

RESEARCH HIGHLIGHTS

1. COMMUNITY STUDIES

1.1 *Assessment of current scenario of food labelling in India*

Consumption of unhealthy foods can be discouraged by effective food labelling, which can help consumers make informed choices. A study was conducted with financial support from WHO-India, employing a combination of systematic review of literature on labelling regulations and community studies, as well as qualitative and quantitative market survey to examine the current scenario of food labelling in the country. The salient observations of the study were that the food labelling regulations in India are on par with those of developed countries; that food labels are not usually read by consumers while making food choices, which may be either due to low literacy rates or lack of nutrition knowledge and awareness. Market survey showed that food packages were 100% in compliance while displaying the basic regulatory requirements like name of the food, net weight, languages used etc.; The labelling information such as 'instructions to use', 'storage conditions', 'use by date', and nutrition information per 100 g or per serving were observed in 77% of pre-packed foods; the nutrition and health claims were indicated on the 10% and 29% of labels respectively. Of the 109 imported and 236 Indian pre-packaged foods, a significantly ($P < 0.05$) higher proportion of Indian foods (79%) consisted nutrient declaration for every 100 g or mL as against 68% for imported foods, which is a mandatory aspect as per PFA. The study clearly highlighted the need to undertake nation-wide studies to understand the consumer knowledge, practices and behaviour related to food labels for formulating strategies to make food labels user-friendly.

1.2 *Multi component health and nutrition interventions on the lifestyles and physical activities among urban adolescents*

The increase in the prevalence of obesity and overweight has been reported to be rapid even among children and adolescents in both developed as well as developing countries. It is very important that the problem of overweight and obesity is addressed early in childhood and adolescence. The school environment is most appropriate to impart health and nutrition education, encourage participation in physical activities and inculcate healthy lifestyle practices. A study examined the effect of multi-component education interventions for 8 months on lifestyles, physical activities of urban school-going adolescents. The following are salient observations of the study. The educational intervention resulted in a significant increase in the health and nutrition knowledge of the adolescents in the perceptions, behaviours and practices among adolescents of intervention group. The mean fat fold thickness at triceps, biceps, sub-scapular, supra-iliac regions and sum of the skin folds significantly declined, with no change in the weight and BMI.

There was an improvement in the healthy lifestyle practices which included physical exercises (intervention: 57.5% Vs 81.7%; control: 48.7% Vs 71.2%), participation in household activities (intervention: 86.9% Vs 99.1%; control: 81.2% Vs 91.2%), playing out door sports and games (intervention: 37.7% Vs 72.4%; control: 33.7% Vs 58.7%) were improved.

2. BEHAVIOURAL SCIENCES

2.1 *The efficacy of an integrated feeding and care intervention among 3-15 months old infants in Andhra Pradesh, India*

The intervention messages, which were developed in the study through a comprehensive formative research were culturally appropriate and could lead to behavior change that was demonstrated through improved dietary intake of energy, protein, vitamin A, calcium, iron and zinc; improvement in growth

(height for age) and development among the infants of the intervened groups. The added benefit of responsive complementary feeding and developmental stimulation was seen in higher mental development scores but not on growth.

3. MICROBIOLOGY AND IMMUNOLOGY

3.1 Evaluation of allergenicity potential of an indigenous anti-HPV vaccine in BALB/c mice

The indigenously developed HPV vaccine (HPV 16 and HPV 18 VLPs) does not seem to have allergenicity potential.

3.2 Micronutrient status in HIV infected population in India

A sub-sample of serum samples collected during an earlier project entitled “Integrated Biological and Behavioral Assessment (IBBA)”, sponsored by Bill and Melinda Gates Foundation; were used to evaluate nutrients such as Vitamin D, Zinc, magnesium, copper and iron in HIV positive and HIV free female sex worker (FSW) population.

The samples were categorized into 4 groups of 100 samples each - Group1 : HIV negative and STI negative. Group2: HIV positive and STI positive, Group 3: HIV negative and STI positive, Group 4: HIV positive and STI negative. The samples were analyzed for Vitamin D, Zinc, magnesium, copper, iron and albumin.

Roughly about 90% of the FSW's were deficient in zinc and iron. FSW with HIV infected asymptomatic population had similar serum concentrations of Zinc, magnesium, copper and iron as FSW without HIV infection. The mean \pm SE of vitamin D and serum albumin were 23.64 ± 0.83 ng/mL and 3.52 ± 0.06 g/dL respectively in HIV infected asymptomatic FSW population. About 80% of the HIV infected FSW population had vitamin D deficiency, when compared to normal women of low socioeconomic status. Iron and zinc deficiency appears to be widely prevalent amongst FSWs with or without HIV infection. Vitamin D deficiency could also be a major problem in this population.

4. CLINICAL STUDIES

4.1 Pregnancy related changes in bone mass in women from low socio-economic group

Calcium requirement increases during pregnancy to support the fetal skeletal mineralization and a few studies from the west have indicated that the maternal bone mineral density (BMD) may transiently reduce during pregnancy due to mobilization of calcium. This study was conducted to investigate the effect of pregnancy on the bone mass of women from low income group consuming low calcium diets.

Baseline DXA was done for 80 women. Of them, 35 women conceived within 6 months of baseline DXA and were recruited as pregnant group. Their BMD was repeated after delivery. Women who did not conceive within 6 months /12 months of baseline DXA served as controls. Mean spinal BMD decreased by 4% in the pregnant group. While, it increased at all sites at 6 and 12 months in control women. The study thus indicates that the undernourished young women from low socio-economic group failed to increase their bone densities as expected during growth phase probably due to the extra demands imposed by fetal skeletal mineralization.

4.2 Vitamin D status in common infections in childhood – A hospital based study

Vitamin D stimulates the expression of potent anti-microbial peptides of host defense system and in epithelial cells lining the respiratory tract where they play a major role in protecting the lung from infection. Studies done in India have shown subclinical vitamin D deficiency to be wide spread in all age groups.

one hundred pre-school children between ages of 1-5 years with different infections were investigated for vitamin D status. Among the infections, diarrhea was 29.3%; fever 13.1%; URTI 19.2% and LRTI 18.4%.

As regards, vitamin D status among the children with infections, it was less than 12ng/mL in 22%, between 12-20 ng/mL in 28% and above 20ng/mL in 50% children. Overall prevalence of vitamin D deficiency was 45%.

4.3 Evaluation of the routine management of anaemia with hemoglobin < 8g in pregnancy and effect on outcome.

Iron deficiency anaemia is one of the most common nutritional deficiencies all over the world. About half of the world's anaemic women live in India and 88% of them develop anaemia during pregnancy. Dietary deficiency of iron and inadequate absorption of dietary iron are the important causes of high prevalence of anaemia. The iron requirement for pregnant women is around 38 mg/day as against the dietary intake of 18 mg/day. Severe anaemia during pregnancy increases the risk of maternal mortality. Daily supplementation was most effective in preventing severe anaemias.

Over 1500 cases were screened to identify pregnant women below 8g both in early and late pregnancies. Pregnant women with hemoglobin less than 8g/dL between 12 to 20 weeks and 24-26 weeks of gestation were recruited for oral supplementation of 120 mg of iron and 500 µg of folic acid and for parenteral iron therapy (iron sorbitol citrate 1000 mg) respectively.

The overall prevalence of anaemia with Hb< 8g in pregnant women was 18.7% and in early pregnancy it was 16.2% and in late pregnancy it was 22.5%. About 65% of the women in early pregnancy and 46.2% in late pregnancy showed increase in haemoglobin above 8g within 3-6 weeks of supplementation. However, 44.1% in early pregnancy and 27.7% in late pregnancy showed increase in haemoglobin above 11g at term. This finding highlights that early supplementation of parenteral iron may increase haemoglobin by term.

4.4 Insulin resistance and TNF α levels in normal and high risk pregnant women

Chronic energy deficiency in women at reproductive age will have impact on the fetal programming in early pregnancy, fetal growth and birth weight of infants. Insulin resistance during pregnancy has been shown to be associated with many complications in addition to impact on pregnancy outcome and birth weight of infants.

The study was carried out to investigate the insulin resistance (IR) and TNF α level at different trimesters of gestation in normal and high risk pregnant women in relation to maternal nutritional status in low socio-economic group.

- ✎ This study indicates the prevalence of insulin resistance around 50% right from early pregnancy.
- ✎ The prevalence of insulin resistance was present right from 12 weeks of gestation.
- ✎ There was significant difference in mean antenatal weight and body fat between insulin resistant group and normal pregnant women at 12, 20, 28 and 36 weeks.

The prevalence of insulin resistance during pregnancy is associated with adverse pregnancy outcome. So it is essential to carry out a prospective study on effect of insulin resistance in early pregnancy on course, complications and outcome of pregnancy.

5. BASIC STUDIES

5.1 Immunoassay for quantitation of metallothionein for assessing zinc bioavailability in Caco-2 cell model.

Inadequate intake and poor bioavailability of zinc are the two major etiological factors for the widespread deficiency of zinc seen in vulnerable segments of the population. Several strategies have been developed to increase the zinc status in vulnerable segments of the population. An important strategy is

dietary diversification. This requires screening and identification of foods with high bioavailable zinc. Induction of mineral specific responsive protein in Caco-2 cell model, a human enterocyte cell line, is a widely accepted screening tool to assess mineral bioavailability in humans. In this context, metallothionein (MT), a zinc inducible cytosolic protein, was considered as a surrogate marker of zinc bioavailability in Caco-2 cells. An indirect competitive ELISA method and an immunoblot for quantitation of MT were developed using an antiserum produced against recombinant human MT. The methods were validated by simultaneously measuring ⁶⁵Zn uptake in Caco-2 cells exposed to varying concentrations of zinc along with quantitation of MT by ELISA and immunoblot. Though zinc uptake increased, there was no concomitant induction in MT levels estimated by both the methods. Thus, the immunoassay method developed may not be suitable as screening test for zinc bioavailability in Caco-2.

5.2 Iron, folate and vitamin B₁₂ levels in pregnant women and the effect of intramuscular iron, folate and vitamin B₁₂ therapy on iron folate and B₁₂ levels

Recent studies have indicated that vitamin B₁₂ deficiency may play an important role in anemia along with iron and folic acid deficiencies. Therefore, a study was conducted with the objective to investigate iron, folate and vitamin B₁₂ status in pregnant women with different grades of anemia and to assess the impact of intramuscular dose of 150 mg iron, 1500 µg folic acid and 150µg hydroxocobalamin acetate on biochemical indicators of these three nutrients in pregnant women with moderate anemia. The study has shown a higher prevalence of iron and folic acid deficiency and relatively lower prevalence of vitamin B₁₂ deficiency. Only 6% had deficiency of all the three micronutrients in the group with hemoglobin less than 8g/dL. Surprisingly, one-fourth of the women with moderate anemia and one half of the women with mild anemia showed no biochemical evidence of deficiency of these three nutrients. Following IM therapy, there was improvement in mean hemoglobin and serum ferritin but no change in vitamin B₁₂ status. There was also a steep increase in folate deficiency from 8.3 to 35.6%. In view of the findings, it is important to assess the prevalence of folate and vitamin B₁₂ deficiency in different parts of the country.

5.3 Studies on the response and interactions of iron and zinc in Caco-2 cells: protein expression

Iron and zinc interact at the enterocyte and influence the absorption of each other. These interactions could be modulated by various factors, particularly the pre-existing iron and zinc status and other pathological conditions such as inflammation. The study presents evidence for the iron and zinc interactions in Caco-2 cells during depletion or repletion of individual nutrients and the effect of inflammatory stimuli on such interactions (i.e. nitrosative stress). The results demonstrate that under simulated inflammatory conditions, iron and zinc uptake decreased in mineral deficient cells, while a similar effect of iron on zinc uptake is conspicuously absent. The observed decrease in iron is mirrored by a decrease in iron influx (DMT-1) and efflux transporter (FPN-1) expression. This was accompanied by changes in iron responsive protein-2 (IRP-2) expression, rather than IRP-1. However, no significant change in zinc influx (Zip-1, -14; except upon NO+zinc) was observed, whereas, efflux transporter (ZnT-1, -4) levels were decreased in mineral deficient cells. It is concluded that zinc selectively affects iron uptake and its interactions under normal conditions, depletion-repletion and simulated inflammation. Inflammation associated hypoferrremia and hypozincemia may be host-protective.

5.4 Maternal magnesium restriction induced increase in the adiposity of WNIN rat offspring may be due to increased stress and fatty acid synthesis

It was reported earlier that maternal magnesium (Mg) restriction irreversibly increased body fat percent, specially the visceral adiposity. In the current year, studies assessed whether or not increased stress was associated with / responsible for this increased adiposity. The results indicated that increased glucocorticoid stress and fatty acid synthesis (suggested by the up-regulation of 11β HSD 1 and FAS) could probably underlie the increased visceral adiposity in the offspring of Mg restricted rat dams. The fact that

rehabilitation could correct the change in 11 β HSD 1 gene expression in adipose tissue but not the changes in FAS expression (gene and protein) or visceral adiposity seem to suggest that maternal Mg restriction induced stress in the offspring may be corrected by rehabilitation but not the changes induced by this stress in the offspring (eg. increased visceral adiposity).

5.5 Health beneficial effects of foods commonly consumed in India: milk, milk products, oil and sugars

Continuing the efforts to generate a database on phenolic content of foods commonly consumed in India and their contribution to the antioxidant activity (AOA), the total phenolic content and AOA (by two different methods: FRAP and DPPH – radical scavenging activity) of milk, milk products, oil and sugar was determined. Although the foods analysed belonged to different classes and their antioxidant activity and total phenolic content showed a wide range of distribution, it was interesting to note that a significant correlation was observed between AOA and TPC in all of them. Among the foods studied, jaggery had the highest AOA, whole milk, milk products and oils were in general poor in their AOA and phenolic content.

5.6 The role of specific nutrients on islet cell generation from adult tissue stem cells - in vitro and in vivo

During regeneration, ductal epithelial cells act as progenitors for the generation of new pancreatic cells. Understanding the modulation rendered by nutrients on the pancreatic endocrine cells and their transcriptional regulation will open intriguing possibilities to basic research. Hence, studies are being conducted to understand the ability of pancreatic progenitors such as ductal epithelial cells (DEC) to proliferate and differentiate into insulin secreting cells regulated by specific nutrients & growth factors. Studies have been undertaken to understand the interplay between nutrient and pancreatic progenitors (PP) towards their expansion and differentiation to neoislets.

The significant findings are: (i) Pyridoxal phosphate (PLP –a vitamin B₆ cofactor) in combination with growth factors, showed increased BrdU incorporation; (ii) stimulated the proliferation of the DEC/CK-19+ve/ABCG-2 (pancreatic progenitors); (iii) increase in the transition from epithelial to mesenchymal phenotype (CK-19 to vimentin positive) before differentiation into the neoislets. Taurine, Nicotinamide and NEAA (differentiation factors) resulted in the formation of islet like cell clusters (iLC) and the matured iLC stained for insulin. The *in vitro* generated neoislets were functionally viable when challenged with high glucose. The transplanted animals showed normalization in their glucose profiles, and cytoarchitecture of the pancreatic tissue. This study gives a scope for understanding the nature of the populating cells either the residual beta cells/progenitor cells of the pancreatic tissue with a diabetic insult.

5.7 Characterization and proliferation of pancreatic progenitor cells/stem cells to insulin secreting cells –Role of nutrients

The present work was focused on inducing differentiation of the pancreatic progenitors such as nestin positive cells (NPC) to insulin secreting cells (ISC) in presence of all trans retinoic acid (RA) with the combination of other mature factors in two weeks and its *in vivo* efficacy in reversing the diabetes in STZ induced mice model. Age dependent characterization and localization of NPC were carried out in the mice pancreatic tissue by immunolocalization technique.

The data showed an increased localization of NPC in the endocrine as compared to exocrine fraction. *In vitro*, RA in combination with growth factors increased the proliferation of Nestin/ ABCG2/ BrdU cells and upregulated nestin to Abcg-2 expression by about 2.5 fold (communicated). Combination of RA and Zn during differentiation showed increased C-peptide content by 3.5-4 times and the neoislets were insulin, Glut2 and Pdx1 positive. *In vivo* transplantation of neoislets in diabetic mice restored the body weights, blood glucose and plasma insulin values shown IPGTT response similar to control animals. The data suggests its potential in the management of diabetes.

5.8 Role of recombinant epidermal growth factor (REGF) factor in cell proliferation / differentiation using drug-induced diabetes, liver damage and in gastric ulcers

The therapeutic modality of rhEGF (developed by Bharat Biotech International limited) has been well documented in the treatment of diabetic foot ulcer, burns and skin grafts *in vitro*. Naproxene was used as the ulceration causing NSAID as it is used more frequently than other NSAIDs by arthritic patients and also because the naproxen-induced gastric antral ulcer model is suitable in the human situation where NSAID-induced gastric ulceration occurs mainly in gastric antrum and there are no reports available documenting the effects of rhEGF against the drug induced gastric ulcers. In this experimental model, an attempt was made to correlate the ulcer healing process by histopathology, Cox-2 immunolocalisation, TBARS assay and expression of the Cox-2 and TGF-Beta genes.

The protective effects of rhEGF have demonstrated as: (i) normalization of cyto-architecture of the gastric mucosa by 14 days; (ii) down regulation of the Cox-2 and TGF-beta genes; (iii) rhEGF negated the increased TBARS levels.

The present study forms the basis for reporting for the first time, the beneficial effects of rhEGF in the management of gastric ulcer healing induced with the use of anti-inflammatory drugs such as NSAID.

5.9 Inhibition of aldose reductase by curcumin

Accumulation of intracellular sorbitol due to increased aldose reductase (ALR2, AKR1B1) activity has been implicated in the development of various secondary complications of diabetes. In this study, it has been described that curcumin, a major active principle present in turmeric, inhibits ALR2 with an IC_{50} of $10\mu M$ in a non-competitive manner. Further, curcumin was able to suppress sorbitol accumulation in human erythrocytes under high glucose conditions. These results suggest that curcumin holds promise as an agent to prevent or treat diabetic complications.

5.10 Cataract and WNIN-Obese rat

NIN's studies have shown that WNIN-Ob and WNIN-GR/Ob rats are more sensitive to streptozotocin and galactose-induced cataract due to remarkable accumulation of sorbitol levels in the eye lens of these rats. Increased susceptibility of WNIN-Ob and WNIN-GR/Ob rats to galactose- and streptozotocin-induced cataract indicates that WNIN-Ob and WNIN-GR/Ob rats could be employed as osmotic stress-induced cataract models.

5.11 Importance of α -crystallin heteropolymer

Together with previous studies, rationale was provided for the existence of α -crystallin as a heteropolymer with 3:1 αA to αB ratio in the eye lens in terms of chaperone function, structural stability and susceptibility to post-translational modifications. Hence, heteropolymer with 3:1 αA to αB ratio might be vital for eye lens transparency under diverse conditions to prevent cataract.

5.12 Impact of polyunsaturated fatty acids (PUFA) on physical and molecular parameters associated with obesity using WNIN/GR-Ob rats

Compared to the diet with safflower oil (n-6 PUFA) alone, a blend of safflower and soybean oils (n-6/n-3 PUFA at 13/1) effectively reduced the condition of hepatic steatosis, while it enhanced skeletal muscle glucose uptake and increased the formation of functional HDL particles and thereby improving insulin-resistant condition of genetically obese glucose-intolerant rats of WNIN/GR-Ob strain. However, both the diets did not bring down the condition of obesity/adiposity.

Oral glucose tolerance test (OGTT) showed a significant decrease in the AUC glucose concomitant with a significant increase in AUC insulin levels in obese rats fed on a diet with a blend of n-6 & n-3 PUFA containing oils compared to obese rats fed on control diet.

6. EXTENSION AND TRAINING

6.1 Assessment of knowledge, food preferences and practices among urban slum dwelling adolescent girls

A school-based nutrition education programme involving 370 adolescent girls living in slums was carried out in two government schools in Hyderabad. A multimedia kit comprising print and audio-visual educational materials was used to educate the girls on matters relating to infant and young child feeding, balanced diet, importance of micronutrients like iodine, iron and vitamin A; family life education etc. after an exhaustive formative research. The study showed significant improvement in the knowledge levels of the adolescents. The multimedia kit is also used in the training programmes for health functionaries.

6.2 MSc. Course in Applied Nutrition

A full-time two year M.Sc. course in Applied Nutrition had been started at the institute in the year 2009 under the affiliation of NTR Health University, Vijayawada. The eligibility criteria for the course include MBBS /B.Sc. (Home Science/ Applied Nutrition/Biochemistry/Nursing)/ B.Sc with Nutrition as one of the major subjects.

A batch of 16 students were recruited in the programme. On the batch of an All India Entrance Examination, 16 students are being selected every year. It is proposed to increase the total intake to 32 from next academic year.

7. FOOD AND DRUG TOXICOLOGY

7.1 Total Diet Study-Andhra Pradesh

Diet is a source of toxicants, as well as nutrients. Availability of safe food is one of the essential public health functions of any country. It is not possible to totally eliminate contaminants in food supply, which passes through various stages in food chain. However, it is possible to compare their levels present in food in the manner they are consumed with their corresponding toxicological reference intakes such as the acceptable daily intake (ADI) or provisional tolerable weekly intake (PTWI).

Twenty two types of most commonly consumed foods in Andhra Pradesh belonging to eleven food categories were selected for the study based on National Nutrition Monitoring Bureau Report of 2004-06. The food samples were processed as they are consumed and analysed for fluoride, toxic metals, pesticide residues and mycotoxins. Fluoride was estimated in water, sorghum, rice, red gram dhal and spinach.

The estimated levels of fluoride in food composite were within the safe limits for any of the groups or category of individuals. Highest contributor of fluoride among the food items tested appeared to be water. Twelve food items were analysed for 19 pesticide residues. All the samples including water had one or the other of the 19 pesticides analysed. Children in the age group of 7-12 years were more at risk to Aldrin due to high intake of milk and rice. Analysis for mycotoxins revealed that in selected food items (Jowar, groundnut oil, red chillies and milk) they were present at significantly low levels or below detectable levels. Toxic metals namely lead and cadmium were analysed in 22 selected food items and water. Sorghum had highest concentration of lead and amaranth had highest level of cadmium. The estimated dietary intake of contaminants based on NNMB diet survey in all age groups, sedentary workers and pregnant women were uniformly much lower than ADI or PTWI.

7.2 Development of PCR and RT-PCR based diagnostic kits for the detection and species specific identification of food and water borne pathogens

Food borne illnesses due to microbial contamination are rampant. Sensitive technique using generic DNA sequence analysis is accurate, quick and less time consuming. Primers to *E.coli*, *Vibrio cholera*,

Vibrio parahaemolyticus, *Salmonella*, *Staphylococcus aureus*, *Bacillus cereus* were used and PCR based uniplex detection method was developed.

7.3 Biomarkers for transapental genotoxic effects and their chemoprevention

Genotoxic effects of B(a)p exposure in tissues of turmeric fed rats(*In vivo*)

In vivo antigenotoxicity of turmeric feeding through diet was studied in WNIN rats that were treated with a single dose of carcinogen. There was significant reduction of DNA damage in tissues and reduction of malondialdehyde in rats given turmeric indicating protective effect of turmeric against genotoxicity.

7.4 Assessment of environmental lead exposure on infection and immunity

Subclinical toxicity due to low level of lead exposure is known to inhibit basal amino levulenic acid dehydratase (ALAD) activity. In this study, 120 children aged 6 months to 12 years were investigated for blood lead, Hb, serum Fe, Zn, Cu, Mg concentrations and basal ALAD. Majority of the cases were anemic accompanied with low Zn and Fe levels. Lead levels were higher in cases than in controls suggesting lead toxicity to be one of the main causative factors for anemia in children.

7.5 Detoxification of mycotoxins by lactic acid bacteria isolated from fermented sorghum and *Cassia tora*

The project on detoxification of mycotoxins by lactic acid bacteria isolated from fermented sorghum and *Cassia tora* was initiated based on earlier findings of reduction in mycotoxins by natural fermentation of mouldy sorghum with *Cassia tora* seeds. The main objectives of the present study were to isolate and identify lactic acid bacteria species present in fermented sorghum and assess their effect on mould growth and mycotoxin degradation potential using naturally contaminated and spiked sorghum samples.

Analysis of sorghum samples obtained from rural households for aflatoxin and fumonisins indicated that about 63% of the samples had fumonisin at levels ranging from 11-145g/kg and about 47% of the samples had aflatoxin at levels ranging from 1-42g/kg. Mycological examination indicated 64-100% of the seeds were infected with mould species belonging to *Aspergillus*, *Curvularia*, *Alternaria*, *Helminthosporium*, *Penicillium* with a predominance of *Fusarium* species. Out of 12 *Fusarium* isolates from sorghum, one isolate produced fumonisin at a level of 8.562µg/g.

Lactobacillus species isolated from fermented sorghum was observed to decrease growth of fumonisin producing strain of *Fusarium moniliforme* after 48 hours of incubation and reduced aflatoxin B₁ to 88% in liquid medium. Using a known mycotoxin reducing strain *Lactobacillus rhamnosus* GG a reduction of 79% in aflatoxin B₁ was observed in liquid medium and 77% when added to spiked sorghum samples at 0 hours of incubation and 24 respectively.

The present study indicated that *Lactobacillus rhamnosus* strain GG has good potential to reduce aflatoxin levels in contaminated grains such as sorghum. The extent of removal of aflatoxin by lactobacillus species isolated from fermented sorghum was observed to be comparable to that observed with *Lactobacillus rhamnosus* strain GG.

8. OTHERS

Total number of publications by scientists in national and international journals was over 36 with an average impact factor of 2.36.