NOMINATION FOR SUN PHARMA SCIENCE FOUNDATION RESEARCH AWARD IN MEDICAL SCIENCES-CLINICAL RESEARCH- 2023.

I, Dr. Piyush Gupta nominate Dr. Kailash Nath Agarwal for Sun Pharma Science Foundation Research Award in Medical Sciences-Clinical Research 2023 whose scientific contribution is briefed as below:

Kailash Nath Agarwal's research on maternal and childhood nutrition, spanning over 50 years, continues to impact the lives of hundreds of millions of people in India where close to 65% of the population is rural and where malnutrition is rampant in women and children. His life-time work is indeed a series of medical breakthroughs beginning with tools for identification of childhood malnutrition, and then creating an understanding of its adverse sequelae, and finally developing novel, affordable community scale treatments i.e. Dahi (fermented milk) and Berseem leaves for malnutrition. His extensive clinical research draws on epidemiological data, clinical studies, MRI based investigations, biochemical and animal studies.

SCIENTIFIC WORK:

1.Developmentof diagnostic tools-For assessment of nutritional status :i) anthropometeric indices, were developed on the nationwide data of affluent children < 5 yr and 5 to 18 yr of age (physical growth & sexual development ,were collected to diagnose underweight, wasted, stunted, overweight and obese (Indian Pediatr(IP) 1992;29:1203-82; 1994:31:377-413; 2001 38:1217-35; The Growth 2015, 3ed CBS. ii) biochemical tests - The fall in salivary ferritin in PEM was sensitive in recognizing severity and early stage of PEM (AJCN 1984;39:181-84).The increase of glutamic acid in erythrocytes(AJCN 1981;34: 924-27) and fall of leucocyte Faan (BJN 1973;29:151-57) were other tests developed(Ann Clin Med Res 2021;2(2) article1031).

2.To study adverse sequel of malnutrition- physical, neurological or cognitive lesions with possible pathologies :i)A prospective epidemiological study was conducted in rural Varanasi, India to study effects of maternal nutrition/anemia on 3700 pregnant women and their offspring's. These women did not gain expected wt and the fundal ht during pregnancy. The offsprings were: 34.6% <2500g (lbw) and only 8.2% > 3000 g. Polygraphic sleep cycle studies-EEG, ECG,ECOG, phasic body activity and respiration were performed on term newborn babies of these severely undernourished mothers, showed *disorganization during active rapid eye movement (REM) sleep and quiet nonrapid eye movement (NREM) sleep,* clinically babies had hypotonia in 72% and hypoexcitability in 56%, with incomplete Moro's(AJOG 1976; 124:641-45; IP 1987;24:703-7& 2002;37:244-53; Acta Paedtr(AP) 1979;68:561-66,Arch Dis Ch 1980;55:134-38).ii)Wasted/ underweight and even moderate degree of malnutrition influences the IQ scores and its effect was of a higher magnitude on immediate memory, visual perception, and visual motor integration as compared to verbal reasoning and comprehnsion. Children with I Q > 90 had poor achievement in arithmetic test and teacher's assessment and had impaired perceptual maturity and conceptual grasp - Learning disability. Reaction time (RT) was affected for total, premotor and motor RT for audio as well as visual stimuli, irreversibly (IP 1992;29:595 IJMR 1989;90: pp163,320,430;& 1991;94:89 &1998;107:98). iii) The stunted- wasted children developed soft neurological signs (SNS), their EEG had slow & sharp waves,in frontal, parietal and temporal lobes, with motor deficit had persistence of impaired repetitive speed movements with overflow & dysrhythmia.Their brain MRI and cognitive evoked potential studies showed decrease in frontal lobes size and *asymmetry of anterior as well as posterior lobes was lost* (AP 1989;78:873 & 1995;84:1357). *Iv) In chronic malnourished children* (31-P MRS) studies showed that for vital functions, body mobilized amino acids from muscles: i) serum enzyme activities increased i.e. LDH, ALP, AST, ALT, CK, CK-MB and CK-mm and ii) beta-ATP and Pi in muscles was increased at the cost of Pcr (Phosphocreatinine). (AP 1994;83:327;Nutr Res(NR) 1995;15:193 & 1996; 16:1147). v) Animal studies conducted on malnourished rats showed that fetal brains fed on wheat or legume diets had: dissociation of brain growth and fetal and weanling rat neurotransmitters were altered (J Neurochem(JNch)1979; 32:1309& Ann NutrMetab 1981;25:328). vi)-Maternal anemia transport of iron to fetus was reduced, placenta showed "Maturational arrest",iron in fetal liver

reduced. **vii)**Latent Iron deficiency in rat: a)Dietary iron depletion in pregnant rats-reduced iron in fetal liver and in brain selectively i.e.Cerebral cortex 17%, Cerebellum 18%, Hypothalamus 19%, Mid brain 21%, and Corpus striatum 32%, but no change in – medulla oblongata and pons. Fetal brain iron content did not change after maternal "Fe" supplementation. b) Fall in brain "Fe" content was associated with alterations in brain Cu, Zn, Ca, Mn, Pb and Cd levels. c) Fetal brain neurotransmitters showed irreversible fall in Glutamate metabolism- GAD, GDH, GABA-T and their receptors-binding, showed irreversible deficit in both excitatory and inhibitory pathways of the CNS.(IJMR.2006;124:124; AP 1978;67:645 & 1985;74:701 NR 1989;9:1177, AJCN 1979;32:1462, Biol Tr Elem Res 1989;45:141,Experentia 1989; 45: 343- J Nch 1989;9:730, BJN 2001;85:814 & IJBioch 2003;18:111).

3) Treatment/ Eradication of Malnutrition-. Indian Dahi (made with- lactobacillus bulgaricus and streptococcus thermophilus) was shown to improve immune recovery in grade II&III malnutrition. It was compared against milk in WHO recommended 2 step diets. Interleukin levels during treatment were much higher on WHO-Dahi as compared to WHO- milk diet after 15 d and 6 wk.The absolute lymphocyte counts, CD3, CD4, CD8, CD19 and CD56 increased in children receiving Dahi in WHO diet for 6 wk.In contrast, these counts decreased in children receiving WHO milk diet. Dahi being immunonutrient should replace the milk in WHO diet for treatment. Secondly, on feeding *Berseem (Trifolium Alexandrium)* leaves to PEM II&III, also showed immunonutrient properties. Both Dahi and Berseem normalized blunted CRP response in PEM. Thus may be added in commercial cereals and legumes *to eradicate malnutrition*(IP 2001;38:905, EJC N 2002;56:556(S-4),I JMR 2007; 126: 199&.2009; 130:31, v) Ann Pediatr Res. 2020;4(4):1046. vi)Acta Sci Paediatr 2018; 1: 2-4 . vi) Intl J Med Sci Clin Res Studies ISSN 2022:02(06) pp 505-511(DOI: https ://doi .org/10.47191/ijmscrs.

Dr. Piyush Gupta
Principal
University College of Medical Sciences
& Guru Teg Bahadur Hospital
Shahdara, Delhi-110095

19 July 2023.

1.2.