

Malnutrition in Females: Assessing Nutritional Risk Through Serum Proteins and Inflammatory Biomarkers

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ABSTRACT

Keywords: Females, Inflammatory Biomarkers, Malnutrition, Malnutrition Screening Tool, Serum Protein..

INTRODUCTION

Malnutrition is a critical yet, often under-addressed problem in females encompassing a spectrum of nutritional imbalance that significantly affects immune function, inflammatory responses, and overall metabolic health (Ma *et al.*, 2024) (Aguilar *et al.*, 2024) (Fatyga *et al.*, 2022). Malnutrition is associated with adverse clinical outcomes, characterized by hypoproteinemia, dyslipidemia, increased risk of morbidity, immune dysfunction, infertility, anorexia (loss of appetite), cachexia, cognitive impairment, increased hospitalization and rate of mortality. However, the etiology of malnutrition is complex and multifactorial (Ma *et al.*, 2024) (Allen & Saunders, 2023). Suspected causes of malnutrition are multifaceted including genetic or psychological factor and a variety of environmental factor such as poor lifestyle, medications, low food availability, aging and unhealthy eating habits therefore, it is crucial to identify and intervene factors contributing to the onset malnutrition in females (Allen & Saunders, 2023). Despite the complex pathophysiology, clinical management of malnutrition is challenging due to lack of universally accepted approaches for preventing or diagnosing malnutrition (Gavran *et al.*, 2019).

Consequently, the Global Leadership Initiative on Malnutrition has established criteria to diagnose malnutrition based on weight loss, loss of body mass index (BMI), reduced food intake and inflammation accompanied by screening tool in clinical practices (Fatyga *et al.*, 2022). A validated malnutrition screening tool (MST) was employed to identify participants at risk of malnutrition (Aguilar *et al.*, 2024). The biochemical parameter includes Serum protein levels were measured to evaluate the protein-energy status of the subjects (Paillaud *et al.*, 2022) (Gavran *et al.*, 2019). Concurrently, the inflammatory biomarkers were analyzed to comprehend the role of inflammation as highly valuable in evaluating and predicting the prognosis of malnutrition in females (Fatyga *et al.*, 2022).

RESEARCH AIM AND OBJECTIVE

The prime aim of this coherent study is to investigate the role of serum proteins and inflammatory biomarkers in identifying nutritional risk and malnutrition among females. One of the key parameter of this study is to assist the accuracy, validity, reliability, specificity and sensitivity of screening tools for identifying individuals at risk of malnutrition to assess the impact of environmental factors.

METHODOLOGY

A prospective cross-sectional study was conducted involving total of 150 females. In this analysis, the inclusion criteria requisite females of 20-50 years while participant suffering from any disease condition for instance any malignant condition, chronic diseases, autoimmune disease and mental disorder were excluded from the study. In addition to anthropometric indices, basic information regarding demographic characteristics, dietary habit, health status and nutritional status was evaluated through a self-reported questionnaire.

Nutritional status was assessed using the MST (Malnutrition Screening Tool), to assess malnutrition in adult characterized by two key question: unintentional weight loss and reduce appetite. Each respond is scored and

total score evaluate the risk of malnutrition. MST score less than 2 define normal nutrition and malnourished or at risk with scores above 2.

Biomarkers, such as CRP, Interleukins (IL-6, IL-8 and IL-10), leptin, serum albumin, prealbumin, total cholesterol, Triglycerides, HDL and LDL were measured alongside data on medical history, socioeconomic status, and physical activity. Participant's body weight and height were measured and Body mass index (BMI) is computed by dividing weight (Kg) by height (m²). The serum concentrations of leptin IL-6, IL-8 and IL-10 were measured by the quantitative sandwich enzyme-linked immunosorbent assay. Additionally, kit method were used to measure routine biochemical parameters and serum proteins. All statistical analysis were executed using Statistical Package for Social Science (SPSS Version 25.0)

RESULT AND DISCUSSION

A total of 150 females participated in this cross-sectional study. Notable variation have been observed among two groups in terms of nutritional screening tool. According to MST, malnutrition screening tool 85 individuals had no nutritional impairment, while 65 were malnourished or at risk, with score of ≥ 2 .

Table 1. Biochemical Profile of Normal and Malnourished Females.

Characteristics	MST<2 Normal females (n=85)	MST $\geq$ 2 Malnourished females (n=65)	P value
Clinical Parameters			
Hemoglobin (g/l)	11.85 $\pm$ 0.13	10.21 $\pm$ 0.223	< 0.0001
Creatinine (mg/dl)	0.68 $\pm$ 1.25	0.65 $\pm$ 1.29	0.9869
HbA1c (%)	4.45 $\pm$ 1.18	3.05 $\pm$ 1.16	0.4083
Lipid Profile			
Total Cholesterol(mg/dl)	161.2 $\pm$ 2.68	147.3 $\pm$ 2.67	0.0004
Triglycerides (mg/dl)	119.3 $\pm$ 2.22	105.17 $\pm$ 1.98	0.0001
HDL (mg/dl)	58.8 $\pm$ 1.14	54.01 $\pm$ 0.88	0.0017
LDL (mg/dl)	83.13 $\pm$ 1.65	73.52 $\pm$ 1.42	0.0002
Serum Protein			
Albumin (g/dl)	4.05 $\pm$ 0.04	3.78 $\pm$ 0.03	< 0.0001
Prealbumin (mg/dl)	20.33 $\pm$ 0.38	17.92 $\pm$ 0.27	< 0.0001
Total Protein (g/dl)	7.05 $\pm$ 0.056	6.75 $\pm$ 0.042	< 0.0001
Leptin (ng/ml)	6.20 $\pm$ 0.23	4.82 $\pm$ 0.22	< 0.0001
Inflammatory Markers			
CRP (mg/dl)	0.16 $\pm$ 0.008	0.36 $\pm$ 0.027	< 0.0001
IL-6 (pg/ml)	1.73 $\pm$ 0.08	2.52 $\pm$ 0.17	< 0.0001
IL-8 (pg/ml)	3.48 $\pm$ 0.184	3.47 $\pm$ 0.230	0.9680
IL-10 (pg/ml)	3.96 $\pm$ 0.199	4.85 $\pm$ 0.238	0.0044

Data presented as Mean $\pm$ SEM (Standard Error of Mean).

CRP; C reactive protein, IL-6; Interleukin-6, IL-8; Interleukin-8, IL-10; Interleukin-10.

Specifically our finding demonstrate that the value of all anthropometric measurement, leptin and serum protein including albumin and pre-albumin and Hb, LDL, HDL, TAG and cholesterol were tend to be lower in malnourished females compared to normal weight indicating impaired protein synthesis and altered metabolic processes which are the characteristic traits for malnutrition. On the contrary inflammatory markers including CRP, IL-6 and IL-10 tend to be markedly higher in malnourished individuals, reflecting a state of chronic inflammation. Whereas no significant changes were seen in Creatinine, HbA1c and IL-8 levels.

CONCLUSION

In conclusion, this study demonstrates that assessment of inflammatory markers and serum protein levels practicing comprehensive nutritional screening serve as independent predictor of malnutrition in females. Hence, the integration of blood biomarkers and nutritional screening tools offers a great potential in identifying the risk of malnutrition in females, while increasing the sensitivity and specificity, facilitating early prevention. These key findings emphasize the need for targeted nutritional interventions that address both inflammation and protein deficiency to improve clinical outcomes in malnourished females.

REFERENCES

1. Ma, Y. C., Ju, Y. M., Cao, M. Y., Yang, D., Zhang, K. X., Liang, H., and Leng, J. Y. "Exploring the relationship between malnutrition and the systemic immune-inflammation index in older inpatients: a study based on comprehensive geriatric assessment." *BMC geriatrics*, vol. 24, no. 1, 2024, pp. 19
2. Aguilar, R. C., Malih, N., Abbate, M., Fresneda, S., Yañez, A., and Veny, B. M. "Validity of nutrition screening tools for risk of malnutrition among hospitalized adult patients: A systematic review and meta-analysis." *Clinical Nutrition*, vol. 43, no. 5, 2024, pp. 1094-1116
3. Allen, B., and Saunders, J. "Malnutrition and under nutrition: Causes, consequences, assessment and management." *Medicine*, vol. 51, no. 7, 2023, pp. 461-468
4. Paillaud, E., Poisson, J., Granier, C., Ginguay, A., Plonquet, A., Conti, C., and Bastuji-Garin, S. "Serum leptin levels, nutritional status, and the risk of healthcare-associated infections in hospitalized older adults." *Nutrients*, vol. 14, no. 1, 2022, pp. 226
5. Fatyga, P., Pac, A., Fedyk-Łukasik, M., Grodzicki, T., & Skalska, A. "The relationship between malnutrition risk and inflammatory biomarkers in outpatient geriatric population." *European geriatric medicine*, vol. 11, no. 1, 2022, pp. 383-391
6. Gavran, L., Pavlović, J., Račić, M., Ivković, N., & Bunc, K. T. "Evaluation of biochemical markers effectiveness in elderly malnutrition assessment." *Medicinski Glasnik*, vol. 16, no. 2, 2019, pp. 351-358