PROTEIN ADEQUACY-INADEQUACY STATUS AMONG INDIAN POUPLATION

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In ancient Greece, Hippocrates, Father of Medicine, 400 B.C. wrote

“let thy food be thy medicine, and thy medicine be thy food”,

emphasizing the value of nutrition.

Regardless of who
the Father of a disease is,
Surely its Mother is
IMPROPER DIET

Old Chinese Proverb

NUTRIENTS

The chemical components present in the food that we eat daily are called nutrients

The nutrients are classified into

- Macronutrients
- Micronutrients

Macronutrients

(Required in large amounts and metabolized in the body to provide energy)

- Proteins
- Fats
- Carbohydrates

NUTRITIVE VALUE

"Is a value that gives an indication of the contribution of a food to the nutrient content of the diet."

This value depends on

- **Quantity of a food digested and absorbed**
- **Amounts of the essential nutrients (protein, fat, carbohydrate, minerals, vitamins) which it contains.**

This value can be affected by

- **soil and growing conditions**
- **handling and storage**
- **and processing**

RECOMMENDED DIETARY ALLOWANCES OF PROTEIN

Nutrient Requirement - min amt of the absorbed nutrient (except energy) required for maintaining normal physiological functions of the body in a healthy individual
(depends on age, gender, body weight and physiological & metabolic status)

RDA (DRI) - an estimate of min daily average dietary intake level that satisfies the daily nutrient requirements of nearly all (97.5%) individuals in a population in a particular life stage and gender group
(+ individual variability within the group, quality of diet, nutrient bioavailability (Protein, Ca, Fe & Zn) due to processing, interactions between nutrients)

Definition of Adequacy and Inadequacy

- The protein and energy requirement curves are assumed to follow 'Normal Distribution', with a coefficient of variation 15%.
- The Expert of ICMR has suggested requirements for energy as the recommended allowances, while in the case of protein, the recommended allowance correspond to mean $\pm$ 2SD of requirements.
- The energy and protein adequacy status for each group was determined with cut-off levels based on RDA (1989). All the individuals consuming protein and/or energy in amounts <Median-2SD of requirements were considered as consuming 'Adequate amounts'.

AS PER NEW RDA

Coefficient of variation (SD) assumed to be 12.5%

RDA=Mean + 2SD (for all nutrients except energy)

RDA is 25% times higher than average or mean requirements

- ***Tolerable Upper Intake Level (UL):*** the highest average daily nutrient intake level (in conc. form either alone or in combination) that is likely to pose no risk of adverse health effects to almost all individuals in the general population (eg., level of fortificants)
- ***Estimated Average Requirement (EAR):*** the average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group (can be used only for nutrient adequacy of populations).

Approaches for deriving RDA

Growth – intake of nutrients through breast milk for satisfactory growth e.g. early infancy (No longer in use)

Nutrient Balance – min intake of nutrient for maint. zero balance in adults, adeq retention of nutrient consistent with satisfactory growth in infants & children, maternal & fetal growth in pregnancy and breast milk output in lactation e.g. Protein

Obligatory loss of nutrients – min loss of any nutrient or its metabolic product (nitrogen for protein) through urine, faeces and sweat (on relevant nutrient free diet). Used to determine the amount of dietary intakes to replace this loss (maint. Req.) e.g. Protein. In infants & children req for growth is added. (R = U+F+S+G). (No longer in use)

Approaches for deriving RDA – Contd...

Nutrient turnover –Daily turnover of nutrients in healthy persons using isotopically labeled nutrients e.g. Fe, Vit B_{12}, C and A (Currently stable isotopes are used in place of radioactive ones for safety. Stable isotopes are expensive and difficult to obtain)

Depletion and Repletion – min req determined by first depleting the healthy subjects to produce a biochemical deficiency (level of vit. or its coenz. in serum or cells viz., erythrocytes, leucocytes) and subsequently repletion with graded doses of nutrient till the observed deficiency is just corrected e.g. water soluble vitamins – vit C, B1, B2 & B6

Reference body weights and heights

- Reference body weights and heights of **healthy children and adolescents** represent their good health and growth rate (MGRS growth standards (by WHO from USA, Brazil, Ghana, Norway, Oman & India) for under 5 y (predominantly breast fed children) and for above 5 y, the 95th centile weights from consolidated data of NNMB)
- Reference body weights of adults represent what can be attained by an individual with normal growth (95th centile weights from consolidated data of NNMB) .

	Reference Man	**Reference woman**
Age:	18-30 yr (prior 20-39 yr)	18-30 yr (prior 20-39 yr)
Wt:	60 kg (no change)	55 kg (prior 50 kg)
Ht:	172 cm (prior 163 cm)	161 cm (prior 151 cm)
BMI:	20.3 kg/m^2	21.2 kg/m^2

8 hr of occupation (sedentary/moderate/heavy activity), 8hr of sleep, 2hr of walking/active recreation/HH chores, 4-6 hr sitting & moving and is free from disease

Proteins

- Made up of structural & functional units called amino acids (AA) which are classified as essential and non essential amino acids
- Nonessential AA are synthesized in the body
- Essential AA must be obtained from proteins in the diet

Depending on protein content…

- Protein rich foods: Over 20% protein

  E.g. Animal foods - meat, fish, egg & milk

  Plant foods - pulses, oilseeds & nuts

  (Soybean – 40 %)

- Moderate protein foods: About 10%

  E.g. Plant foods – cereals & millets

- Low/poor protein foods: <2%

  E.g. Plant foods – Green leafy vegetables, fruits, roots & tubers

Quality of protein

- An important factor for defining the protein needs is the quality of protein because the utilization of protein depends on its ability to supply essential amino acids.
- Vegetable proteins are compared against egg protein (best quality protein, EAA in right proportions). Current RDA is also based on the standard AA pattern for scoring protein quality.
- Indian diets comprises of mixture of vegetable proteins which are generally of poor quality because of low digestibility and deficiency of one or other EAA like lysine and methionine.
- Biological quality of mixed vegetable proteins in a typical cereal –pulse diet (5:1) is 65

Why proteins are required

- Proteins are primary structural and functional components of all living cells
- Almost half the protein is in the muscle and the rest is in bone, cartilage and skin
- Required for growth (infancy, childhood), fetal development (pregnancy), milk output (lactation), maintenance (tissue wear & tear), and during infection, illness or stress
- Requirements vary with age, physiological status, stress and the quality of protein consumed

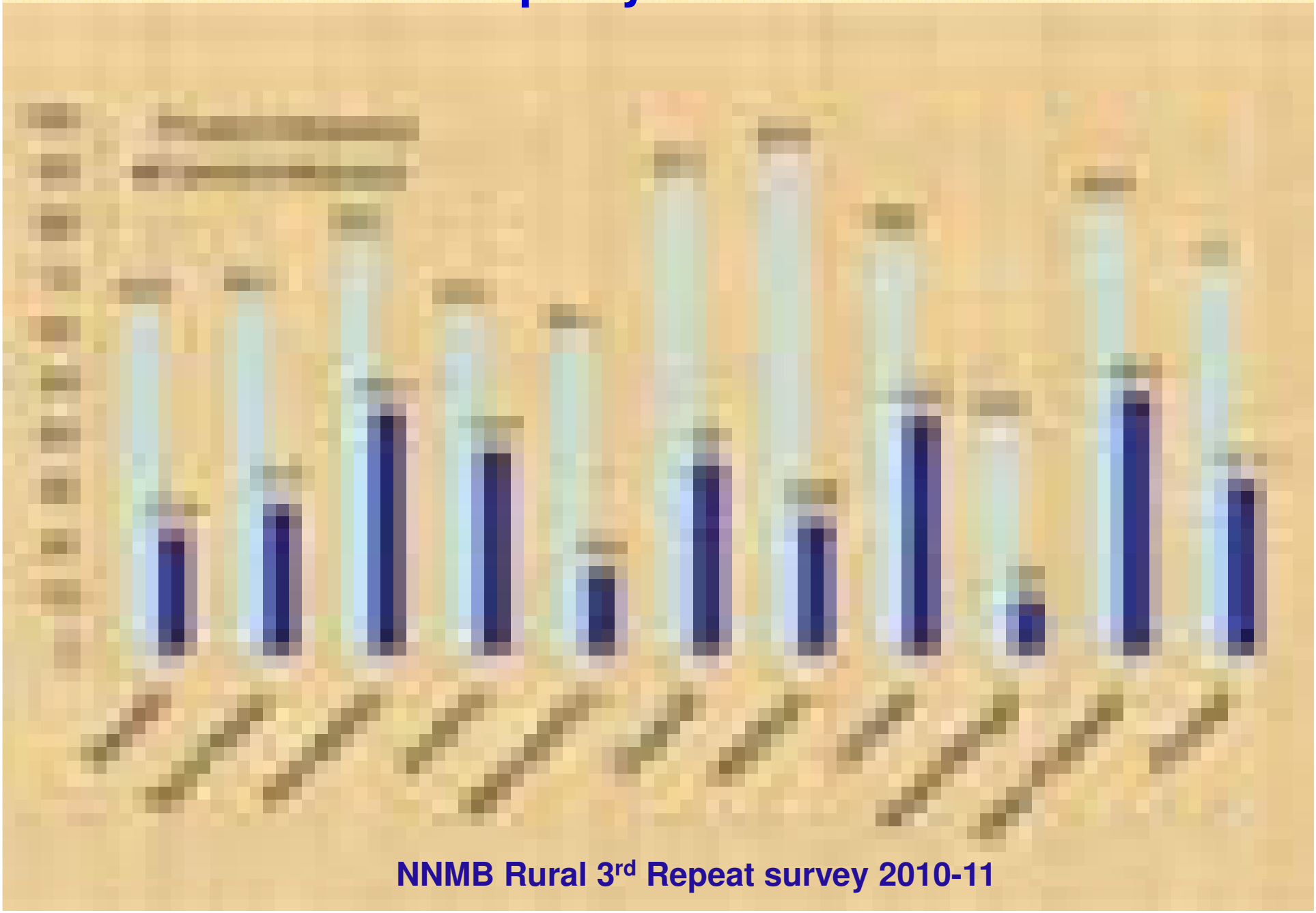
RDA for Protein

Group	RDA (g/day)	Group	RDA (g/day)
Adult Man (All activities)	**60** (60)		
Adult Woman (All activities)	55 (50)		
Pregnant Woman	78 (65)		
Lactating Woman	< 6months: 74 (75) 6-12 months: 68 (75)		
Infants	**(g/Kg/d)**	Adolescents	
0-6 m	1.16 (2.05)	13-15 yr- Boys	70 (52)
6-12 m	1.69 (1.65)	Girls	65 (52)
Children		16-18yr – Boys	78 (60)
1-3yr	16.7 (22)	Girls	63 (58)
4-6yr	20.1 (30)		
7-9yr	29.5 (41)		

( ) Revised 2009-10

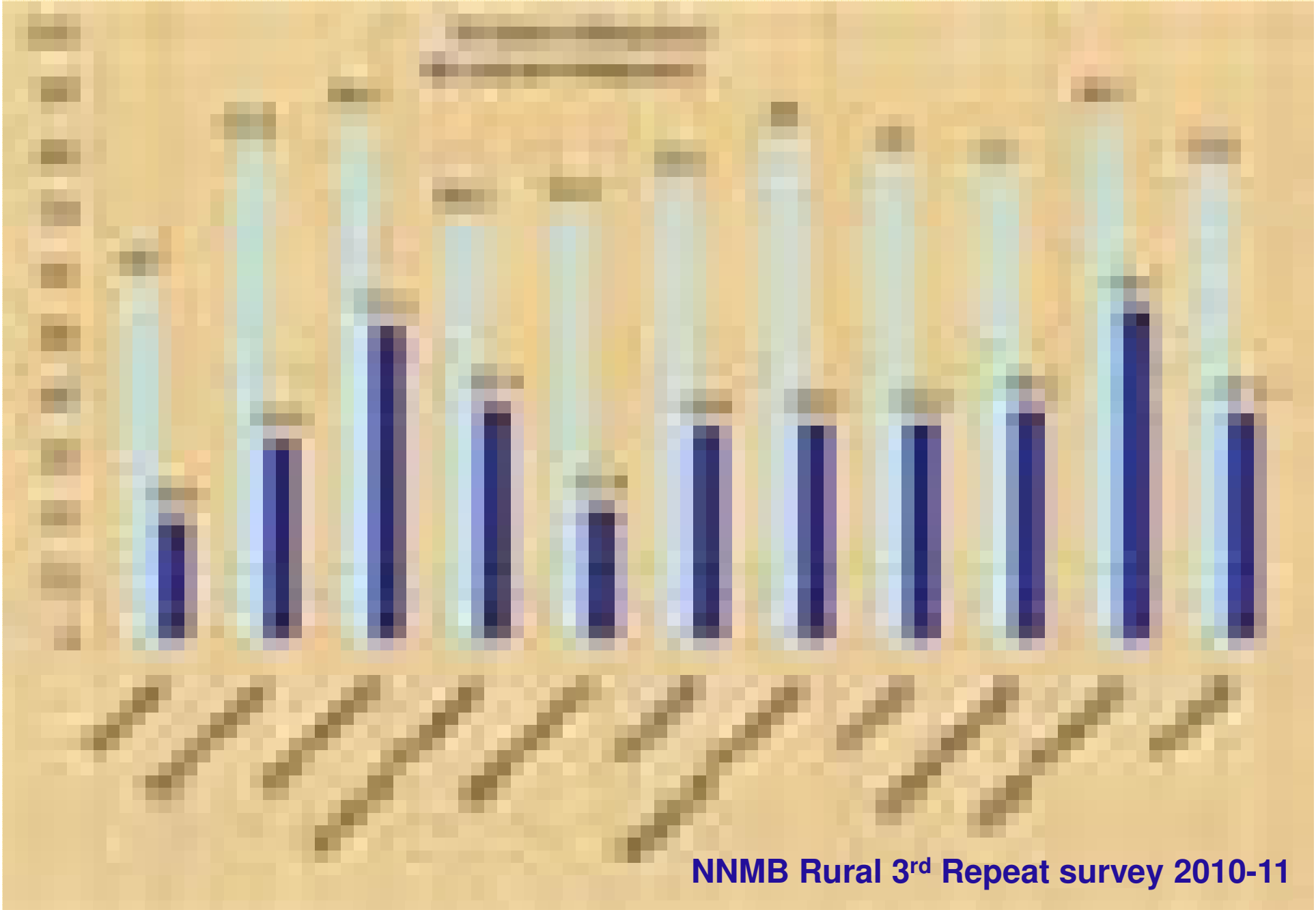
NNMB RURAL III REPEAT SURVEY 2010-11

Protein Calorie Adequacy Status: Rural Households



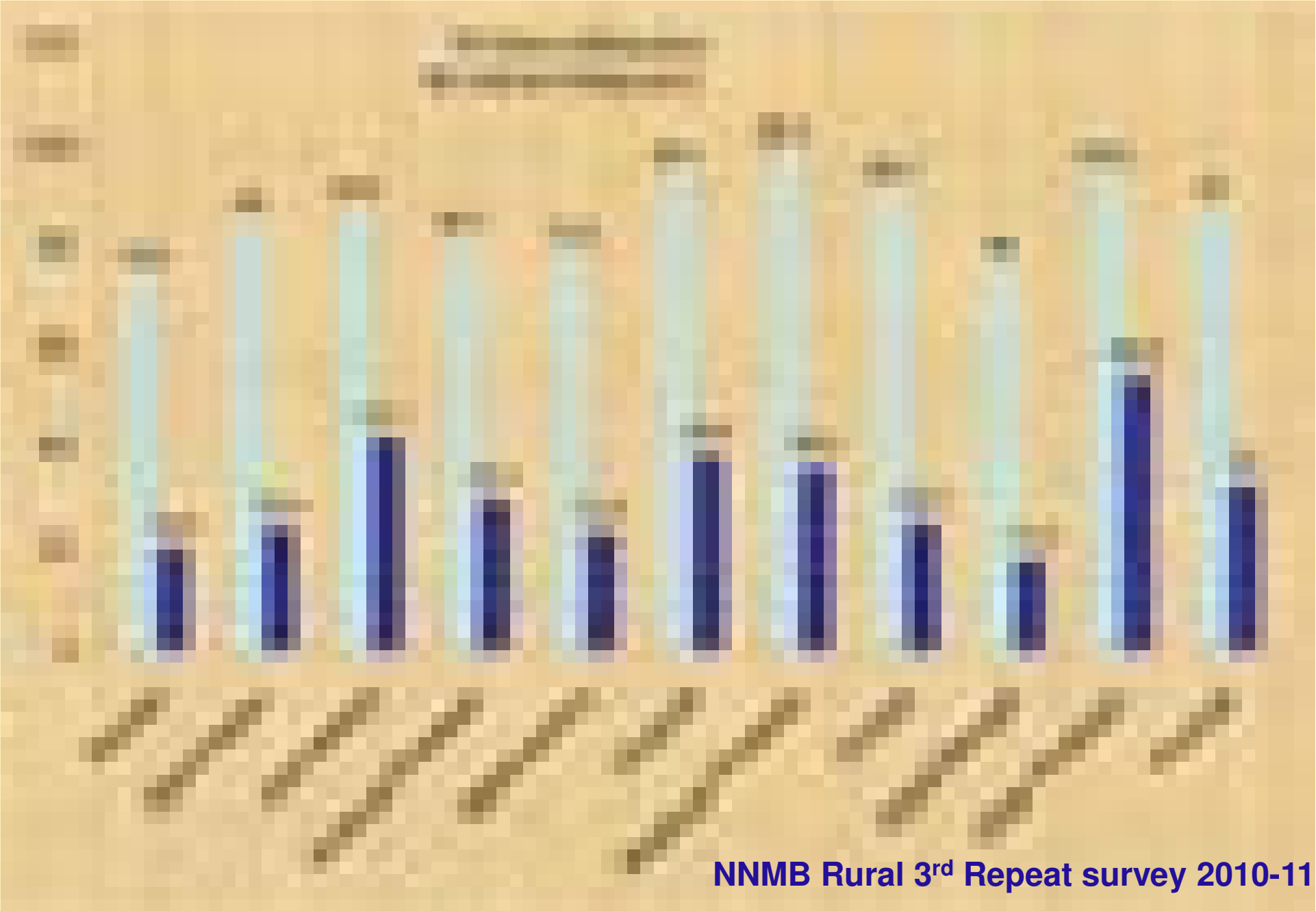
NNMB Rural 3rd Repeat survey 2010-11

Protein Calorie Adequacy Status: 1-3 year Children



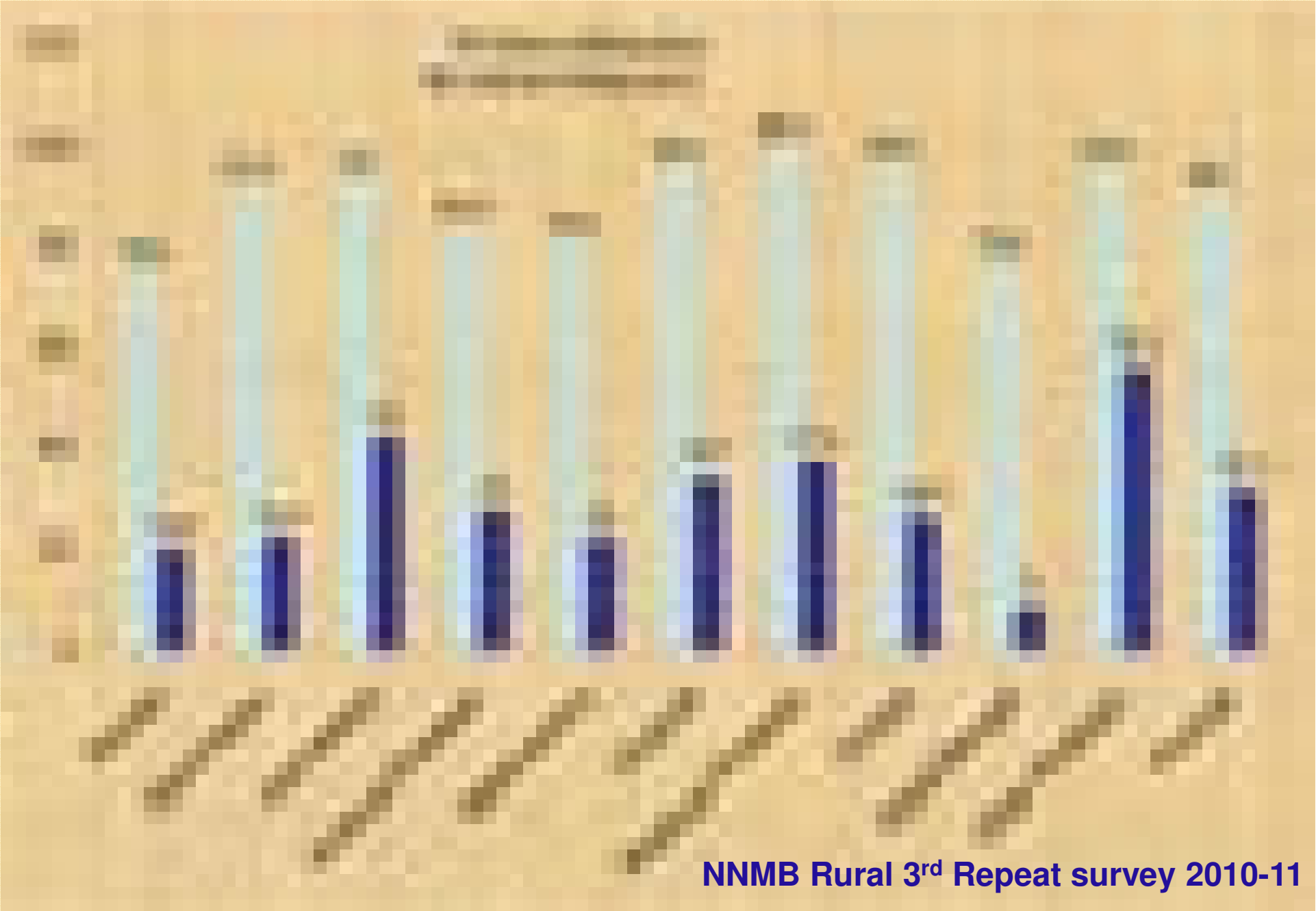
NNMB Rural 3rd Repeat survey 2010-11

Protein Calorie Adequacy Status: 4-6 year Children



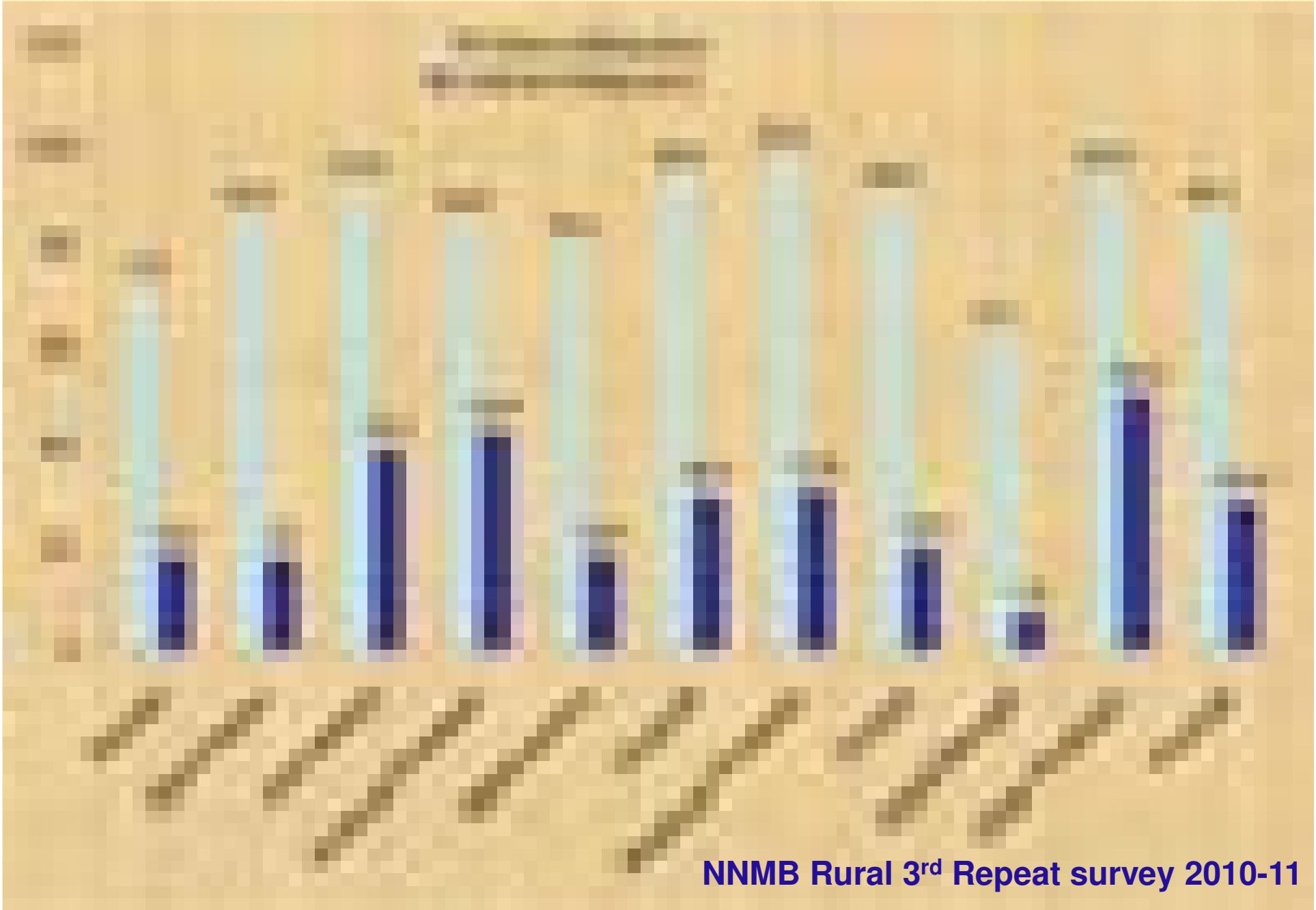
NNMB Rural 3rd Repeat survey 2010-11

Protein Calorie Adequacy Status: 7-9 year Children



NNMB Rural 3rd Repeat survey 2010-11

Protein Calorie Adequacy Status: 10-12 year Boys



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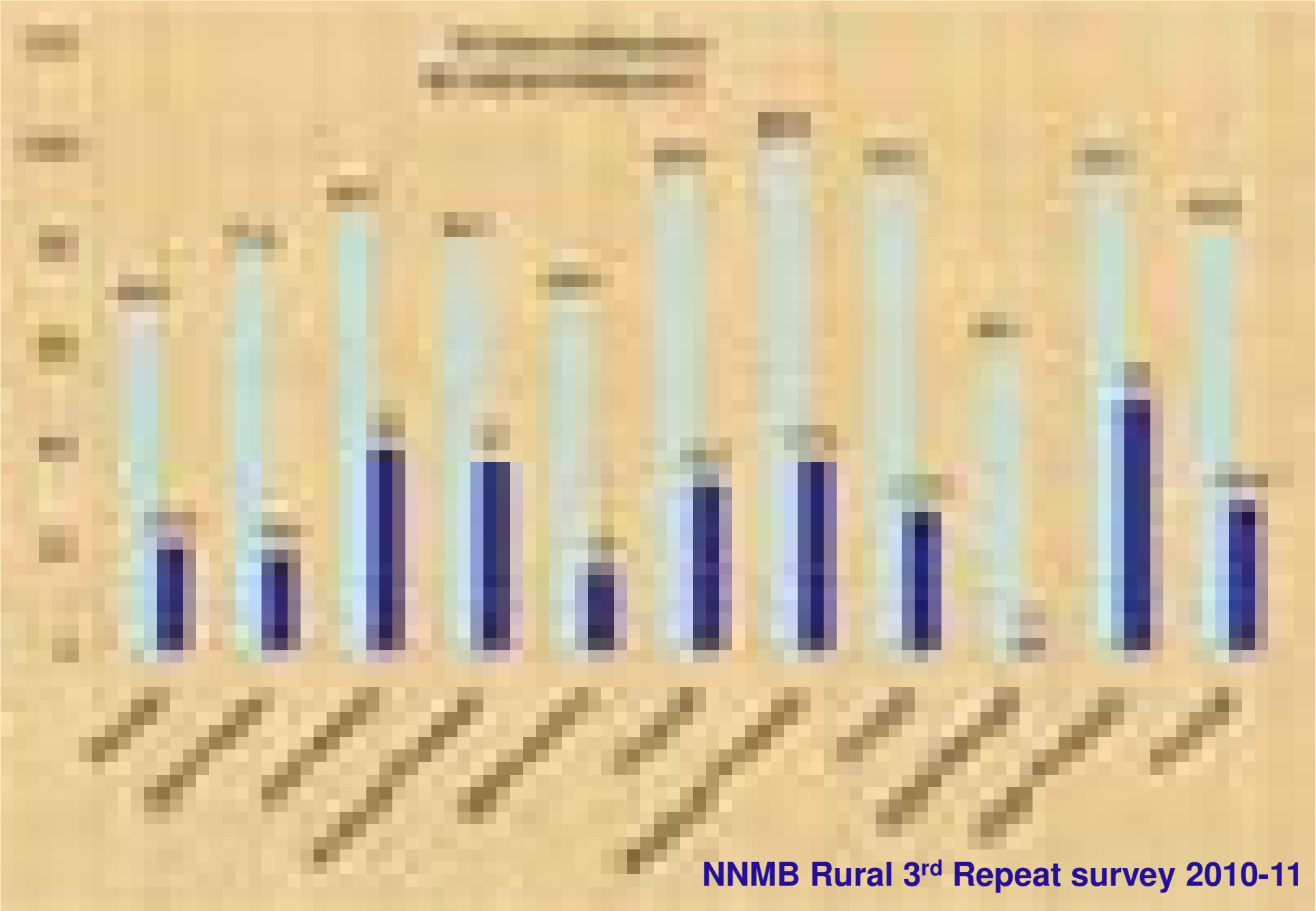
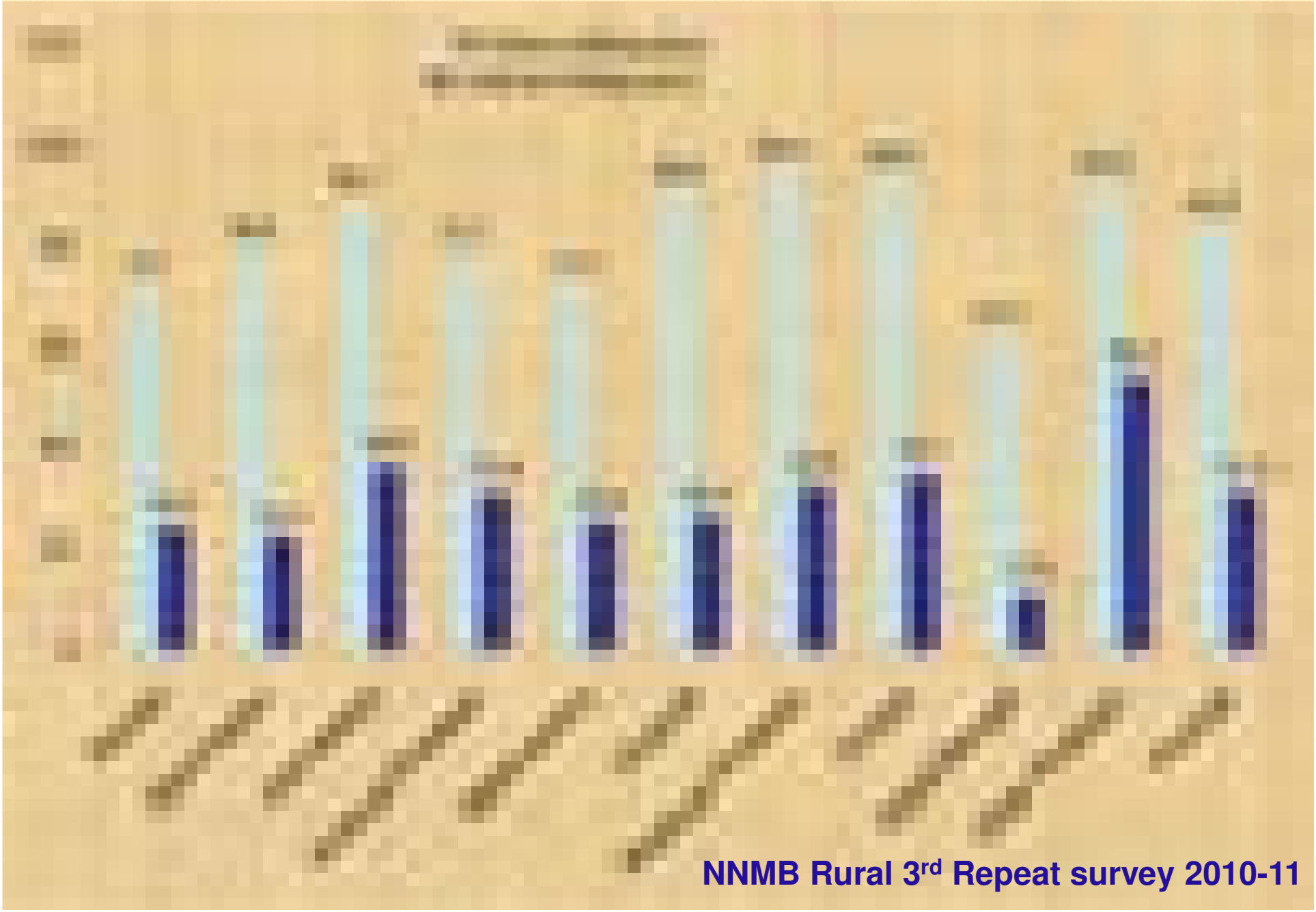


NNMB Rural 3rd Repeat survey 2010-11

Protein Calorie Adequacy Status: 13-15 year Boys



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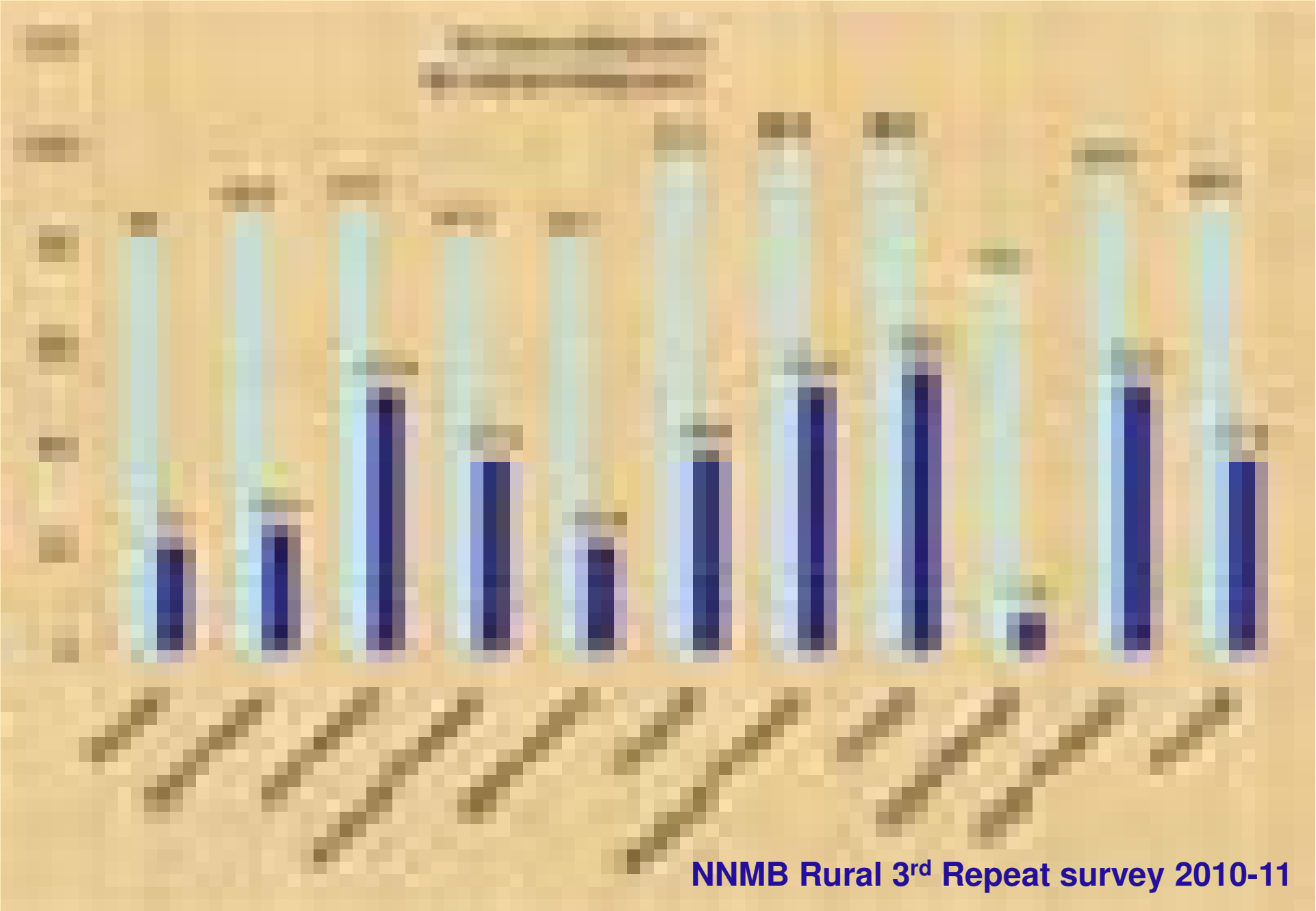
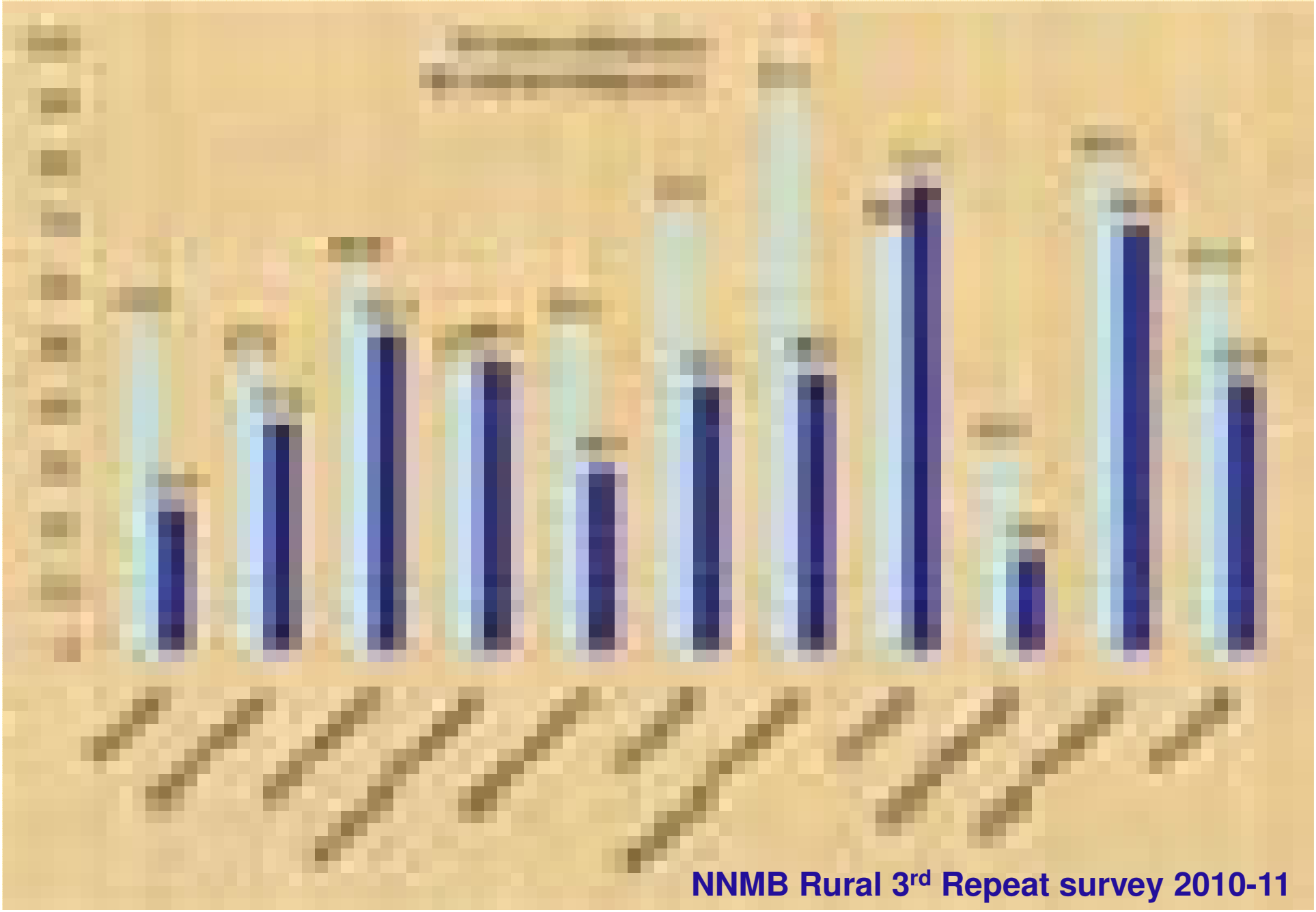
Protein Calorie Adequacy Status: 13-15 year Girls



NNMB Rural 3rd Repeat survey 2010-11

Protein Calorie Adequacy Status: 16-17 year Boys



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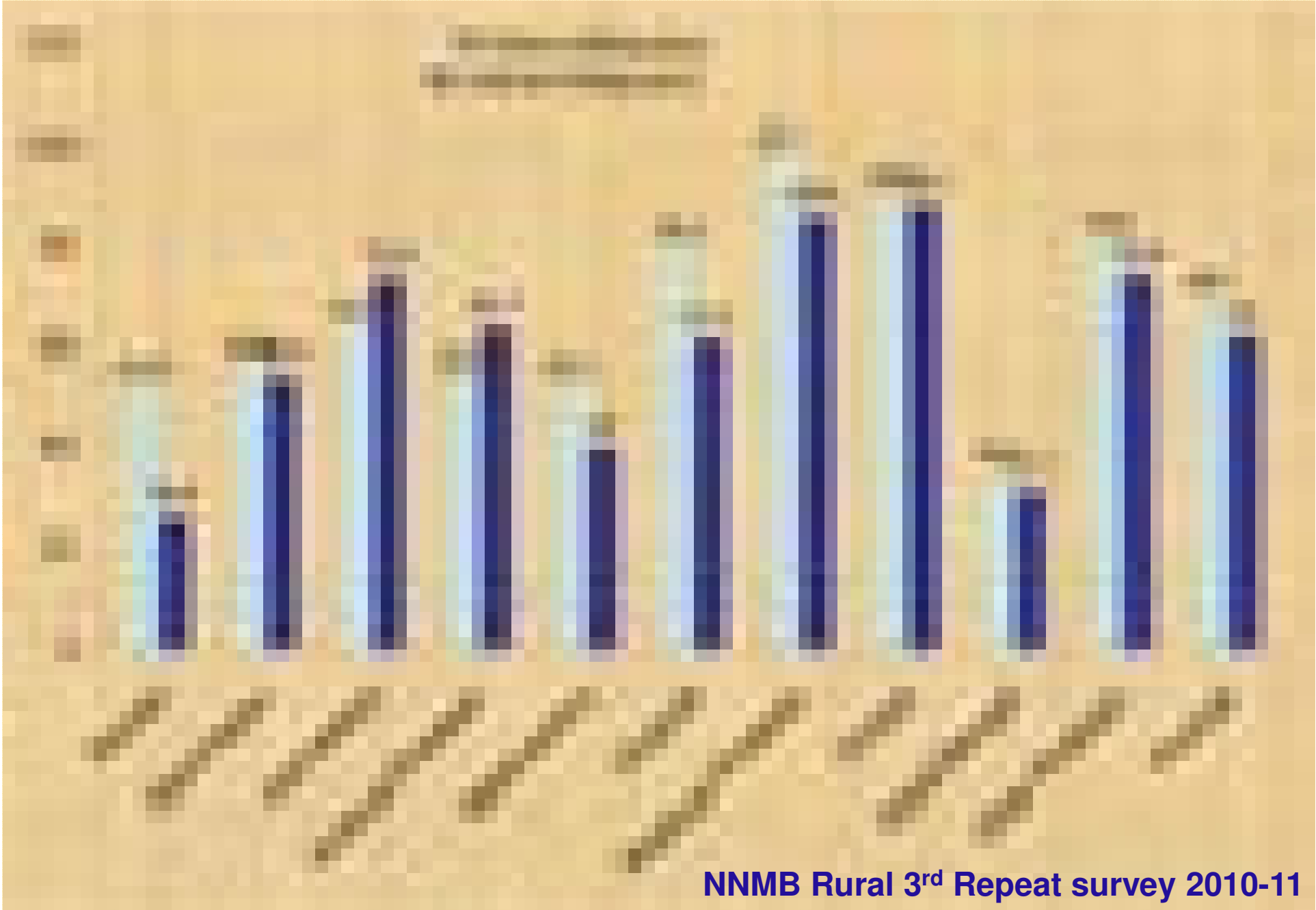
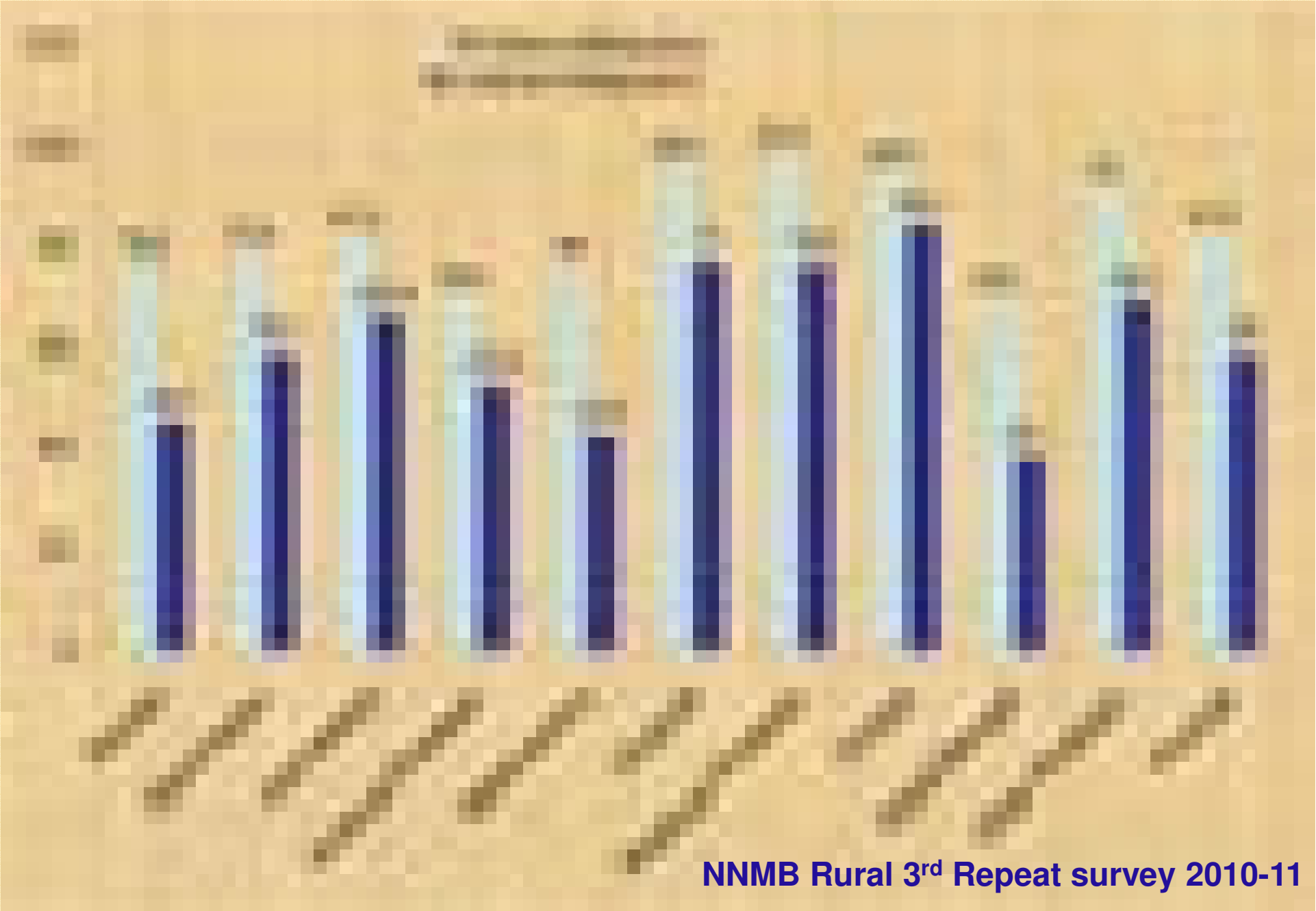


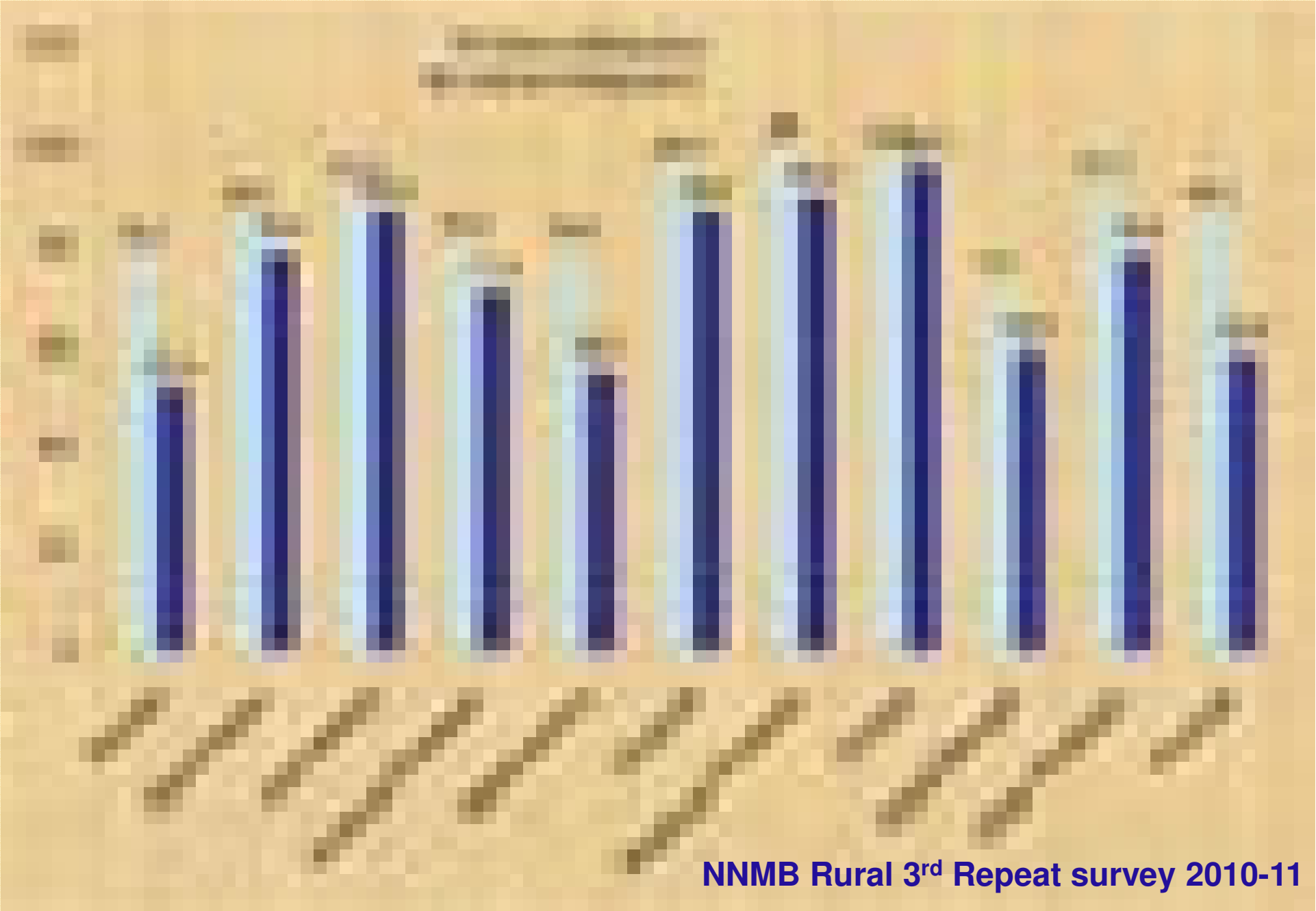
NNMB Rural 3rd Repeat survey 2010-11

Protein-Calorie Adequacy Status: ≥18 year men (Sedentary)



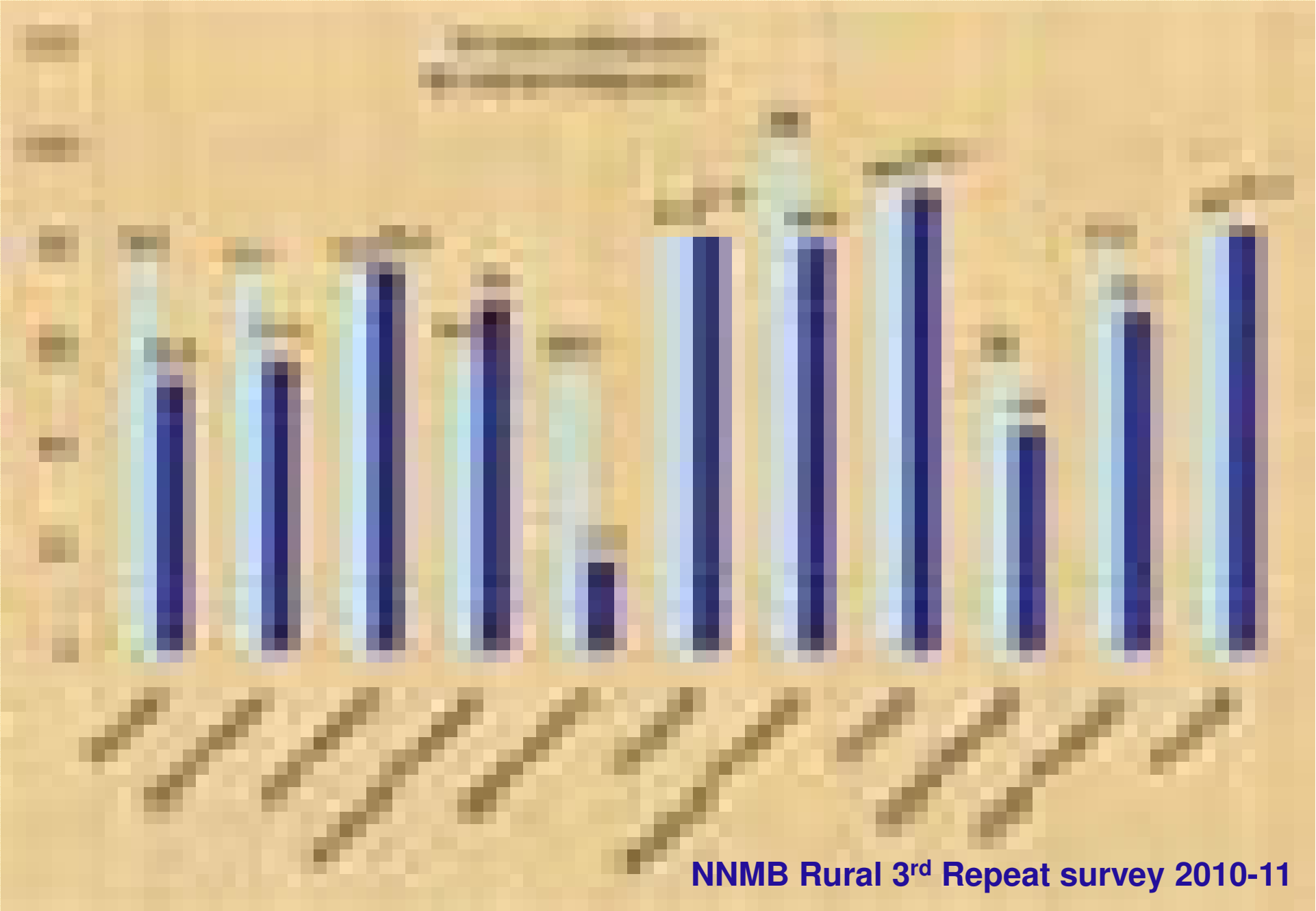
NNMB Rural 3rd Repeat survey 2010-11

Protein-Calorie Adequacy Status: ≥18 year women (NPNL)



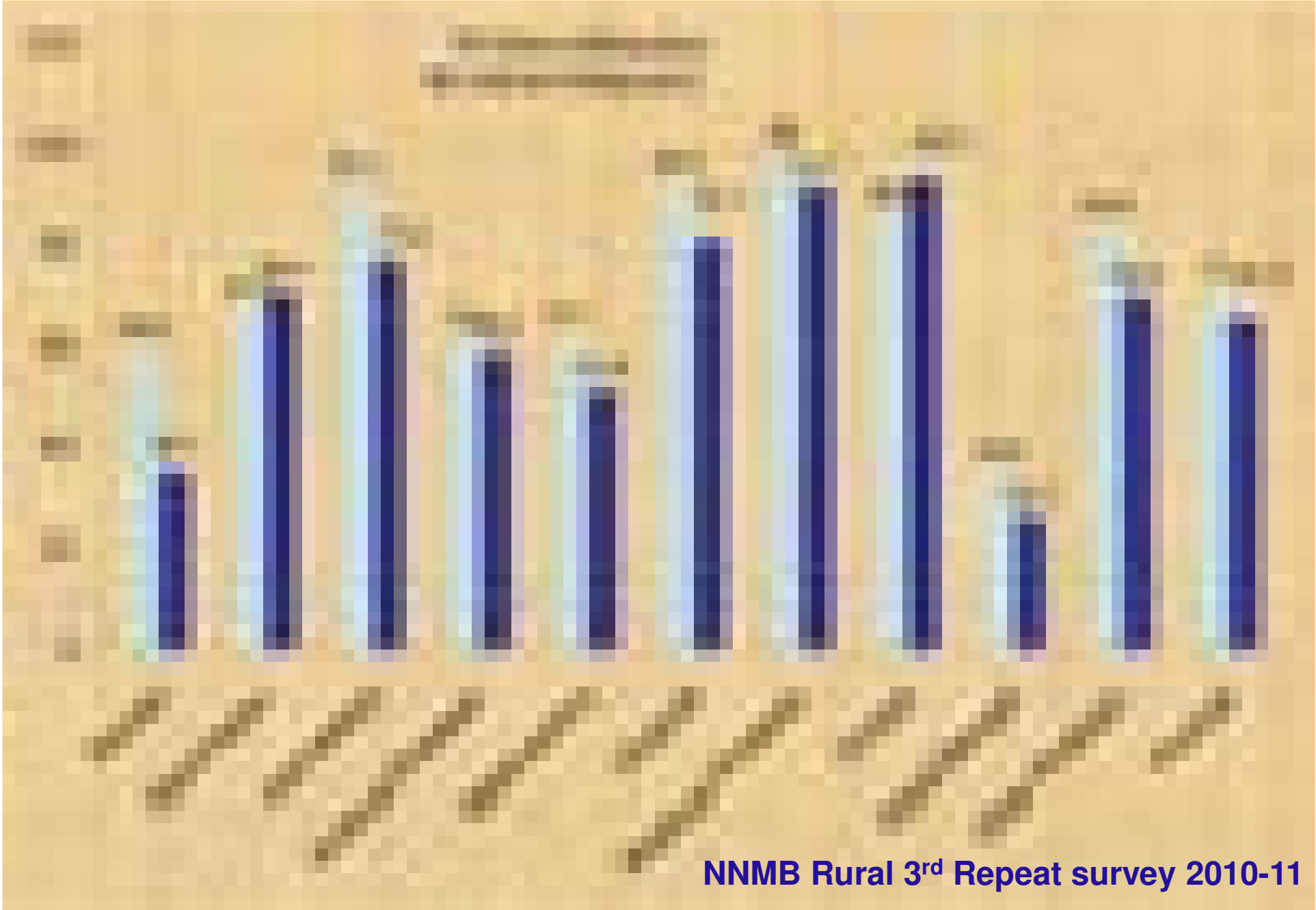
NNMB Rural 3rd Repeat survey 2010-11

Protein-Calorie Adequacy Status: Pregnant women



NNMB Rural 3rd Repeat survey 2010-11

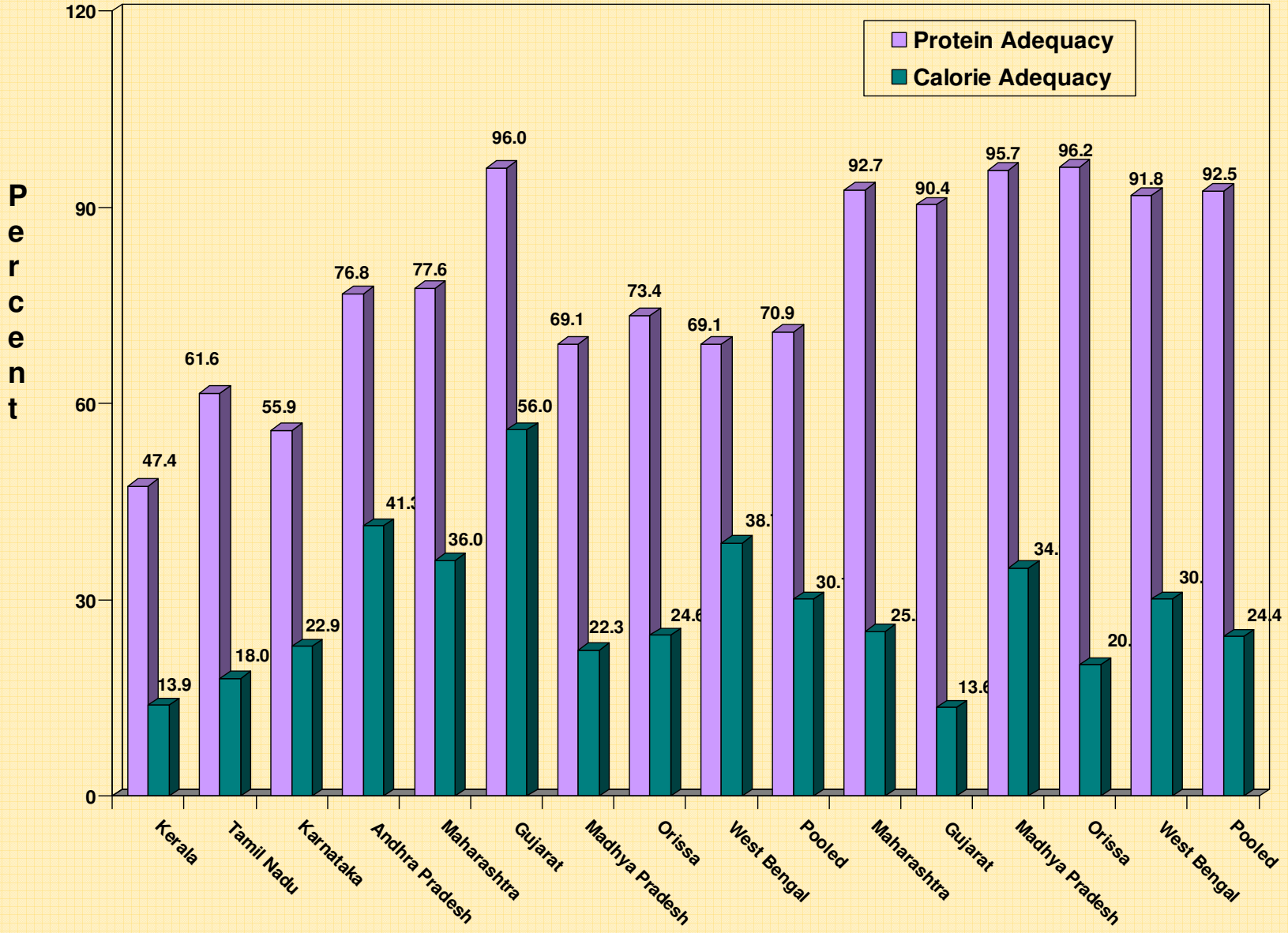
Protein-Calorie Adequacy Status: Lactating women



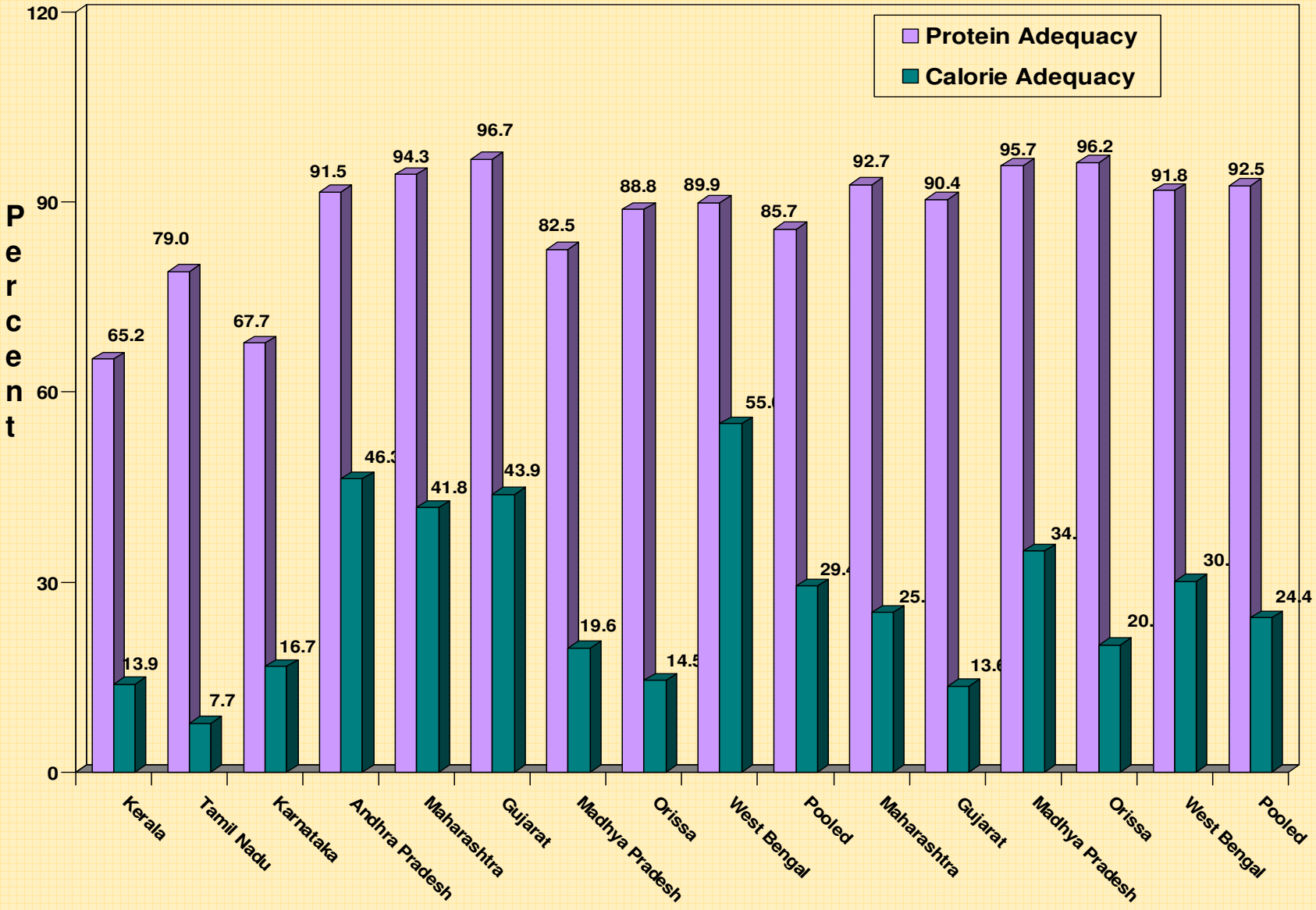
NNMB Rural 3rd Repeat survey 2010-11

NNMB TRIBAL II REPEAT SURVEY 2009-10

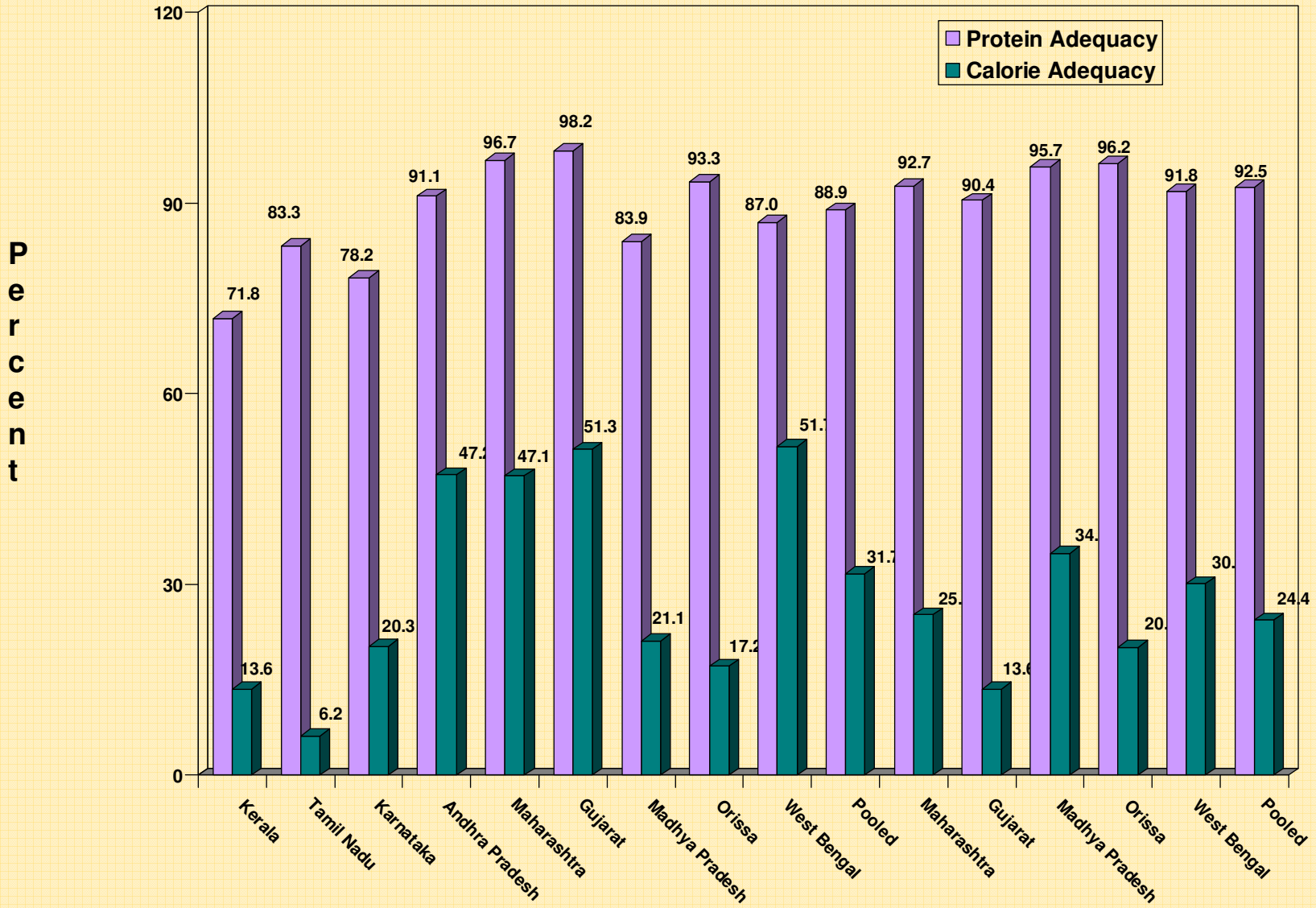
Protein –Calorie Adequacy : 1-3 years Children



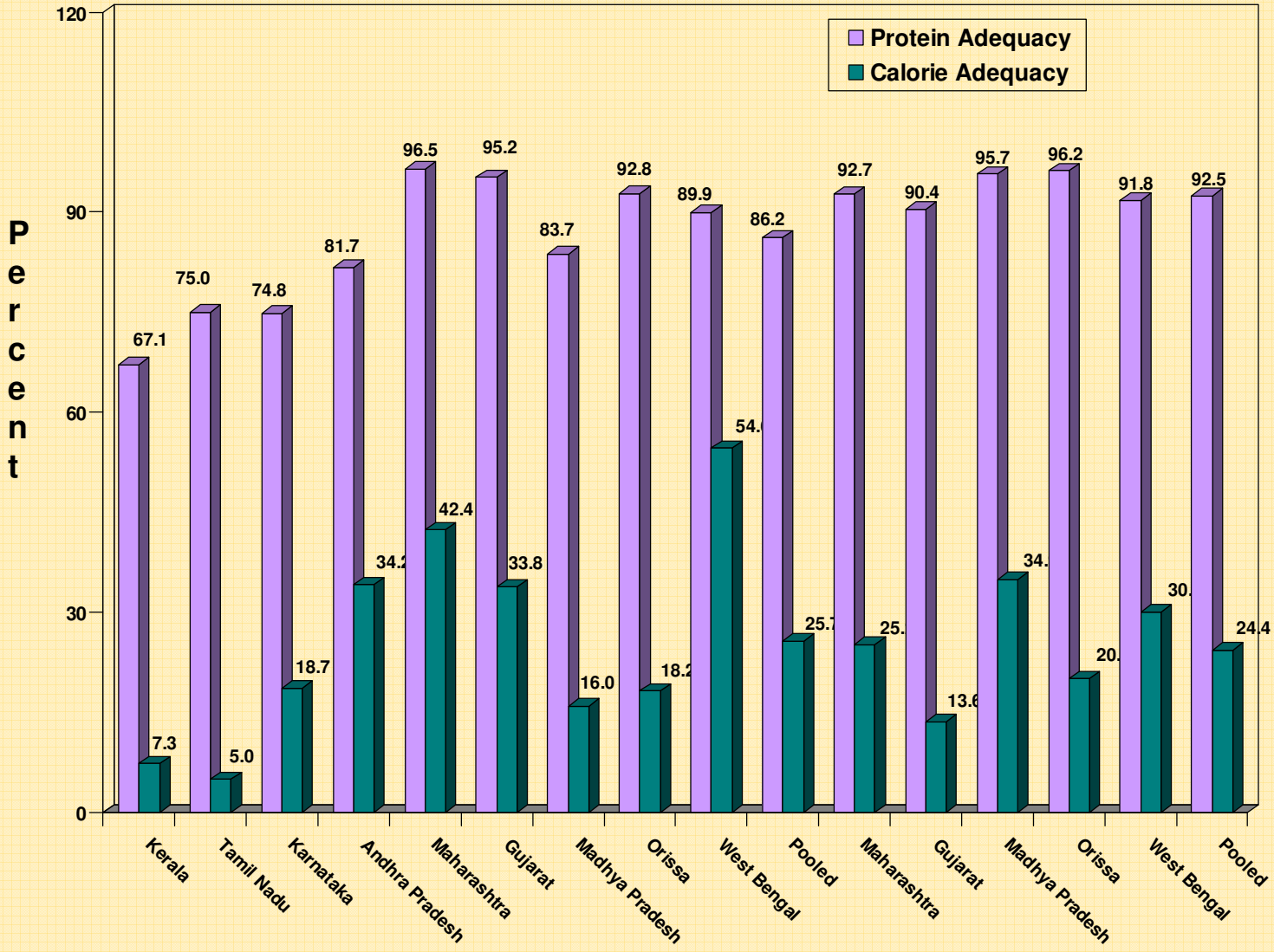
Protein –Calorie Adequacy: 4-6 years Children



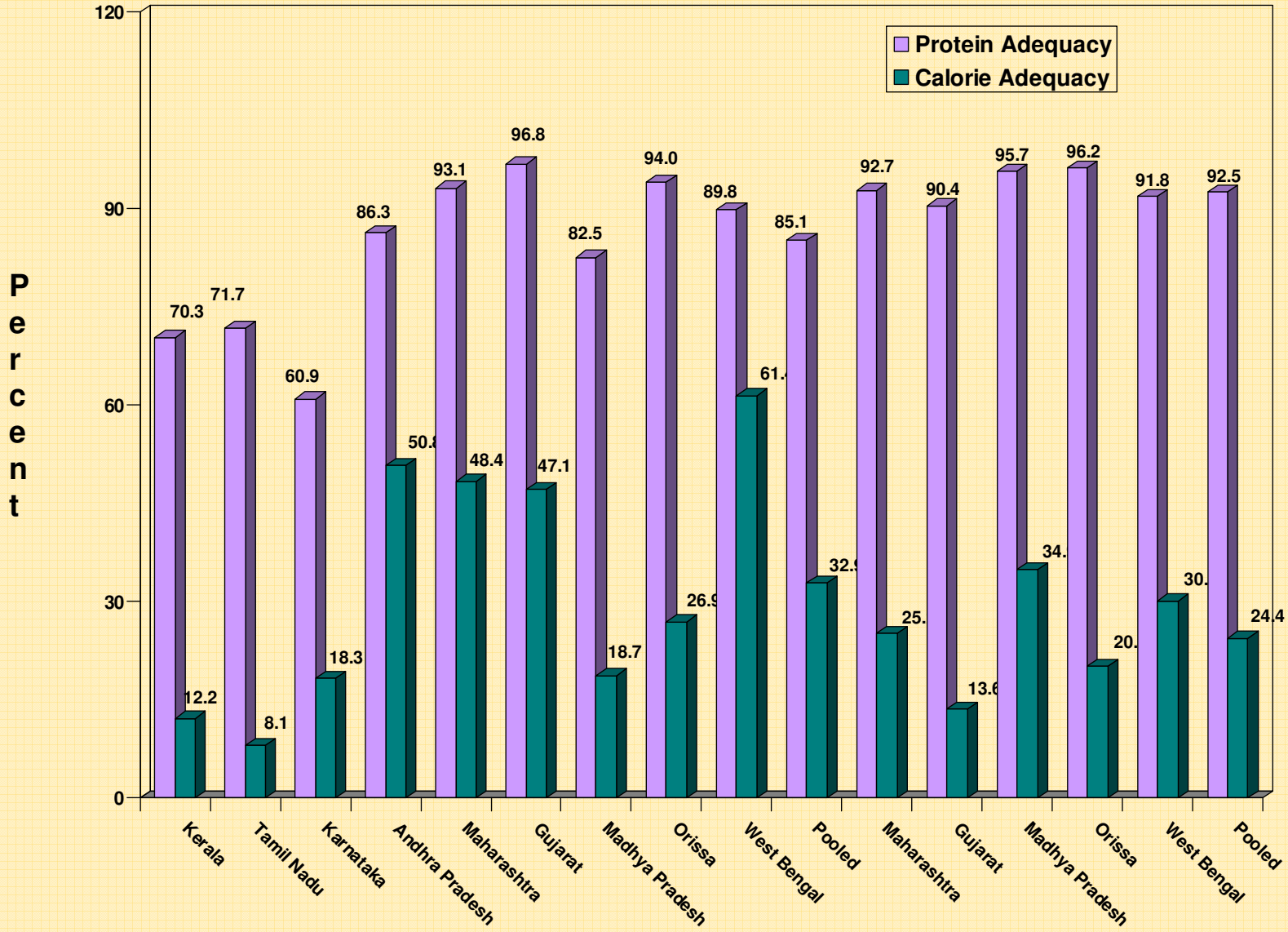
Protein –Calorie Adequacy : 10-12 years Boys



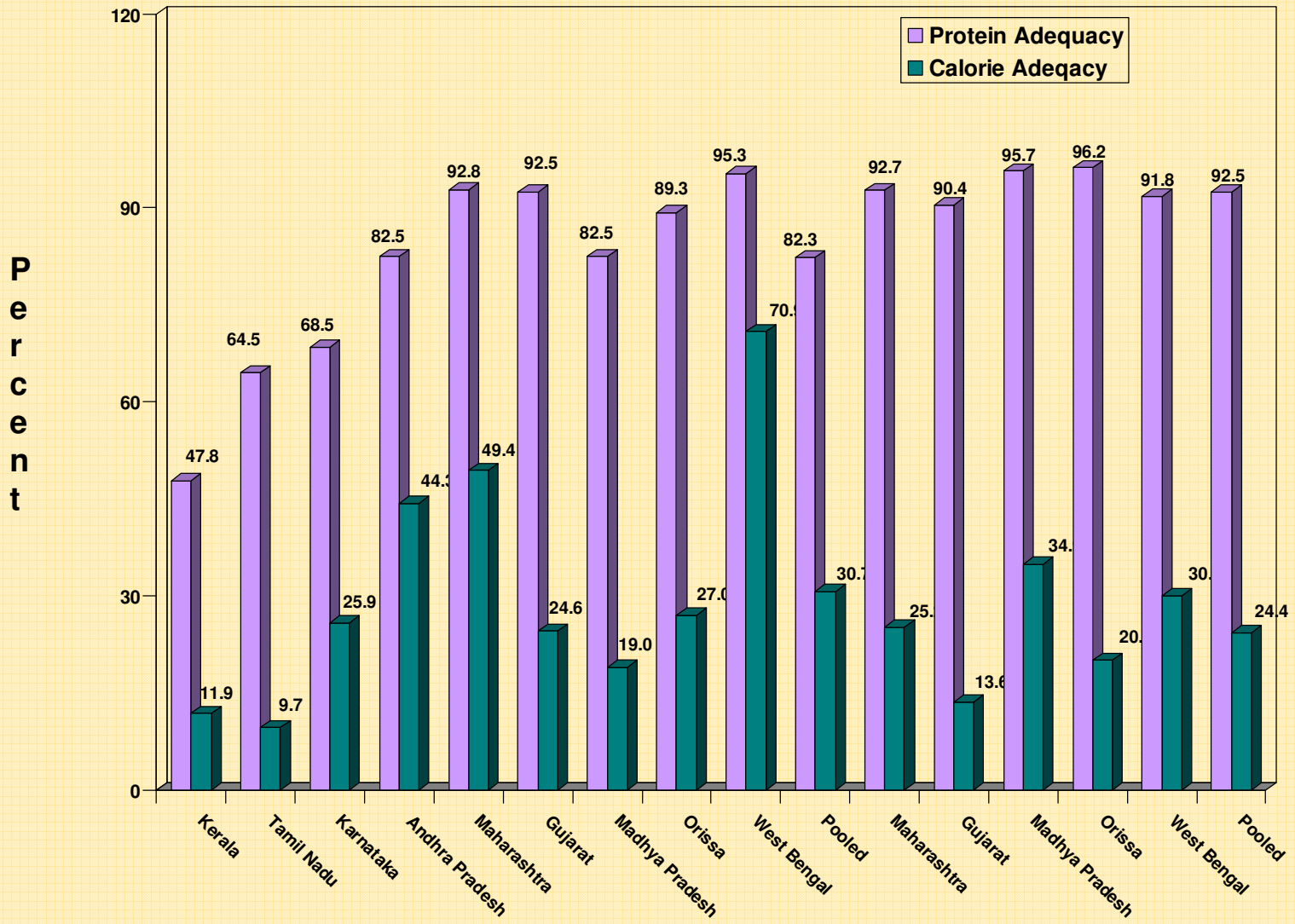
Protein –Calorie Adequacy: 10-12 years Girls



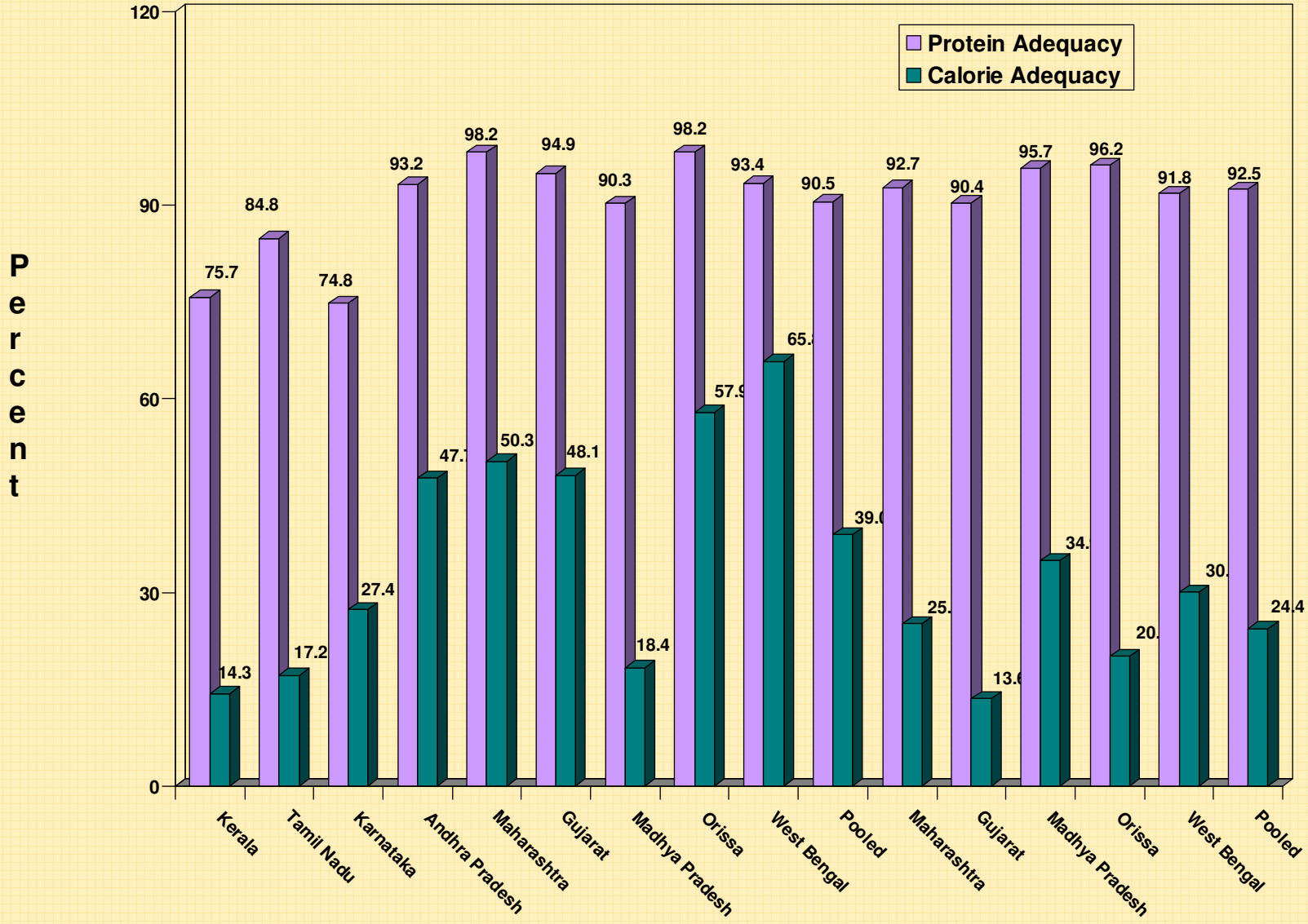
Protein –Calorie Adequacy: 13-15 years Boys



Protein –Calorie Adequacy:13-15 years Girls



Protein –Calorie Adequacy: 16-17 years Boys



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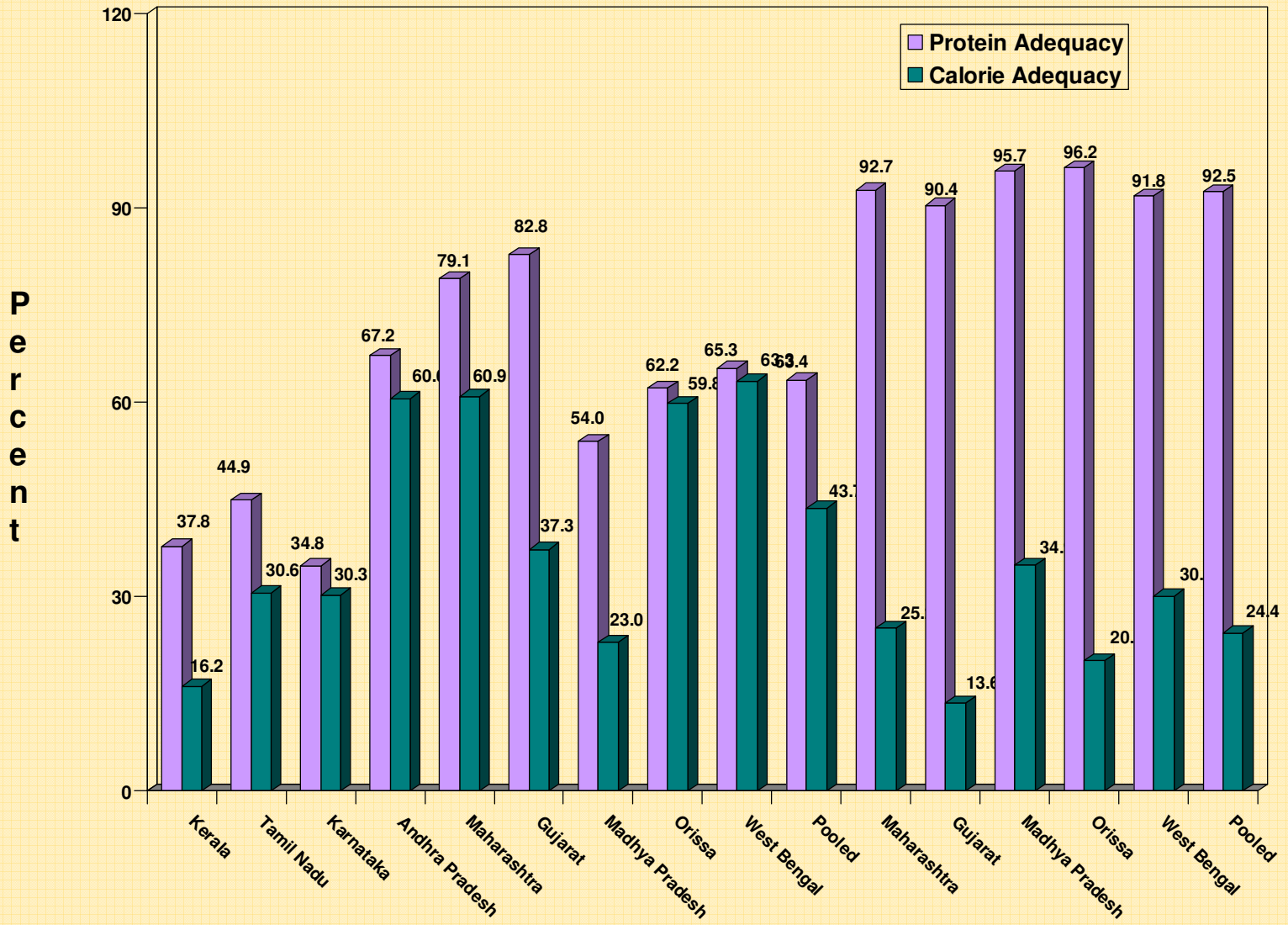
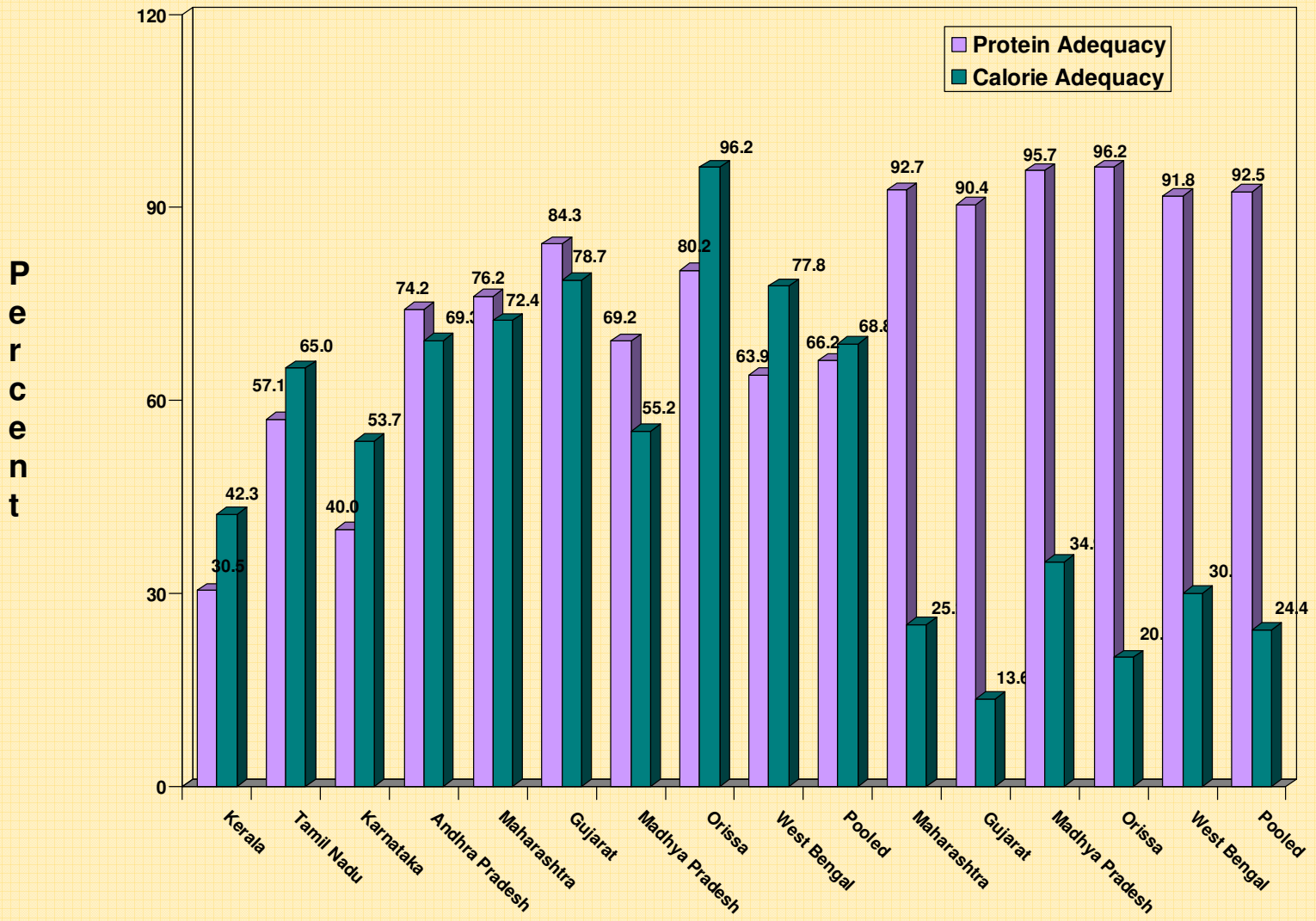
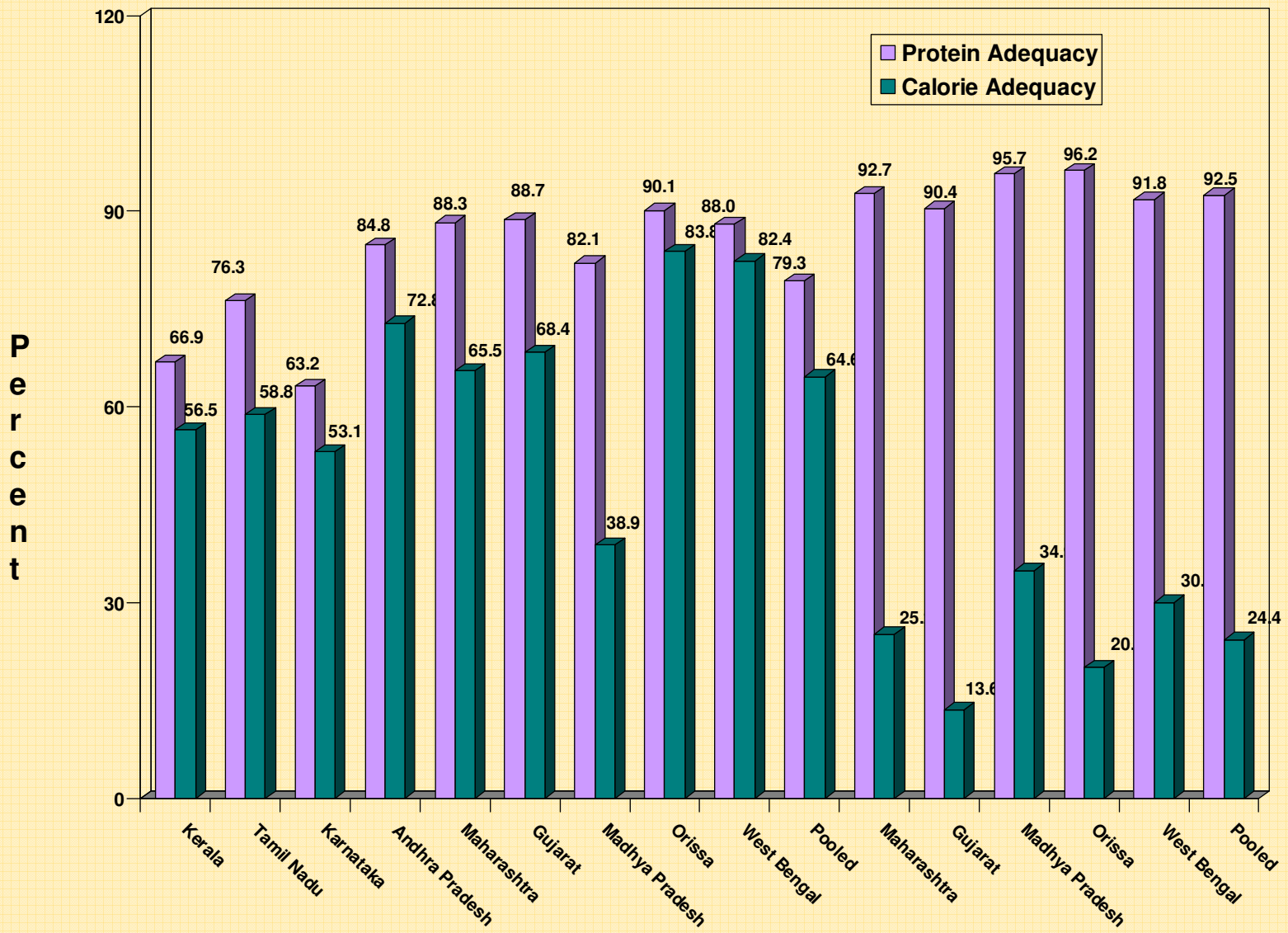


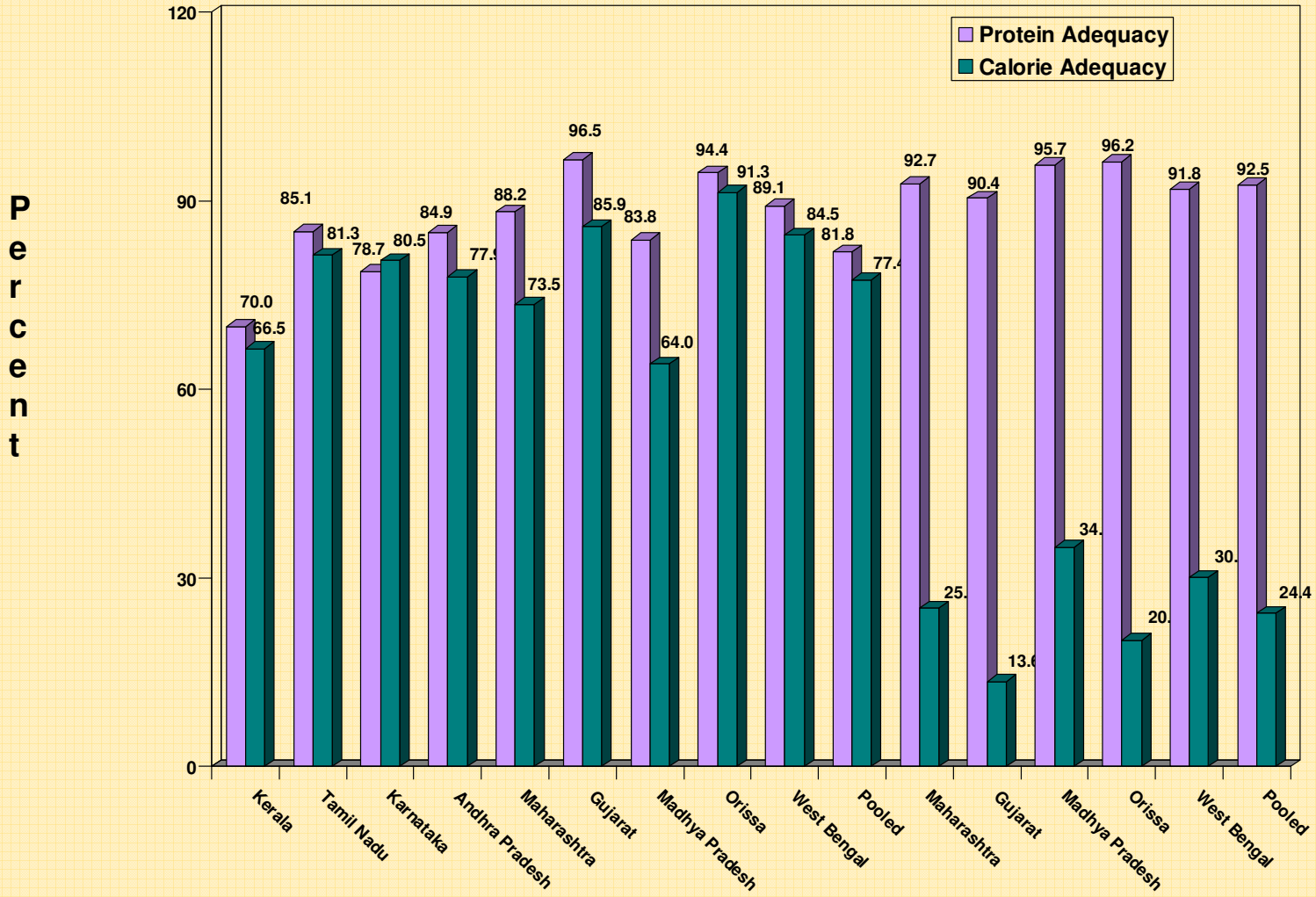
Protein-Calorie Adequacy: 16-17 years Girls



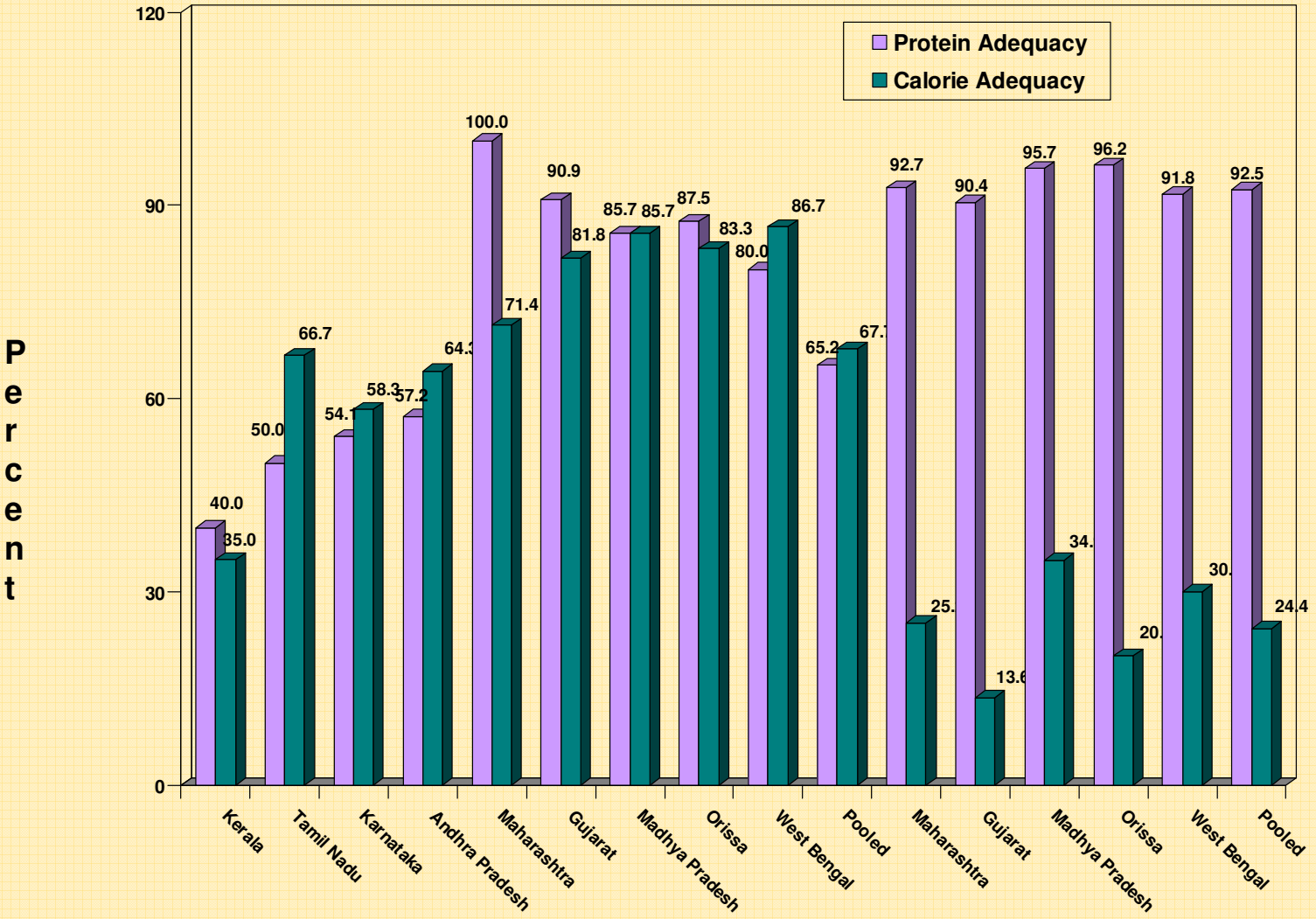
Protein Calorie Adequacy: Men (≥18 years-Sedentary)



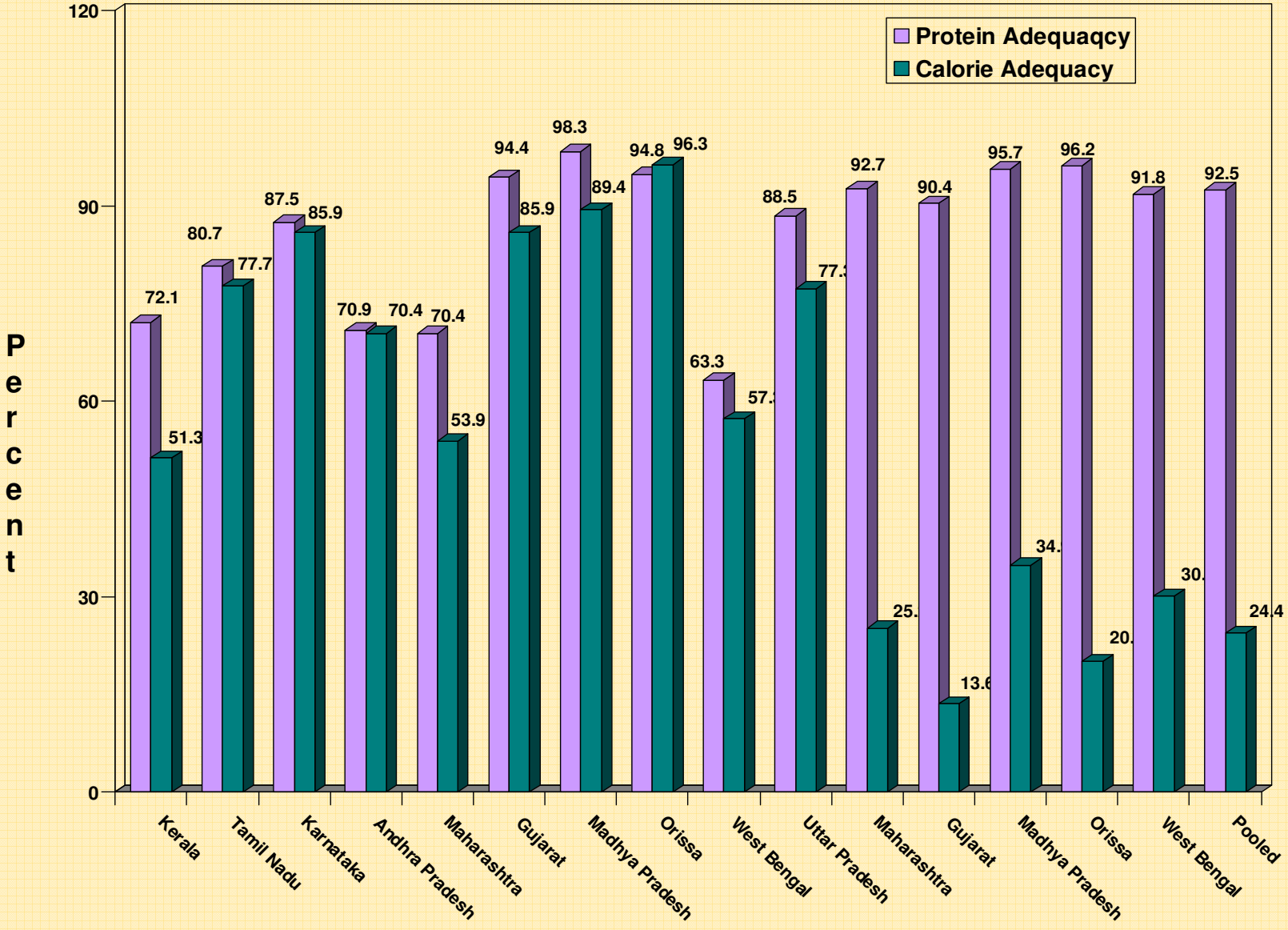
Protein –Calorie Adequacy: Women (≥ 18 years -NPNL)



Protein –Calorie Adequacy: Women (≥ 18 years – Pregnant)



Protein –Calorie Adequacy: Women (≥ 18 years – NPNL)



NIN URBAN SURVEY 2010-11
(Hyderabad)

Protein – Calorie Adequacy: Urban Adults ≥ 20 Years)