Specimen Format for Thesis of the Month

Faculty:	Dr.A.Thirumani Devi, Professor and Former HoD, (Retd) Department of Food Science and Nutrition, School of Home Science.
Department:	Food Science and Nutrition
Branch /Area:	Community Nutrition
Sub Subject Heading:	-----
Candidate's Name: (Surname, First name. Middle name)	Sai Gayathri.H
Candidate Address with email:	Research Scholar, Department of Food Science and Nutrition, School of Home Science, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu. 641043. e-mail id:saigayathrihnair@gmail.com
Title of the Thesis:	Triple Burden of Malnutrition in Young Adult Women (18-21 years) and the Effect of Nutrition Interventions on their Nutritional Status and Nutritional Knowledge
(i) in Roman Script	----
(ii) in Roman Script	----
Nomenclature of Degree : Ph.D/D.Phil M.D ,D.Litt/D.Sc./L.L.D	Ph.D in Food Science and Nutrition
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Name of Supervisor(s):	Dr.A.Thirumani Devi
Designation of Supervisor(s)	Professor
Centre/ Department/School in which Research was conducted:	Mercy College, Palakkad and Department of Food Science and Nutrition, School of Home Science, Avinashilingam Institute for Home Science and Higher Education for Women,

	Coimbatore, Tamil Nadu. 641043.
University's Name & Address:	Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu. 641043.

Abstract (within 300 words):

The research titled "Triple Burden of Malnutrition in Young Adult Women (18-21 years) and the Effect of Nutrition Interventions on their Nutritional Status and Nutritional Knowledge" addresses a pressing global health issue. The Triple Burden of Malnutrition, included the dimensions of underweight, overweight, and micronutrient deficiencies. It is expected to affect over 2 billion people worldwide, leading to increased healthcare costs and perpetuating cycles of poverty. The study focuses on young adult women, a neglected demographic in existing research studies, analysing the demographic conditions that contribute to the prevalence of triple burden of malnutrition and educate them about its consequences and develop dietary interventions to improve their nutritional status.

The study was carried out in five phases, starting with a demographic study at Mercy College in Kerala, where 570 young women participated. The assessment of nutritional status utilized anthropometric measurements, biochemical estimations, clinical examinations, and dietary intake evaluations. The study developed and validated nutrition education modules and dietary supplements tailored to address malnutrition. The effectiveness of these interventions was evaluated through pre- and post-assessments of nutritional knowledge and health indicators. Statistical analyses were conducted using SPSS to determine the significance of the interventions. Findings indicated a high prevalence of malnutrition among subjects, with notable deficiencies in micronutrients despite adequate macronutrient intake. Three dietary supplements were formulated and tested for acceptability and cost-effectiveness, revealing significant potential for improving nutritional status among young adult women.

The results demonstrated that the nutrition interventions in the form of Dietary Supplements and Nutrition Education made an impact on the nutritional status and nutritional knowledge of the selected subjects in the Experimental group as the p value is less than 0.05 for the t test which was carried out for the pre and post values for different parameters (viz) Anthropometric measurements and Blood parameters. The results of KAP study shows that there is an effect of nutrition interventions on the nutritional knowledge of the selected subjects in the Experimental group as the t-test showed a p value which is less than 0.05 for knowledge and attitude. The chi-square test and Karl Pearson Correlation showed an association between different parameters (viz) Nutrient intake, Blood parameters, Anthropometric measurements and Socio-economic profile.

i) Major Objectives:

To:

- Study the effect of nutrition interventions on nutritional status and nutritional knowledge of the selected young adult women.
- Study the socio-economic profile and dietary pattern of the selected young adult women in the age of 18-21 years.

- Assess the nutritional status of the selected young adult women.
- Develop and validate nutrition education modules for nutrition education.
- Standardize and evaluate nutrient content, shelf life and cost of the formulated Dietary Supplements.

i) Hypotheses:

- Nutrition interventions has a great effect in bringing down Triple burden of malnutrition in young adult women (18-21 years)

ii) Methodology:

The study consisted of 5 phases. In the first phase of the study was conducted at Mercy College in Palakkad, Kerala, on the basis of, its accessibility and availability of young adult women aged 18-21 years, which aligned with the research study's requirements. The selection was further influenced by the cooperative attitude of the college authorities, who showcased strong coordination with the researchers. Importantly, the subjects from the institution were willing to participate in the study, having obtained permission from both their parents and the institution itself. This combination of factors - suitable demographics, institutional support, and participant willingness made Mercy College an ideal location for the research study.

In the second phase, the study assessed the nutritional status of selected subjects using a comprehensive approach. This included four key methods: anthropometric measurements to evaluate physical characteristics, biochemical estimation to analyze nutrient levels in biological samples, clinical examination to identify visible signs of nutritional deficiencies, and quantitative dietary intake assessment to understand food consumption patterns. This multi-faceted approach allowed for a thorough evaluation of the subjects' nutritional health, combining physical, biological, clinical, and dietary pattern.

In third phase, this study outlined a comprehensive nutrition intervention program addressing the triple burden of malnutrition. It involved two main components: first, the development and evaluation of dietary supplements, including their development, sensory evaluation, cost effectiveness, nutrient analysis, and shelf-life analysis. Second, the creation and implementation of an educational initiative, which encompasses developing and validating nutrition education modules, providing health education and personalized diet counselling to the selected subjects, creating a website for lifestyle modification awareness, and using WhatsApp groups for ongoing monitoring and evaluation. This multi-faceted approach combined direct nutritional support with extensive education and digital outreach, aiming to effectively address malnutrition issues and promote healthier lifestyles among the study subjects.

In fourth phase, the study evaluates the effectiveness of a nutrition intervention program through two key aspects. Firstly, it assessed the effect of dietary intervention on the nutritional status of the selected subjects, likely comparing physical and biochemical indicators before and after the dietary intervention for the period of 90 days. Secondly, it examined how nutrition education influenced the subjects' nutritional knowledge, using KAP (Knowledge, Attitude, and Practice) study to measure changes in understanding of dietary principles. By combining these two elements, the research aimed to provide a comprehensive view of the

intervention's success, addressing both the practical improvements in nutritional health and the enhancement of nutrition-related knowledge among the selected subjects.

In fifth phase, the data was consolidated and analysed with appropriate tools using SPSS. Descriptive measures were analyzed using percentage, Mean and Standard Deviation and Categorical variables were compared using the Karl Pearson $\chi 2$ test. Continues variable was analyzed by Karl Pearson Correlation. Comparison of means performed using independent sample T- test. Paired t-test was performed to determine the significance of the effect of interventions using pre and post intervention. One way ANOVA (analysis of variance) was used to find out the statistical significance among the three variations of the developed dietary supplements.

iii) Findings:

The study involved 570 young adults (aged 18–21), with a majority being urban residents (71 per cent), unmarried (85 per cent), and from nuclear families (72 per cent). The religious composition was fairly balanced among Christians (41 per cent), Hindus (29 per cent), and Muslims (30 per cent). Most fathers were postgraduates (37 per cent) and government employees (53 per cent), while over half of the mothers were graduates (58 per cent), with 21per cent in government jobs. Socio-economic status, assessed via the revised Kuppuswamy scale, showed 71per cent were lower-middle class, highlighting economic challenges that could impact nutrition and health outcomes. The findings emphasize that family income plays a significant role in shaping nutritional status and overall well-being.

Anthropometric data revealed a mean height (154.83 cm) below, and mean weight (57.35 kg) above, ICMR-NIN standards for women. Strikingly, 69per cent were underweight (BMI <18.5), while 14per cent were overweight and 5per cent obese, indicating a dual burden of undernutrition and overnutrition. Waist-hip ratio (WHR) was within normal limits for most, but 37per cent had WHR between 0.76–0.8[paste.txt].

Biochemical tests showed 37per cent had anaemia (Hb <12 g/dl), 16per cent had low calcium, and among the anaemic, 53per cent had folic acid deficiency and 47per cent iron deficiency. Clinical symptoms included headaches (54 per cent), hair loss (30 per cent), fatigue (14 per cent), and visual problems (12 per cent), all suggestive of nutritional deficiencies

Dietary analysis revealed only 48per cent consumed a varied diet daily, while the rest had monotonous eating patterns, increasing the risk of malnutrition. The 24-hour recall indicated excessive intake of energy, carbohydrates, protein, and fat, but significant deficiencies in iron, calcium, folic acid, vitamin A, vitamin C, and dietary fiber. This pattern reflects a coexistence of overnutrition (excess macronutrients) and micronutrient deficiencies.

Three dietary supplements—Sprouts Tikki, Ragi Brownie, and Nutri Ball—were formulated to address these nutritional gaps. Sensory evaluation showed high acceptability for specific variants (ST1, RB1, NB3), all of which were cost-effective (each ~Rs 22–23 per 100g). Nutrient analysis confirmed these supplements as rich sources of fiber, iron, calcium, and folic acid. Shelf-life studies found they remained safe and palatable for up to 7–10 days.

Dietary intervention with these supplements led to significant improvements in BMI and iron status among experimental groups ($p<0.05$), while no significant change was observed in WHR—likely due to the short intervention period. These results underscore the effectiveness of targeted, affordable dietary interventions in improving nutritional status among young adults.

Examiners:

Internal Examiners:

Dr. Abha Khetarpal,

Retd. Officiating Principal and Associate Professor,

D.A.V College for Girls,

Yamuna Nagar, Haryana, 135001.

External Examiners:

Dr. Haleama Al Sabbah,

Associate Professor,

Department of Public Health Science,

College of Health Science,

Abu Dhabi University, UAE.

Dr. A. Thiruvasi Devi.