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Study to Assess the Efficacy of Wheatgrass Juice Therapy Intervention on Haemoglobin Level in Adolescent Anaemic Females

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ABSTRACT: Background and Objectives: Wheatgrass juice is rich in various minerals like iron, magnesium, calcium, phosphorus, antioxidants like beta carotene, and insoluble dietary fibers. It has a significant amount of medicinal value with a rich source of Chlorophyll. The chemical structure of Chlorophyll is almost identical to Haemoglobin. The only difference is that magnesium is a central element in chlorophyll and iron in Haemoglobin. The vital component of wheatgrass helps in building Haemoglobin in our body. Thus, it is used therapeutically for various clinical conditions involving Haemoglobin deficiency and other chronic disorders ultimately it is considered as green blood. Adolescents are susceptible to both macro and micronutrient deficiencies. Adolescent girls are mainly vulnerable groups due to blood loss during menstruation and poor dietary habits. The present study aims to evaluate the effect of wheatgrass fresh juice on the Haemoglobin level of adolescent anemic females. **Materials and Methodology:** 60 subjects were selected with Haemoglobin less than 10mg/dl and divided into two groups. Group 1- Study group was given 30ml of freshly prepared wheatgrass juice on empty stomach daily for 60 days. Where Group 2- Control group were observed with regular activities. **Results**: After 60 days the symptomatic improvement and increase in Haemoglobin level in the study group was noticed as compared to the control group. **Conclusion**: Wheatgrass juice consumption will improve the Haemoglobin levels among anemic adolescent females Index.

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INTRODUCTION

The history of wheatgrass traced back over 5000 years ago, in ancient Egypt and even early Mesopotamian civilizations. The ancient Egyptians found it sacred and applied young leafy blades of wheat for positive health and vitality [1]. Wheatgrass is a Shoot of Triticum aestivum Linn. (Hindi Name- gehun, Kanak, Sanskrit name- godhuma) and it belongs to the family of Gramineae. Common or bread wheat, is widely cultivated almost all over the world. Generally, 15-20 species are recognized, of which 8 have been reported to occur in India [2]. Wheatgrass is freshly juiced or dried into powder for animal and human consumption. Wheatgrass contains a good source of mineral nutrients, a significant amount of iron, phosphorus, magnesium, manganese, copper & zinc, and also a rich source of tocopherols with high vitamin E potency. It stimulates metabolism and its abundance of alkaline minerals helps reduce over-acidity in the blood and gives alkaline nature to blood. Wheatgrass helps restore healthy cells through detoxification [2]. Wheatgrass juice (WGJ) is a liquid form of germinal shoot of wheatgrass. Germinated shoot contains high content of chlorophyll, due to this, it is referred to as green blood[3]. Chlorophyll and Haemoglobin (Hb) molecules share a similar atom structure. Magnesium is the metallic atom in chlorophyll, while the iron is in human blood and Hb. Magnesium found in chlorophyll is beneficial and essential for about 30 enzymes of our body. WGJ is widely used therapeutically for the management of diseases like anemia, thalassemia, inflammatory bowel diseases, etc.

The normal values of Hb in men are 14.0-18g/dL and in females12-16g/dL[4]. Anemia is a clinical condition that results from an inadequate supply of healthy red blood cells to oxygenate the tissues and that results in hypoxia. The most common cause of anemia throughout the world is nutritional deficiencies (iron, vitamin B12, and folic acid).

Adolescence is defined by WHO as the period of life spanning the ages between 10-19 years which is a period where both physical, as well as psychological changes, occur. During childhood, the nutritional needs of boys slightly differ from that of girls. But the difference in the nutritional needs widens after the onset of puberty. Iron requirements peak during adolescence due to rapid growth and an increase in blood volume[5]. Anemia during adolescence influences the development and growth of girls, lessens their focus on everyday tasks, restricts their learning capacity, builds their weakness to dropping out of school, causes loss of craving bringing about diminished nourishment admission and sporadic menstrual cycles, and diminishes physical wellness and future work efficiency [6].

Nutritional anemia is prevalent everywhere throughout the world with an expected one billion individuals being iron deficient.[7] Data from a nationally representative study, the third National Health and Nutrition Examination Survey (2003-2006), indicated that 9% of non-pregnant women between age 12 and 49 had iron deficiency anemia.[8] In India, Recent information from the District Nutrition Project (Indian Council of Medical Research) in 16 regions of 11 states, on the prevalence of anemia in non-pregnant adolescents (11-18 years) showed rates as high as 90.1% with extreme anemia (Hb<7 g/dL) in 7.1%[9]

Anemia in India fundamentally happens because of iron deficiency and is the major nutritional deficiency disorder in the nation today. As per National Family Health Survey (NFHS)–III data, more than 55% of both adolescent men and women are anemic. Adolescent girls specifically are more helpless to anemia because of the rapid development of the body and loss of blood during the menstrual cycle. As per NFHS-III, just about 56% of Adolescent girls aged 15–19 years experience the ill effects of some type of anemia.[10] In Karnataka, as indicated by NFHS-III, the prevalence of anemia among Adolescent girls,15–19 years, is 51.3% incorporating 33.5% with mild anemia, moderate anemia, and 1.3% with severe anemia[11].

In 1970 India was among the very first developing country to take up the “National anemia prophylaxis program” (NAPP) to prevent anemia among women and children. The program was not successful in the prevention of anemia because of various flaws such as side effects (nausea, vomiting, etc.), irregular supply chain of iron and foliate tablets, poor compliance, etc. [12]. This prompts us to look for other alternatives. The use of WGJ therapy can be considered one such alternative because it is a good source of plenty of micronutrients and extensively available, cost-effective, can be easily grown (even at home in trays) in 8 to 10days and fresh juice can be readily extracted every day with minimum.

MATERIALS AND METHODS

Two hundred subjects with ages ranging between 17-19 years participated in the study. They were screened through a routine medical checkup and estimation of hemoglobin. Those satisfying diagnostic criteria for anemia were recruited. They were randomly divided into two groups after screening. Group 1 (n=30) with 30ml of freshly prepared wheatgrass juice on empty stomach daily for 60 days, group 2 (n=30) were observed with regular activities. Assessments were recorded after 30 days and on the day of completion of intervention on the 60th-day

Females with ages ranging from 17 to 19 years.
Subjects were excluded if they are already under medication for anemia and diagnosed with any underline pathology.
The study protocol was approved by the institutional ethics committee and written informed consent was obtained from each subject.
A prospective randomized controlled trial design was used in which each participant was randomly allocated to two groups.

Group-1- Intervention of 30ml of wheatgrass juice
Group-2- Control group

A baseline assessment as was done by the investigator. The subjects were given interventions i.e. 30ml of freshly prepared WGJ given on empty stomach daily in the morning for 60 days. Post assessments were done after 30 days and on the day of completion of intervention on the 60th day. Both the groups followed a similar diet

Subjects who fulfilled the inclusion criteria were shown an information sheet having details regarding the nature and intervention of the study. Subjects were given enough time to go through the study details mentioned in the information sheet. They were allowed to ask any questions and if they agree to participate in the study they were asked to sign the informed consent form which was mainly provided in English /Regional language. All expressed their willingness to participate in the study by giving signed informed consent. Approval was obtained from Institutional Ethical Committee, as all tests were essentially non-invasive. Wheat was grown on several pots every day, as per the standard procedure described by Wigmore, in 1985. 7days old wheatgrass was collected and fresh juice was prepared by the standard procedure described by Wigmore. Each individual was given 30ml (approximately 1 ounce) [13] of freshly prepared wheatgrass juice on empty stomach every day in the morning for 60 days[14].

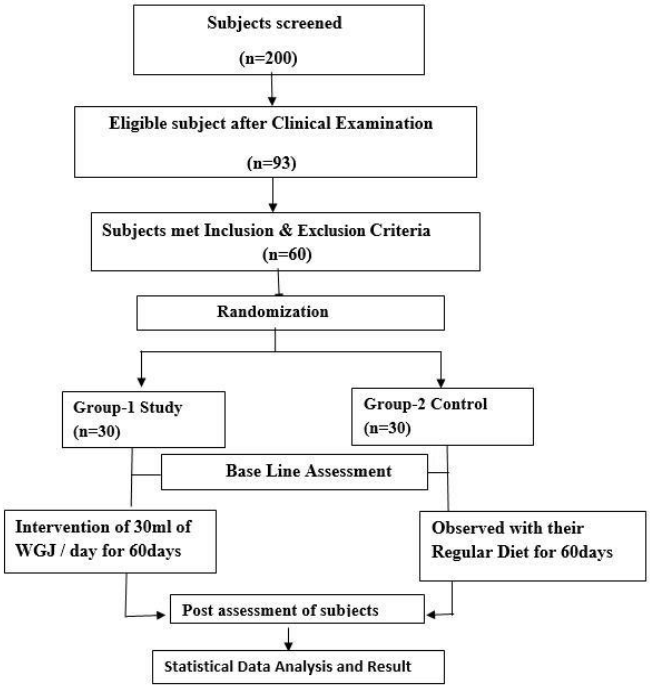

Figure 1: Trial Profile

Assessments

Blood sample collected from the individual was estimated in Alva's health center laboratory accredited from CMC External Quality Assurance scheme under the aegis of ACBI-Lab No.0561 Vellore by cyanmethemoglobin method

Statistical Analysis

Appropriate statistical tests were done to assess mean differences across the baseline (Pre) and following intervention (Post) based on the quality of data. These tests were done using Statistical Analysis Software - Statistical Package for Social Sciences (SPSS for Windows version 16.0)

RESULTS AND DISCUSSION

Hb values are reported for cases and controls. The values are taken for three different periods as before the intervention of WGJ, after 30days, and after 60 days of intervention of WGJ. The Mean Hb values of cases and controls are given in Table 1. It is found that the difference in Hb values was not significant before and even after 30 days of intervention. But after 60 days of intervention, the difference between cases & controls was found to be significant. ($p<0.001$). The mean Hb of cases is 12.606 and control is 9.853.

ANOVA was applied to see the changes of Mean Hb at different time intervals at cases and Controls separately and it was found that there is a significant difference at a different time interval. ($p<0.001$). Hence we applied the Bonferonni t-test to see the significance in the multiple comparisons as shown in the Table 3.

The difference in the Hb values before giving WGJ and after 60 days was taken. It was found that there was a mean difference of 3.013 in cases and only 0.303 in controls. This difference was also found to be statistically significant , in cases $F(2,87) = 181.654$($p<0.001$) and in control $F(2,87) = 11.366$ ($p<0.001$).

In the present study consuming WGJ of 30 ml/day for 60 days showed significant ($p=0.001$) improvement in the Hb levels among anemic adolescent females. Earlier there were few studies conducted to evaluate the efficacy of WGJ on both physiological as well as therapeutic applications shown similar results. In order to develop a holistic approach for the treatment of chronic diseases, scientists and clinicians world over are now a day's conducting extensive studies to evaluate the efficacy of wheatgrass (in the form of powder or juice) and also for the healthier understanding of the therapeutic potential of this medicinal grass[15]. Wheatgrass juice is also declared as green blood due to comprising high chlorophyll content.[3] It contains more than 70% of chlorophyll (which is an important dietary constituent). The chlorophyll molecule in wheatgrass is nearly matching to the Hb molecule in human blood. The only modification is that the central element in chlorophyll is magnesium and in Hb it is iron. It is worked around a porphyrin ring, which happens in an assortment of natural organic molecules. The most interesting group of molecules that contain porphyrin rings are those included in cell respiration or the transportation and utilization of oxygen. These include Hb, myoglobin, and cytochromes. The chemical resemblance between Hb and chlorophyll was initially recommended by Verdel in 1855[16].

Chemists report that the synthesis of haem by animals can occur similarly to the synthesis of chlorophyll in plants.[17] Attributable to the close molecular resemblance between chlorophyll and Hb, it was hypothesized that chlorophyll is nature's blood-building component for every single herbivorous animal and human. This conclusion was strengthened by the perception that animals, which ate just green leafy plants, had adequate measures of Hb in their red blood cells[18]. The pH of the blood and WGJ is same i.e. 7.4. This is the reason for the quick absorption of juice in blood[19]. This protein component of the chlorophyll molecule enhances the body's production of globin which explains the effect of chlorophyll on Hb synthesis[20]. Magnesium found in the chlorophyll of WGJ is also vital and valuable for about 30 enzymes in our body. Chlorophyll has recognized anti-cancer effects in animals and, in the latest study, proved valuable in preventing gastrointestinal absorption of specific aflatoxin, a carcinogenic chemical produced by molds that grow on seeds, nuts, and legumes[21]. This protein component of the chlorophyll molecule enhances the body's production of globin which explains the effect of chlorophyll on Hb synthesis[22]. Although green foods have long been deliberated useful for their "blood-building" qualities, the chlorophyll found in green foods is itself valued for many other therapeutic purposes. The number of surface conditions in which chlorophyll has been effectively utilized would be unbelievable were they not so well do.

Table 1: Hb Values at different time intervals in cases & controls.

	GROUP	N	Mean	T
Before	Cases	30	9.587±0.517	0 .254
	Controls	30	9.550± 0.600	p=0.801 ns
After 30 days	Cases	30	10.593± 0.885	0.624
	Controls	30	10.797± 1.550	p=0.535 ns
After 60 days	Cases	30	12.600± 0.338	17.975
	Controls	30	9.853± 0 .766	<0.001

Table 2: Comparison of Mean Hb values of cases and controls.

Group	Base line	After 30days	After 60days	F (2, 87)	P values
Cases	9.587±0.517	10.593±0.885	12.600±0.338	181.654	< 0.001
Control	9.550±0.600	10.797±1.550	9.853±0.766	11.366	<0.001

Table 3: Intercomparisons: Dependent Variable: Hb Bonferonni

GROUP	(l)TIME	(J) TIME	Mean Difference (l-J)	P
Cases	Before	After 30days	-1.0067	<0.001
		After 60days	-3.0133	<0.001
	After 30days	After 60days	-2.0067	<0.001
Controls	Before	After 30days	-1.2467	<0.001
		After 60days	-0.3033	0.807
	After 30days	After 60days	0.9433	0.003

Table 4: Difference from before to after 60 days

GROUP	N	Mean±Std. Deviation	T
Cases	30	3.013 ± 0.438	26.90800
Controls	30	0.303 ±0.335	<0.001

WGJ decreases transfusion requirements in patients with thalassemia major. Patients with thalassemia consuming WGJ daily reduced on average their necessities for blood transfusion. As shown in a pilot study, which randomly selected patients with transfusion-dependent b-thalassemia in a controlled study to receive WGJ verse the typical procedure of blood transfusions, WGJ was found to have a beneficial effect on the transfusion requirements in 50% of patients. Though there are some inadequacies in this study, the small sample size of 16 patients and the indiscipline of the patients to ingest the WGJ, there is still some suggestion that WGJ reduced the total volume of blood transfused and improved the intervals between blood transfusions, suggesting an increase in red blood cells. The chlorophyll also accounts for arise in energy s similarly as it functions in plants, sunlight excites electrons, which become stored energy as ATP in the cells[21]. Thus consumption of WGJ plays a major role to improve the Hb among adolescent anemic females as well as maintain the good health of the individual, also relieve many health issues.

CONCLUSION

Wheatgrass juice consumption will improve the Haemoglobin levels among anemic adolescent females. Further studies need to be conducted with a larger sample size, for different age groups and gender for its general application. Further research with larger sample with longer follow up required to draw more meaningful conclusions.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors.

ETHICS STATEMENT

This study was approved by Ethical committee of Alva 's college of naturopathy and yogic sciences, moodabidre, D.K ,Karnataka institutional ethical committee.

The authors have taken all the necessary permissions as per ethical guidelines wherever applicable. The authors will be responsible for all the technical content mentioned in the manuscript. Journal and Publisher will not be responsible for any copyright infringement and plagiarism issue.

AUTHOR CONTRIBUTIONS

The entire study was conceptualized, designed and conducted the study with the help of other authors, wrote the first draft of the manuscript, and other authors contributed significantly to the revision of the manuscript. All Authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be constructed as a potential conflict of interest.

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