

Effectiveness of Ayurvedic Program in Managing Hair Loss Associated with Iron Deficiency Anemia among Nursing Students

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Abstract:

Background: Iron deficiency anemia is an important public nutritional health problem. Severe depletion of serum iron levels leads to hair loss. **Aim:** This study was conducted to assess the effectiveness of the Ayurvedic Program in managing hair loss associated with iron deficiency anemia among nursing students. **Design:** A quasi-experimental design was utilized. **Setting:** data were collected from the Faculty of Nursing, Menoufia University, Egypt. **Sample:** A purposive sample of 145 nursing students who were diagnosed with iron deficiency anemia and had hair loss. **Tools:** Four tools were used to collect data: Tool (I): a structured interviewing questionnaire, Tool (II): the IRONIC-FFQ, Tool (III): a Hair Loss Questionnaire, and Tool (IV): Bio-physiological measurements. **Results:** The mean age of the female student participants was 18.64 ± 0.62 years. Post implementation of the Ayurvedic program, there was a significant improvement in the mean total knowledge level compared to before the Ayurvedic program (23.46 ± 3.85 vs. 16.1 ± 2.40 , respectively). Moreover, there were significant increases in hemoglobin level, mean cellular volume, hematocrit, serum iron, and ferritin post-Ayurvedic program than before ($p < 0.01$). **Conclusion:** The findings of this study indicated that the Ayurvedic program effectively manages hair loss associated with iron deficiency anemia among nursing students. The implementation of the Ayurvedic program resulted in significant positive changes in hemoglobin, mean cellular volume, hematocrit, serum iron, and ferritin. **Recommendation:** Public health awareness should be initiated to raise awareness about the Ayurvedic program and the relationship between iron deficiency anemia and hair loss.

Keywords: Ayurvedic program, Deficiency Anemia, Hair Loss, Iron, Nursing Students.

Introduction

A common nutritional disorder that affects people of all ages worldwide is iron deficiency anemia (IDA) (WHO, 2020). It is defined as a drop in hemoglobin, hematocrit, and/or red blood cell levels that are leading to various health consequences. Hair loss is one possible outcome that has drawn interest. Low iron levels can cause the follicles to receive less oxygen, which weakens the hair shafts and increases hair shedding. Although hair loss is not a life-threatening complication, it can significantly affect a person's sense of self-worth, body image, and general well-being (Pasricha et al., 2021).

Nursing students, who frequently have demanding schedules and may disregard their nutritional needs, are more likely to develop iron deficiency anemia, which can lead to hair loss. For nursing students, who are already under considerable stress and pressure, experiencing hair loss can add a burden to their daily lives. Furthermore, hair loss may impair their body and confidence, thereby affecting their relationships with patients and colleagues (Camaschella, 2022).

Despite Egypt's Adolescent Anemia Prevention Program, iron deficiency anemia remains a health issue that must be addressed in order to enhance adolescent girls' health. Iron deficiency anemia is a severe health concern in Egypt, representing 59.3% in Upper Egypt. A study of 932 females in Egypt found that 30.2% of them had IDA (Camaschella, 2022). Recent research has revealed that lifestyle modifications are more beneficial in preventing and treating anemia (Abuaisha et al., 2020). A certain lifestyle approach focuses on attaining energy balance or a shortage of energy for weight loss, consuming healthy fats, improving fruit and vegetable consumption, selecting foods high in whole grains, decreasing consumption of junk food, increasing daily physical activity, lowering the risk of chronic disease, and the Ayurvedic program (Cappellini & Motta, 2019).

Nursing interventions can play a crucial role in reducing hair loss among nursing students with iron deficiency anemia. Nurses have the knowledge and abilities to evaluate clients' nutritional condition, identify iron deficiency anemia, and give appropriate therapies. These interventions may involve nutritional counseling, encouraging an iron-rich balanced diet, educating nursing students about iron supplementation, and evaluating their treatment response (El-Kholy et al., 2021).

Moreover, nurses can provide emotional support, education on stress management techniques, and encourage self-care practices such as massage to mitigate the psychological impact of hair loss. By implementing these nursing interventions, it is possible to improve the overall well-being of nursing students, reduce hair loss, and enhance their academic and clinical performance (Dugan et al., 2021).

Massage has been employed as a systematic healing approach by almost every civilization, most notably the Egyptians, Greeks, Romans, Japanese, Chinese, and Indians. Ayurveda is the only ancient and scientific scripture that is utilized to prevent stiffness, boost circulation, and promote overall health (Cappellini & Motta, 2019). Ayurvedic massage is a synchronized massaging of the body by using a simple application of oil toward the direction of the movement of arterial blood. Scalp massages are an old Ayurvedic program. The human body contains 108 essential spots known as Marma points, which help in draining, cooling, and releasing pressure in the head area. Massaging these pressure areas increases blood circulation and promotes healthier, stronger hair growth (Badyal & Malhotra, 2022).

Therefore, conducting a study to investigate the effectiveness of nursing interventions in reducing hair loss in this population is warranted. The findings from such a study can contribute to the development of evidence-based nursing interventions tailored to the specific

needs of nursing students, ultimately improving their overall well-being and academic success.

Significance of the study

Anemia affects more than 1.6 billion individuals worldwide, making it one of the most prevalent dietary deficiencies. Adolescent girls had a higher incidence of anemia (39.9%), iron deficiency anemia (30.2%), and iron deficit without anemia (11.4%) (WHO,2022). More effort is required to establish programs and treatments to prevent and cure anemia across the world. The World Health Organization aims to reduce anemia prevalence by 50% by 2025. Anemia should be managed properly in order to improve quality of life and reduce complications. Nursing care standards may be raised and empower nurses in care provision and its sequelae can be strengthened by offering evidence-based nursing intervention (Cappellini et al., 2020). The results can enhance nursing care standards, education, application of Ayurvedic massage, and policies to improve the

$$n = \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{ES} \right)^2$$

management of hair loss and outcomes of iron deficiency anemia.

Purpose of the study: The present study aimed to determine the effectiveness of the Ayurvedic program in managing hair loss associated with iron deficiency anemia among nursing students.

Operational definition:

Ayurvedic program

It is a type of nursing education that was given to nursing students. It involves a combination of scalp massage, dietary modifications, and lifestyle changes.

Hypotheses:

1. Nursing students will exhibit improvement in their knowledge level post-Ayurvedic program than before.
2. Nursing students will exhibit improvement in their mean iron dietary intake post-Ayurvedic

program than before.

3. Nursing students will exhibit a significant decrease in items of hair loss history post-Ayurvedic program implementation than before
4. Nursing students will exhibit improvement in their mean laboratory values post-Ayurvedic program than before

Subjects and methods

Research design:

A quasi-experimental design (one group pre and post-test) was used to accomplish the study.

Research Setting:

The current study was conducted at the Faculty of Nursing, Menoufia University, Egypt.

Study sampling:

A purposive sample of 145 female nursing students who had iron deficiency anemia and complained of their loss was included in this study.

The researchers called the parents of the study samples to get their consent for the students to participate in the study because they were not of legal age.

Sample size calculation:

Given a 95% confidence interval, a 0.5 standard deviation (anticipated variance), and a 5% margin of error, the sample size was calculated as follows.

where α is the selected level of significance and $Z_{1-\alpha/2}$ is the value from the standard normal distribution holding $1-\alpha/2$ below it, $1-\beta$ is the selected power, and $Z_{1-\beta}$ is the value from the standard normal distribution holding $1-\beta$ below it and ES is the effect size. The predicted sample size was increased to take into account any potential expected dropouts (10%).

Inclusion criteria:

Female nursing students aged between 18- 20 years who had iron deficiency anemia and complained of hair loss were included in the study. Diagnosed as having iron deficiency anemia by the physician participating in the study after undergoing blood tests.

Tools of data collection:

-Tool (I): Structured interviewing questionnaire: this instrument was utilized by researchers to assess student's sociodemographic data and their knowledge. It includes the following two parts.

-Part one: Sociodemographic data: It included six items about the student's age, marital status, size of their family, number of their family members, income, residence, and family history of hair loss.

-Part two: Knowledge assessment questionnaire: The questionnaire was developed by Abuaisa et al., (2020) to assess students' understanding of iron deficiency anemia (definition, triggers, signs, problems, early detection, iron-rich foods, foods high in vitamin C to boost iron absorption, it included nine open-end questions.

Scoring system: Each question was given a score of three if the response was correct and complete, a score of two if the response was correct but incomplete, and a score of one if the response was wrong or unknown. The total scores were summed, and then converted into percent scores, with a score of <13.5 (>50%) denoting poor knowledge, a score from 13.5–20 (50–75%) denoted fair knowledge and a score of >20–27(>75%) denoted good knowledge.

Tool (II): The IRONIC-FFQ (IRONIC-FFQ—IRON Intake Calculation-

Food Frequency Questionnaire): The questionnaire was developed by Glabska et al. (2017) to show how frequently a limited selection of foods and drinks rich in iron is typically consumed over a selected time. The normal range of food and beverage questions for diet assessment is between 80 to 120.

Scoring system

-The total number of servings was divided into seven days. The formula that was followed was used to predict the consumption of iron from every item:

Iron intake (mg) = daily number of servings ×

typical iron content in 1 serving

-The total daily dietary iron consumption was estimated from all analyzed product groups.

Toll (III): Hair Loss Questionnaire

This questionnaire was developed by the researchers after reviewing related literature (Chanprapaph et al, 2021, Suchonwanit et al, 2019 Rojhirunsakool & Suchonwanit, 2017) to assess studied female students for the history of hair loss and the presence of risk factors. It consists of two parts:

Part one: it includes questions about hair loss risk factors such as the presence of severe stress, regularity of menstruation ----- -- etc.

Part two: it includes questions for assessing hair loss risk factors such as history such as the condition of hair falling out, worsening of hair loss recently, and the presence of bald spots----- etc.

Tool (IV): Bio-physiological measurements.

Bio-physiological measurements to assess iron deficiency anemia by conducting some laboratory investigations (hemoglobin level, mean cellular volume, Hematocrit, Serum iron, and Ferritin) were conducted on all nursing students who have from 18-20 years old and accepted to participate in the study to decide whom will be selected to continue in the study.

Method:

-Ethical considerations and human rights:

The Faculty of Nursing Menoufia University's ethics and research committee (No. 976) provided official clearance for this study. The researchers phoned the student's parents to explain the purpose of the study. They obtained their verbal consent for the students to participate in the study. They explained to them that a blood sample would be taken to examine the presence of iron deficiency anemia. This procedure would be carried out under the supervision of an internal medicine specialist and then requested that their written consent should be sent with their daughters. They were

guaranteed that all collected data would be kept secret and utilized exclusively for the study's purposes. The researchers noted that participation in the study was completely optional, and the students' confidentiality was guaranteed.

-Formal approval: Obtained written authorization from the head of the Medical-Surgical Nursing Department at Menoufia Faculty of Nursing after outlining study objectives.

-Instruments development: The researchers developed all study instruments after reviewing the literature (Chanprapaph et al, 2021; Suchonwanit et al, 2019; Rojhirunsakool & Suchonwanit, 2017), After a comprehensive reviewing the literature, the study instrument was constructed by the researchers while part two from tool(I) and second tool were adopted from Abuaisha et al., (2020) and Glabska et al. (2017) respectively.

-Validity: all study instruments were tested for their content validity by a panel of seven experts specialized in Medical-Surgical Nursing to ascertain and establish their relevance and completeness.

-Reliability: the reliability of the IRONIC-FFQ (IRONIC-FFQ-IRON Intake Calculation Food Frequency Questionnaire) adopted from **Glabska et al. (2017)** investigated the questionnaire's reliability and discovered that the IRONIC-FFQ may be used as a useful instrument for assessing iron intake and analyzing the effectiveness of dietary interventions in young women at risk of anemia. The correlation coefficient was over 0.85. The IRONIC-FFQ was verified and found to have an acceptable level of validity and favorable repeatability. The instruments' consistency was assessed by test-retest and Pearson correlation coefficient calculations. All instruments had reliability scores of 0.74, 0.85, 0.75, and 0.82, respectively.

-Pilot Study: A pilot study was conducted

before data collection on 15 nursing students (10%) to test all instruments for clarity, objectivity, feasibility, and applicability. Also, it was conducted to identify any problem associated with administering the instruments and measure the time needed for data collection, then the necessary modifications were carried out accordingly. Students included in the pilot study were excluded from the current study sample.

Data collection:

-Data was collected from October 2022 to March 2023.

-The program was carried out through four phases as follows (assessment, planning, implementation, and evaluation)

Assessment phase:

-Students who met the inclusion criteria were divided into groups to undergo Biophysiological measurements at a Biomedicine Laboratory under the supervision of the researchers and drew blood samples by venipuncture from the antecubital vein while they were in the sitting position. Hemoglobin level, mean cellular volume, Hematocrit, Serum iron, and Ferritin level were tested. Anemia was defined when hemoglobin <11.5 g/dL. The degrees of iron deficiency anemia were determined by the following criteria: Iron deficiency anemia was concluded when serum Ferritin <12 μ g/L, Mean cellular volume level below 80 fl, and hematocrit level of 35.5%. Iron deficiency anemia was defined according to the World Health Organization criteria (WHO, 2018).

-Students who had iron deficiency anemia were selected and interviewed individually by the researchers in a predetermined office during the university day

-The researchers attended the predetermined office three times/week from 9 AM to 2 PM according to the student's schedule.

-The students' baseline data was collected using all structured instruments: sociodemographic characteristics and their knowledge about iron

deficiency anemia were assessed using instrument one.

-Iron Intake Calculation-Food Frequency Questionnaire (instrument two) was used to assess how frequently iron is consumed in their intake of foods and drinks over a period of one week to show how frequently a limited selection of foods and drinks rich in iron is typically consumed over a selected time. The total number of servings was divided per seven days to estimate the daily number of servings. The iron intake from each product estimate was done using the following equation:

$$\text{Iron intake (mg)} = \text{daily number of servings} \times \text{typical iron content in 1 serving}$$

-The total daily dietary iron intake was obtained as the sum of the iron intake values from all the analyzed groups of products. The normal range of food and beverage questions for diet assessment is between 80 to 120.

-Also, assessing risk factors of hair loss was done using instrument three. Around 20-30 minutes were taken to complete questionnaires for each student.

Planning phase:

-The researchers divided all students into five groups, each group consists of 29 or 30 students according to their lecture schedule. After the student's assessment extensive literature review (Chanprapaph et al, 2021, Suchonwanit et al, 2019 and Rojhirunsakool & Suchonwanit, 2017), was conducted by the researchers formulated nursing interventions. Goals and priority of care were taken first into consideration. An illustrative designed nursing intervention, video, PowerPoint presentations, and brochure were prepared to be introduced to each student as a guide for all data related to the protocol of interventions.

-The researchers planned two teaching sessions for each sub-group, one session/ day.

Implementation phase:

-The researchers interviewed each sub-group in a predetermined office at the previously

mentioned settings for two teaching sessions one session/day for 3 days/week. The first session took about 45 minutes, and the second session took about 30 minutes according to the student's timetable.

-The educational nutritional brochure that was made by the researchers was distributed to each included student at the beginning of the first sessions. It includes information about the meaning, reasons, signs, and risk factors of iron deficiency anemia, and a diet high in iron such as poultry, meat, fish, and green leafy vegetables as well as the significance of iron, dietary supplements, inhibitors (such as drinking tea with meals), and promoters (such as citrus fruits or tomatoes) of iron absorption. Lectures, group discussions, demonstrations, re-demonstrations, and videos were used for illustration.

-PowerPoint presentations were delivered in the student's classroom. The presentation's subjects included (a) the importance of iron in boosting immunity, (b) the hazards of young adult women lacking immunity, (c) iron-rich food products that are low in fat and calories, and (d) dietary alternatives for lactose intolerant or vegetarians. The PowerPoint presentations included photographs of iron-rich foods, iron sources, the RDA for iron for women of a certain age, advice for increasing iron intake, and information on supplementing. Following the PowerPoint presentation, there was an engaging group discussion regarding the difficulty of increasing iron intake through food. At the end of this session, the researchers permitted each student to ask any necessary questions and provided them with the question's answers. This session took about 45 minutes.

The prepared Ayurvedic program was conducted through the following sessions:

-During the first session, the researchers provided each subgroup with knowledge about the value of iron in boosting immunity, suitable iron-rich food items that are lower in fat and

calories, featured images of iron-rich foods, iron sources, and the RDA for iron for the female age group. At the end of this session, the researchers allowed each student to ask any required question and provide them with the question's answers. This session took about 45 minutes.

-At the beginning of the second session, the researchers reinforced the previously received learning knowledge, answered any questions, and explained the Ayurvedic scalp massage to be applied later by each student. Also, the researchers emphasized that the duration of the massage is different according to the length and thickness of the hair. The most recommended oils are olive, sesame, mustard, almond, and coconut. The students were told that the massage should be applied for 20 minutes once every other day for 12-16 weeks. The researchers turned on a video after completing the instruction. This session took about 30 minutes.

The massage was conducted according to the following steps:

-Step 1: Apply a small amount of warm oil to the crown region and gently dab it with the palm of hands and spread it to the scalp. Then, massage the scalp gently but vigorously with open palms and the flat surface of their fingers rather than their fingertips in tiny circular motions, beginning from the sides and moving upward.

-Step 2: Pull strands of hair from the roots in fistfuls while maintaining knuckles near the scalp. Starting with one hand and moving to the other, start at the top of the neck and work upwards down.

-Step 3: Students were asked to put their right hand's thumb underneath the right occipital region and their left hand's thumb underneath the left occipital region (base of the head). They were asked to use friction or a rubbing motion to loosen the tense muscles. The right hand had to be placed on the right shoulder, and the left hand had to be placed on the left shoulder close

to the neck. Focus was done on contracting and relaxing the student's muscles.

-Step 4: Finally, lightly rub the head with the flat parts of the fingers and thumbs. Students were asked to use an herbal shampoo or dry shampoo powder to bathe their hair. After completing the massage, the researchers presented a video about scalp massage to be sure all steps were mastered.

Evaluation phase:

-All students were evaluated eight weeks after the initial educational intervention to gauge their post-educational knowledge. Immediate post-program assessments of students' knowledge of iron deficient anemia were conducted using instrument one. Additionally, dietary habits concerning IDA were evaluated using instrument two. Each student's hair loss was measured after the program using instrument three. Hemoglobin (Hg), mean cellular volume (MCV), hematocrit (Hct), serum iron (FE), and ferritin levels were assessed for each student after the Ayurvedic program using instrument four.

-A comparison was carried out between the results before and after the implementation of the Ayurvedic program to examine the effect of this intervention in managing hair loss.

Statistical Method

- 1) The collected data were tabulated & analyzed by SPSS (statistical package for the social science software) statistical package version 20 on IBM compatible computer (**SPSS, Chicago, IL, USA**). Mean and Standard deviation reflected the quantitative data while number and percentage (No &%) for qualitative data. The used tests of significance included the Pearson Chi-square test, student t-test, 3-paired t-test, Wilcoxon test, and Spearman correlation test. P value of <0.05 was considered statistically significant.

Results

Table (1): Distribution of socio-demographic characteristics of studied female students,

reveals that the mean age for studied students was 18.64 ± 0.62 years. About two-thirds of them (66.2%, 64.8 %, and 64.8) were single, had four family members or more, and lived in rural areas respectively. The majority of them (83.4 %) didn't have a family history of hair loss.

Table (2): Distribution of total knowledge level of the studied female students' pre and post-implementation of the Ayurvedic program, states that none of the students (0%) had a good total knowledge level pre-Ayurvedic program was highly significantly increased to 71 % post-Ayurvedic program

Figure (1): Mean total knowledge level of the studied female students pre-and post-implementation of the Ayurvedic program, illustrates the improvement of mean total knowledge score among studied students after the implementation of the Ayurvedic program than before (16.1 ± 2.40 pre-Ayurvedic program VS 23.46 ± 3.85 post-Ayurvedic program) with highly statistically significant difference at P value < 0.001 .

Figure (2): Mean total iron intake among studied female students pre-and post-implementation of the Ayurvedic program, presents that there was a highly statistically significant improvement in mean total iron intake among studied students after the implementation of the Ayurvedic program than before 250.21 ± 149.99 pre-Ayurvedic program VS 319.78 ± 141.77 post-Ayurvedic program.

Table (3): Distribution of hair loss risk factors among studied female students, shows that about half of the studied students had severe stress during the past 6 months and regular menstrual periods (46.9% and 57.9% respectively). Also, more than one-third of them shampooed their hair once / week, used hair dye, and used a hair dryer greatly (40%, 34.5%, and 34.5% respectively). The majority of them (95.9%) never chemically straighten their hair.

Table (4): Distribution of hair loss history among studied female students pre and post-implementation of the Ayurvedic program, illustrates that the majority of studied students had hair coming outgrowing of roots, hair breaking off and the hair loss was recently worsening (91.7%, 86.2%, and 73.8% respectively). Approximately all items of hair loss history were highly significantly improved after the Ayurvedic program than before.

Table (5) Distribution of laboratory investigations among studied female students' group pre and post-Ayurvedic program, illustrates that after the Ayurvedic program, there were statistically significant improvements in all laboratory values (hemoglobin, hematocrit, mean cellular volume, serum iron, and ferritin with P greater than 0.01.

Table (6): Correlation between total students' knowledge level and their laboratory investigation values among studied female students pre- and post-Ayurvedic program, shows that there were significant positive correlations between total knowledge level with Hemoglobin, serum Iron, and Ferritin levels post-Ayurvedic program. While there was a highly significant positive correlation between students' total knowledge level and their iron intake post-Ayurvedic program.

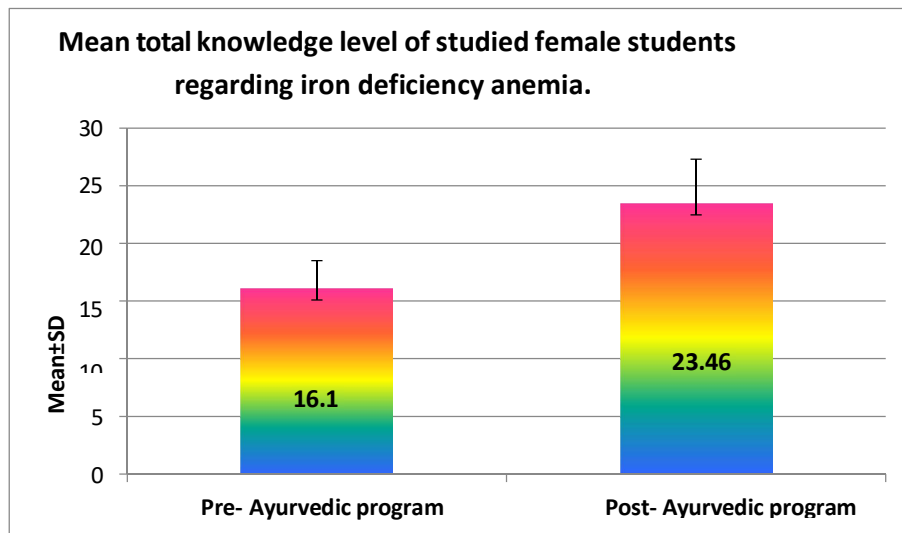
Table (1): Distribution of socio-demographic characteristics of studied female students (N= 145).

Demographic characteristics	Study group (n=145)	
	No.	%
Age (years):		
Mean±SD	18.64 ± 0.62	
Range	18.0 – 20.0	
Marital status:		
Single	96	66.2
Married	49	33.8
Number of Family members:		
2-3	51	35.2
≥ 4	94	64.8
Perceived family income:		
Low	43	29.7
Medium	86	59.3
High	16	11.0
Residence:		
Urban	51	35.2
Rural	94	64.8
Family history of hair loss.		
Yes	24	16.6
No	121	83.4

Table (2): Distribution of total knowledge level of the studied female students' pre and post-implementation of the Ayurvedic program (N= 145).

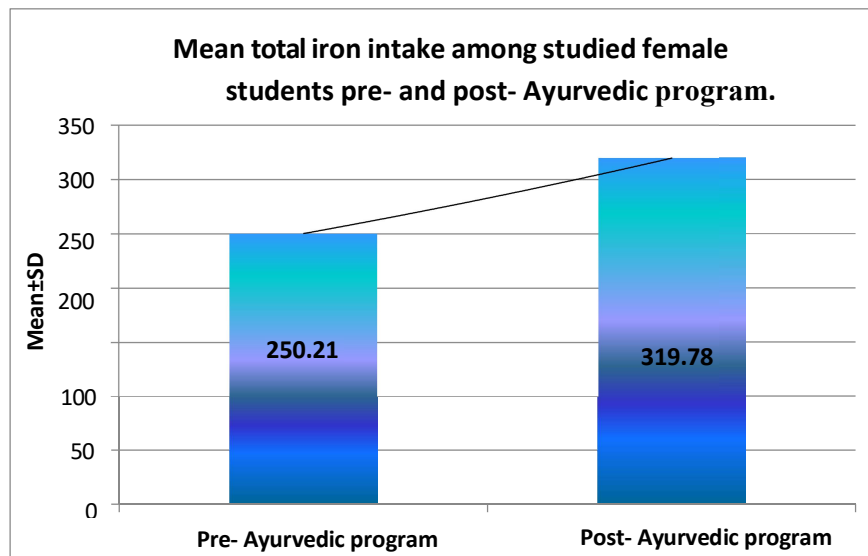
Total knowledge level	Study group (N=145)				X ²	P
	Pre Ayurvedic program		Post Ayurvedic program			
	No	%	No	%		
Poor knowledge	22	15.2	0	0	164.76	<0.001 HS
Fair knowledge	123	84.8	42	29		
Good knowledge	0	0	103	71		

HS: highly significant



Paired t test=20.15 P value<0.001 HS

Figure (1): Mean total knowledge level of the studied female students pre-and post-implementation of the Ayurvedic program (N= 145)



Wilcoxon test=9.24

P value <0.001 HS

Figure (2): Mean total iron intake among studied female students pre-and post-implementation of the Ayurvedic program (N= 145)

Table (3): Distribution of hair loss risk factors among studied female students (N= 145).

Hair risk factors	Studied female students (n=145)	
	No.	%
Percent of severe stress during the past 6 months		
Yes	68	46.9
No	77	53.1
Special diet during the past year		
Yes	23	15.9
No	122	84.1
Regularity of menstrual period		
Yes	84	57.9
No	61	42.1
Is the student a vegetarian		
Yes	23	15.9
No	122	84.1
Frequency of shampooing hair	10	6.9
- Every day.	22	15.2
- Every 2 days.	40	27.6
- Every 3 days.	58	40.0
- Once a week.	15	10.3
- Once every two weeks.		
Using hair dye		
- Yes	50	34.5
- No	95	65.5
Increasing use of hair dryer		
Yes	50	34.5
No	95	65.5
Frequency of chemically processing or straightening hair		
Never.	139	95.9
Once a week.	6	4.1
Presence of dandruff.		
Yes	18	12.4
No	127	87.6

NB: all studied students didn't have any serious illness, psoriasis, or dandruff as well as did not receive general anesthesia.

Table (4): Distribution of hair loss history among studied female students pre and post-implementation of the Ayurvedic program (N=145)

Hair loss history	Study group (n=145)					X ²	P
	Pre Ayurvedic program		Post Ayurvedic program				
	No.	%	No.	%			
Duration of hair thinning							
Day.	15	10.3	15	10.3			
Month.	98	67.6	98	67.6	NA	NA	
Years.	32	22.1	32	22.1			
Hair coming out at the roots							
Yes	133	91.7	50	34.5	102.02	<0.001	
No	12	8.3	95	65.5		HS	
Hair breaking off							
Yes	125	86.2	50	34.5	81.05	<0.001	
No	20	13.8	95	65.5		HS	
Noticing excess hair							
In comb.	57	39.3	34	23.4			
On shoulders.	31	21.4	11	7.6	153.97	<0.001	
In the sink.	27	18.6	2	1.4		HS	
On the pillow.	30	20.7	3	2.1			
None	0	0	95	65.5			
Condition of Hair falling out							
In patches scattered (all over the scalp.	75	51.7	8	5.5	81.05	<0.001	
Mostly over the top of the scalp.						HS	
In other places.	54	37.3	36	24.8			
None	16	11.0	6	4.1			
	0	0.0	95	65.5			
Losing of hair was recently Worsening							
Yes	107	73.8	50	34.5	45.12	<0.001	
No	38	26.2	95	65.5		HS	
Presence of bald spots?							
Yes	35	24.1	6	4.1	23.88	<0.001	
No	110	75.9	134	95.9		HS	
Itching or burning scalp							
Yes	82	56.6	54	37.2	10.85	<0.001	
No	63	43.4	91	62.8		HS	
Site of itching symptoms of the scalp							
In the top.	26	18	8	5.5			
Sides.	37	25.5	15	10.3			
Back.	15	10.3	19	13.1	104.90	<0.001	
Other	4	2.8	12	8.3		HS	
None	63	43.4	91	62.8			

HS: highly significant

Table (5): Distribution of laboratory investigations among studied female students group pre and post-Ayurvedic program (N= 145).

Laboratory values	Studied female students		Paired t-test	P value
	Pre- Ayurvedic program (n=145)	Post- Ayurvedic program (n=145)		
	Mean \pm SD	Mean \pm SD		
Hemoglobin (Hg)	10.24 \pm 0.63	11.67 \pm 0.61	29.80	<0.001 HS
Mean cellular volume (MCV)	84.24 \pm 4.37	85.88 \pm 4.72	11.0	<0.001 HS
Hematocrit (Hct)	29.07 \pm 1.70	30.76 \pm 3.10	8.47	<0.01 S
Serum iron (FE)	39.27 \pm 7.43	41.87 \pm 12.14	3.34	0.01 S
Ferritin	34.55 \pm 9.98	35.17 \pm 9.84	3.34	0.01 S

HS: Highly Significant

S: Significant

Table (6): Correlation between total students' knowledge level and their laboratory investigation values among studied female students pre and post-Ayurvedic program (N= 145).

	Students' knowledge level (Pre- Ayurvedic program)		Students' knowledge level (Post- Ayurvedic program)	
	r (spearman correlation coefficient)	P value	r (spearman correlation coefficient)	P value
P value	-0.08	0.31		
Student's iron intake (Post)			0.35	<0.001 HS
Hemoglobin (Hg) (Pre)	-0.04	0.61		
Mean cellular volume (Pre)	0.04	0.62		
Hematocrit (Pre)	0.01	0.86		
Serum iron (Pre)	-0.10	0.22		
Ferritin (Pre)	0.05	0.50		
Hemoglobin (Hg) (Post)			0.22	0.007 S
Mean cellular volume (Post)			-0.01	0.89
Hematocrit (Post)			0.05	0.50
Serum iron (Post)			0.16	0.04 S
Ferritin (Post)			0.18	0.03 S

HS: highly significant**S:** Significant

Discussion

Nursing students are more susceptible to anemia due to their increased nutrient requirements, particularly for iron as a result of menstruation. The monthly menstrual cycle further increases the risk of iron deficiency anemia. Inadequate nutrition and dietary factors also contribute to the development of anemia, leading to growth impairment, fatigue, and decreased attention. One potential consequence that has gained attention is hair loss. Ayurvedic program is often used in the management of hair loss due to anemia (**Kusuma & Kartini, 2021**).

Approximately two-thirds of the studied students were single and came from families with four or more members. The majority of them did not have a family history of hair loss. Furthermore, about two-thirds of them resided in rural areas. The study findings indicated that a significant proportion of the studied students had an insufficient understanding and knowledge of iron-deficient anemia (IDA). These results are consistent with a study conducted by **Mohamed, et al (2022)** their study aimed to assess the lifestyle of female student nurses with iron deficiency anemia in Cairo. It revealed that more than half of female student nurses had poor knowledge of iron.

Concerning the mean total knowledge level of the studied female students' pre-test and post-test implementation of the Ayurvedic program, the current study indicated a highly statistically significant improvement in mean total knowledge level after the Ayurvedic program than before. This finding aligns with previous studies conducted by **Nhyira et al., (2021)** who studied the “efficacy of nutrition education with an emphasis on the consumption of iron-rich foods on hemoglobin levels among pregnant women” in Northern Ghana. The results showed a substantial improvement in the total mean knowledge score among the study participants following the intervention. This suggests that nutrition

education and Ayurvedic treatment improved their understanding of anemia and iron-rich diets.

Similarly, **Abujilban et al. (2019)**, investigated “the impact of a planned health educational program on the compliance and knowledge of Jordanian pregnant women with anemia” and reported that the educational program effectively enhanced participant's understanding of the meaning of anemia and its management. Along the same line, **Sunuwar et al. (2019)**, in Nepal, who studied the “effect of nutrition education on hemoglobin level in pregnant women” reported significant improvements of knowledge scores after educational interventions related to anemia and nutrition. These results support the first study hypothesis of the current study.

Concerning mean total iron intake among studied female students pre-and post-nutritional education, the present study stated a highly statistically significant increase of mean iron intake among studied female students after the implementation of Ayurvedic program than before. This finding suggests that the Ayurvedic program intervention had a positive impact on the participants' iron intake. This finding is consistent with those done by **Abu-Baker et al. (2021)**, who studied “The impact of nutrition education on knowledge, attitude, and practice regarding iron deficiency anemia among female adolescent students in Jordan” and reported significant improvements in dietary knowledge and iron intake among pregnant women after educational interventions. These results support the second study hypothesis.

However, the result contradicts **Ahmed et al. (2021)**, who studied the “effect of health promotion instructions regarding iron deficiency anemia on young pregnant women's knowledge and practice” in Egypt and found no significant variation in dietary

iron consumption among anemic women before and after the intervention. Another study that contrasts with the finding is the study conducted by **Sunuwar, et al. (2019)**, who examined "the impact of educational interventions on knowledge and behavior related to iron deficiency anemia among adolescent girls in rural India." They found no significant improvement in dietary iron consumption among the participants following the intervention.

This discrepancy could be attributed to several factors, including differences in study design, intervention strategies, participant demographics especially the first study was done on pregnant women who had an extra need of iron than female students, and cultural contexts between the two studies. Moreover **Sunuwar, et al. (2019)**, study focused on adolescent girls in rural India, whereas the current study focuses on female students undergoing the Ayurvedic program. Additionally, the educational interventions and the methods used to assess knowledge and dietary practices may have variations between the two studies, leading to different outcomes. It was known that the duration of menses hadn't a significant effect on the prevalence of anemia, but a longer duration of menses and irregular menstrual periods will lead to more blood loss and as a result, the female will be more likely to develop anemia. Regarding hair loss history among studied female students pre-and post-implementation of Ayurvedic program, the current study illustrated that highly statistically significant improvements were observed post-Ayurvedic program regarding almost all items of hair loss history than before. Supporting these results a study was conducted by **Mishra et al. (2024)**, who studied "a clinical investigation on the safety and effectiveness of Ayurvedic hair oil in controlling hair fall in healthy adult human subjects" in India and found significantly decreased hair fall, promoted hair growth, and

improved scalp health after Ayurvedic program. This may be a result of increasing blood supply to the scalp and reducing dandruff.

The findings of the current study revealed a significant increase in the mean blood hemoglobin level after the program than before. This result is consistent with previous studies conducted by **Abd- El Mageed et al. (2017)**, who studied "the impact of management protocol on pregnant women with iron deficiency anemia using health promotion model" in Egypt and **Sunuwar et al. (2019)**, who stated a significant rise in mean hemoglobin level among pregnant women following nutritional interventions. From the researcher's point of view, Ayurvedic program interventions that include education about the importance of increasing iron intake have the potential to positively impact dietary behaviors and increase iron intake, which is essential for preventing iron deficiency anemia this report supports the findings of the current study which revealed that about half of studied students had irregular menstrual period. Also, the current study revealed that about half of the studied students had severe stress during the past 6 months. This finding is supported by a study conducted by **Hamed et al. (2018)** in Damanhour City, Egypt, titled "Risk factors and nutritional assessment among early adolescent girls with iron deficiency anemia," which also demonstrated similar results.

Moreover, the present study identified a significant increase in serum iron and ferritin levels among studied female students post-Ayurvedic program than before. This finding aligns with **Mishra et al. (2024)** who found a significant increase in serum iron level and ferritin levels post-Ayurvedic program than before. Similarly, **Neeru et al, (2020)** studied the "concept of hair problems and its treatment in Ayurveda" in the United Arab Emirates and found Ayurvedic program had a significant

effect in managing hair loss associated with iron deficiency anemia. This indicates that the implementation of Ayurvedic program resulted in a significant improvement in participants' knowledge level

Positive changes in many bio-physiological parameters, such as hemoglobin, iron, and serum ferritin. Levels. These findings support the fourth research hypothesis.

Regarding the correlation between students' knowledge levels and their lab investigation results before and after Ayurvedic program, the current study found significant positive correlations between total knowledge level and hemoglobin, serum iron, and ferritin levels after the program. Supporting these findings, **Hamed et al. (2018)** discovered substantial favorable connections between overall student knowledge level and lab investigation outcomes in pre- and post-Ayurvedic programs. These findings may be connected to raising students' understanding of the need to adhere to prescribed nutritional consumption, which can enhance test results.

Conclusion

The findings of this study indicated that the Ayurvedic program shows effectiveness in managing hair loss associated with iron deficiency anemia among nursing students. The implementation of the Ayurvedic program resulted in a significant improvement in participants' knowledge level and positive changes in various bio-physiological measurements, including hemoglobin level, mean cellular volume, hematocrit, serum iron, and ferritin. These outcomes suggested that the Ayurvedic program can be a valuable approach to managing hair loss related to iron deficiency anemia among students.

Recommendations:

Based on the study results, the following recommendations are proposed:

-Public health awareness and educational initiatives should be initiated to raise awareness about the relationship between iron

deficiency anemia and hair loss. Promoting early detection, timely treatment, and the benefits of Ayurvedic program can help prevent and manage hair loss in individuals susceptible to iron deficiency anemia.

-To enhance the understanding of Ayurvedic program's effectiveness in managing hair loss-related iron deficiency anemia, additional research studies with larger sample sizes and longer follow-up periods are recommended to allow for greater generalizability of results. These studies should also explore the long-term effects, cost-effectiveness, and patient perspectives regarding Ayurvedic interventions.

-Healthcare institutions, particularly nursing education, should consider integrating Ayurvedic program as an adjunctive treatment option for managing hair loss associated with iron deficiency anemia in their nursing program. This can be achieved by incorporating relevant training modules into the nursing curriculum and providing opportunities for students to gain practical experience in applying Ayurvedic program principles in patient care.

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