water. Open defecation was practiced by 37.5% households and 73% had separate kitchen with ventilation. Around 26% children had very dirty nails and 21% had very dirty clothes. Only 10.62% children and 10% mothers had practice of wearing footwear while going out. Poor nutritional status of mothers (54.4%) and children (36% wasted, 60% stunted, 59% underweight) and poor maternal anemia (80%) (12% were severely anemic, 48% were moderately anemic and 39% were mildly anemic) were also recorded. Presence of safety net programs in the area such as ICDS, PDS, MDM etc. ensures food stability which was an important indicator of food and nutrition security, though the access to the programs and utilization of the benefits available need to be improved. This status of food and nutrition security indicated urgent need of an integrated approach as the status was far away from WHO global

targets and poorer than national and regional NFHS data. Birth weight of child ($p<0.05$*), practice of giving water for 1st 6 moths ($p<0.01$**), poor intra household food distribution ($p<0.05$*), poor household dietary diversity ($p<0.05$*), poor family income ($p<0.05$*), untidy clothes ($p<0.05$*), and no exclusive breastfeeding practices ($p<0.05$*) were identified as predictors of undernutrition among children. Mother's nutritional status also significantly associated with child's wasting ($p<0.01$**) and household ($p<0.001$***), and women dietary diversity score ($p<0.001$***).

Phase II results revealed that using HDDS as criteria, 43.1% mothers were identified with PDB, using IYCN score as criteria, 48.8% (78) mothers were identified with PDB, using hygiene and sanitation score as criteria, 31.9% (51) mothers were identified with PDB, Using weight for age z score as the criteria, 40.6% (65) were identified with PDB among 160 mothers. Overall in 4 clusters, total 15 mothers were identified with PDB using all 4 criteria. Only 13 mothers with PDBs were available in two experimental clusters for positive deviant behavior promotion as change agents who scored positive in all the four attributes assessed. Exclusive breastfeeding for 1st 6 months, colostrum feeding, no use of pre-lacteals, pulses, legumes, vegetables, milk and milk products consumption, cleanliness of clothes of children were determined as most followed positive behaviors present in the study area with highest OR values among the mother child pairs. Food utilization in the study area improved by capacity building using PD mothers as change agents at micro and meso level. In the experimental group intra household food distribution increased by 33.3% ($p<0.001$***), consumption of breakfast increased by 19.8% ($p<0.001$***), drumstick leaves consumption increased by 76% ($p<0.001$***). After intervention, Knowledge and practice regarding IYCN also improved. Knowledge regarding timely initiation of breastfeeding increased by 43.8% ($p<0.001$***), colostrum feeding increased by 14.3% ($p<0.01$**), providing pre-lacteals decreased by 32.5% ($p<0.001$***), providing water (62.7%) and top milk (21.7%) within 1st 6 months also decreased significantly ($p<0.001$***) in ND group. Exclusive breastfeeding for 1st 6 months increased by 56.6% ($p<0.001$***), continuation of breastfeeding up to two years or more increased from 34% to 76% ($p<0.001$***), breastfeeding during illness increased by 9.6% ($p<0.01$**), initiation of complementary feeding increased from 61% to 89% ($p<0.001$***), and active feeding increased from 29% to 82% ($p<0.001$***)in ND group. Hygiene and sanitation practices also improved post intervention significantly ($p<0.001$***). Practice of using

soap increased by 18%, hand-wash with soap during food handling increased by 59%, practice of purification of drinking water increased by 68%, practice of covering cooked food increased by 35%, Cleanliness of clothes increased by 48%, cleanliness of nails increased by 43%, practice of wearing shoes outside by children increased by 55% and by mothers increased by 40% after intervention. After intervention in the ND group, Percentage of underweight children reduced by 13.3% ($p<0.01$**), Child wasting reduced by 21.7% ($p<0.01$**) and percentage of underweight mothers reduced by 20.4%($p<0.01$**). Overall in the experimental group wasting reduced by 17.7% as compared to only 5.8% reduction in control group, underweight reduced by 6. 25% in experimental group whereas in control group it increased by 7.69%. Stunting though increased by 5.21% in the experimental group, the increase rate in much higher in the control group (11.54%) after completion of the study post intervention. Also 17.7% reduction took place in case of mother's undernutrition in the experimental group as compared to 7.6% increase in the control group after completion of the study. Stunting could not be reduced just after intervention as its a result of chronic undernutrition. Food availability, accessibility and affordability of the selected study area at exo and macro level was improved by strengthening its indicators through public private partnership. Food aid was improved by increasing the no of ICDS centers (2 new AWCs), empowering the ICDS workers and sensitizing mothers regarding importance of ICDS which increased the participation of children and utilization of supplementary nutrition provided by ICDS. Consumption of balbhog increased by 35.4% ($p<0.001$***), home visit by AWWs increased by 8.3%, accessing AWC by children increased by 34.4% ($p<0.001$***). Agricultural practices were improved by promoting kitchen garden and encouraging drumstick cultivation by seeds and plant distribution. Drumstick plantation increased by 22.9% ($p<0.001$***). Road and drinking water access improved and solar street lights were installed to improve food accessibility, Smokeless chulhas were distributed to reduce fuel cost and increase food affordability. Skill development program for women started to generate income and empower women.

It can be thus concluded that though rural communities are blessed with various types of flora, underutilization has led to poor dietary diversification. Along with existence of several programs and policies of Government of India, poor access and unawareness still is a cause of concern. Nutritional status reflects that poor utilization is still the

biggest challenge in rural communities. Thus, efforts to coordinate between several nutrition specific and nutrition sensitive interventions need to be done in order to improve food and nutrition security.

> "To make nutrition a springboard for development and not a roadblock we need to overcome poverty, lack of nutrition literacy and nutrition-insensitive agricultural and food processing practices. For the nutrition security of India's large and growing population across the life course of each individual, we need policies and programs to steer our agriculture, food production and processing enterprise to the goal of assuring calorically adequate and nutritionally appropriate diets to everyone of all ages."

Views expressed by the president of Public Health Foundation of India (https://www.outlookindia.com/magazine/story/india-news-diversity-is-the-challenge/302036).

Community resource mobilization using innovative options such as positive deviance approach (PDA) under public-private partnership (PPP) on a continuous basis may lead to enhanced food and nutrition security (FNS) along with social security nets. Positive deviance approach (PDA) using mothers who outperformed their neighbors in healthy practices and had healthier children in similar community settings can be a powerful, low lost, acceptable approach for improving child health and nutrition in rural communities which have a very distinctive anthropological behavior. Practicing health-care workers including practicing pediatricians should encourage these 'deviant' behaviors of the mothers amidst poor habits and customs which enable them to outperform their neighbors with whom they share the same resources. Involvement of community leader and workers and private organization in the area through public-private partnership can be an effective step towards improving persistent undernutrition and food and nutrition security and achieving the sustainable development goals.