



PROTEIN AND LYSINE INTAKES OF YOUNG INDIAN WOMEN AND PROTEIN QUALITY OF THEIR MEALS ASSESSED BY AMINO ACID PROFILING AND *IN VITRO* PROTEIN DIGESTIBILITY

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INTRODUCTION

- ✓ Protein and amino acids apart from muscle synthesis also play a complex role in regulation of body composition, bone health, glucose homeostasis, satiety, cell signaling, gastrointestinal function and bacterial flora.
- ✓ In India, cereal based diets and less consumption of animal foods offer low quality protein and pose a risk of quality protein deficiency. Lysine intake in India is low mainly due to lesser food intake, consumption of cereals as staple diet and processing loss of lysine.
- ✓ The percentage of population at risk of quality protein deficiency in India vary between 4-26% among different age groups and between urban or rural sectors.
- ✓ The assessment of protein quality through amino acid profiling and *in vitro* protein digestibility is imperative to determine the extent of lysine inadequacy in different population groups.

METHODOLOGY

Selection of Subjects

- **Number:** 500 young adult women
- **Age group:** 20-30 years
- **Location:** Hostels of Punjab Agricultural University, Ludhiana, Punjab, INDIA

Dietary Survey

- **Dietary Pattern**
- **Food intake** by 24 Hours Recall
- **Nutrient intake** by Diet Cal Software (Kaur 2020)

Collection of representative meals

- **Duplicate meals** viz. breakfast, lunch and dinner of 30 volunteer subjects were collected for 7 days.

Nutrient Analysis of Composite Meals

- Composite meals representing 7 days hostel diet menu were homogenized and dried at 60 degree Centigrade till constant weight.
- The dried samples were analyzed for **protein** (AOAC 2016), **nine indispensable amino acids** (Amino acid analyzer and *In vitro* Protein Digestibility)

Table 1: Average daily protein and lysine intake of selected young adult women

Meal	Group I (20-25y) (n= 346)	Group II (26-30y) (n=127)	t- value	Overall (n=473)
Protein	39.22 ± 7.73	40.39 ± 8.46	1.42 ^{NS}	39.53 ±7.94
Lysine	956.45 ±252.51	1024.82 ±287.01	2.51*	975.32 ±263.66

Protein intake: 86.5% of the RDA of 45.7g (ICMR 2020)

Lysine Intake: 39% of the requirement of 2475mg (WHO/FAO/UNU 2007)

Table 2: Protein, lysine and *In vitro* Protein Digestibility (IVPD) per100g dry matter of three major meals of seven- days menu of hostel diets

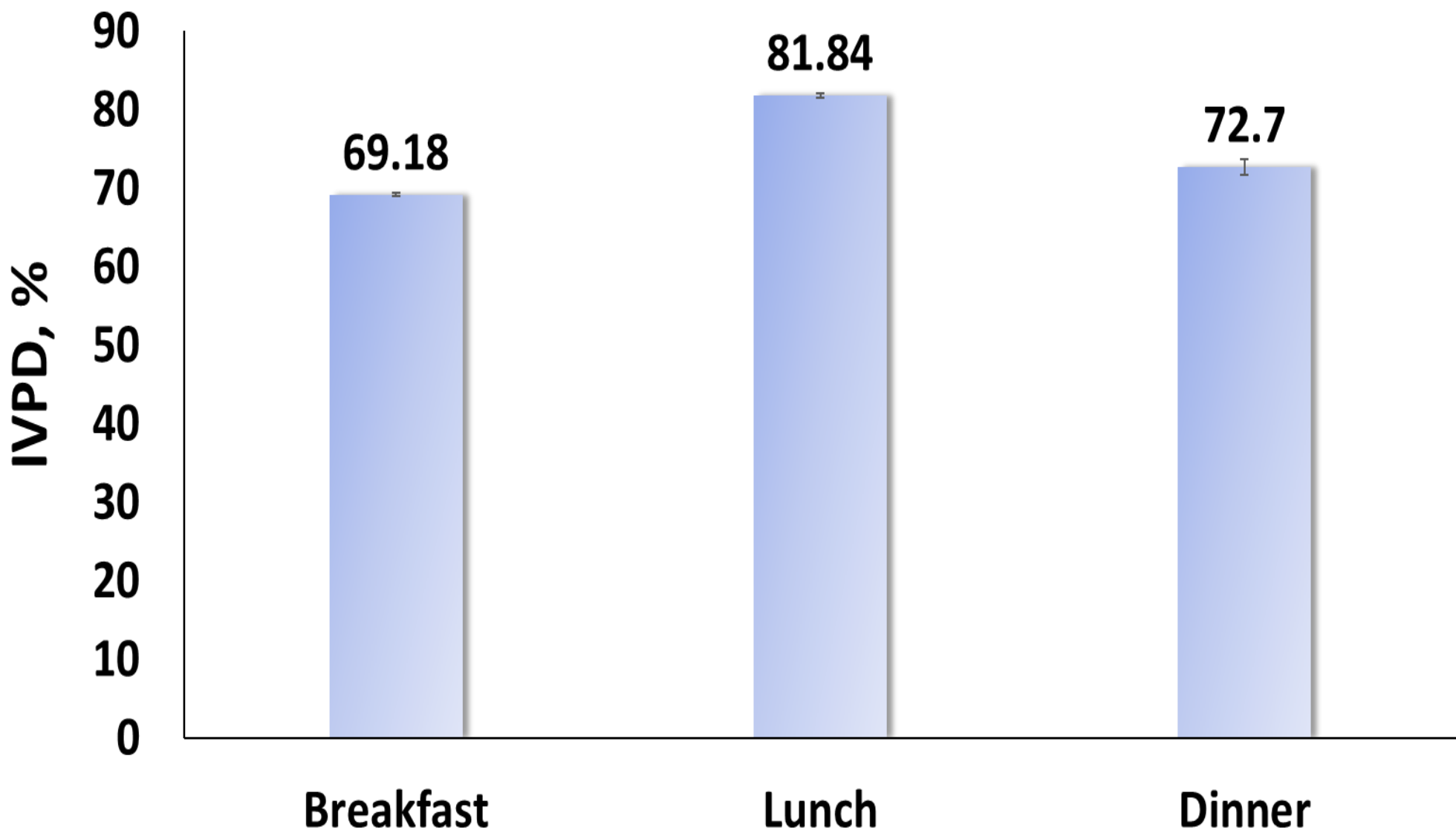
	Days of the Week							LSD at 5%
	1	2	3	4	5	6	7	
BREAKFAST								
Moisture (%)	67.96±0.94	68.97±0.96	67.32±0.94	67.56±0.92	59.78±0.88	69.43±0.97	59.44±0.95	4.37
Protein (g)	22.70±0.1	24.34±0.14	26.53±0.23	27.30±0.18	31.27±0.21	31.09±0.14	35.65±0.39	3.61
Lysine (mg)	896±25.17	930±20.0	916±20.82	950±34.64	893±25.17	896±5.77	883±11.54	0.04
IVPD (%)	69.82±0.53	68.81±0.39	68.14±0.30	68.76±0.42	69.92±0.05	69.11±0.55	69.72±0.35	0.47
LUNCH								
Moisture (%)	70.87±0.97	72.56±0.96	68.88±0.77	76.08±0.89	71.91±0.94	71.66±0.96	71.96±0.99	3.19
Protein (g)	24.93±0.06	25.19±0.19	26.62±0.33	23.6±0.52	28.91±0.29	32.45±0.69	36.75±0.11	NS
Lysine (mg)	866±25.17	860±10	896±11.55	906±15.27	916±15.27	923±15.27	933±49.32	39.28
IVPD (%)	80.6±0.55	79.06±0.06	83.54±0.27	85.5±0.25	82.33±0.20	80.55±0.51	81.25±1.02	NS
DINNER								
Moisture (%)	75.36±0.98	72.97±0.99	69.52±0.87	69.14±0.99	67.94±0.97	65.52±1.0	68.18±0.99	5.49
Protein (g)	26.85±0.06	25.68±0.28	23.75±0.26	29.86±0.15	30.99±0.12	33.35±0.67	36.38±0.80	5.01
Lysine (mg)	866±15.27	876±30.55	903±15.27	873±15.27	870±10	886±5.77	896±5.77	22.14
IVPD (%)	70.64±0.56	71.9±0.32	74.66±0.77	71.09±0.68	73.46±0.01	72.67±0.41	74.74±6.14	2.81

Table 2: Indispensable Amino Acids (per gram of protein) from three major meals and their comparison to the amino acid requirements of adults (WHO/FAO/UNU, 2007)

	Breakfast	Lunch	Dinner	Average	Requirement
Lysine (mg)	32.00	31.75	29.83	31.19 ↓	45.00
Methionine(mg)	29.82	29.81	29.02	29.55 ↑	16.00
Valine (mg)	63.02	63.71	61.08	62.60 ↑	39.00
Leucine (mg)	156.52	157.72	150.70	154.98 ↑	59.00
Isoleucine (mg)	445.70	446.78	429.03	440.51 ↑	30.00
Threonine (mg)	99.60	98.28	94.87	97.58 ↑	23.00
Phenyl Alanine (mg)	95.09	95.39	91.78	94.09 ↑	30*
Histidine (mg)	630.92	630.82	606.17	622.64 ↑	15.00
Tyrosine (mg)	50.06	51.15	48.69	49.97 ↑	30*

* Requirement of Phenyl Alanine + Tyrosine

In Vitro Protein Digestibility (IVPD) of three major meals of seven-days menu of hostel diets



SALIENT FINDINGS

- ✓ The daily intake of protein and lysine were 39.5g and 975.3mg/day and met only 86.5 and 55% of the recommended intakes, respectively.
- ✓ The analysis of individual meals showed that the lysine/g protein of three meals, namely breakfast, lunch and dinner, was 32.00, 31.75 and 29.83 mg g-1 protein and was lower in all the three meals in comparison with the requirement level of 45mg/g of protein. All other indispensable amino acid intakes were more than the requirements.
- ✓ The meals consumed at lunch had maximum *in vitro* protein digestibility (81.9%) followed by the meals consumed at dinner and breakfast. The overall digestibility of the three major meals of young adult women was 74.6%.

CONCLUSIONS AND RECOMMENDATIONS

- ✓ The diets of young women were quantitatively as well as qualitatively poor in protein.
- ✓ In population groups where the dietary supply of essential amino acids is low, it is pertinent to correctly monitor the relationship between dietary requirements and supply of ‘available amino acids’, as deficiency of the latter is likely to restrict protein metabolism.
- ✓ There is a need to shift the objectives of various policies and programs providing subsidised foods from energy sufficiency to nutrient quality sufficiency, of which quality protein should be an integral part.