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Evaluating The Eight Dietary Factors (Ashtavidhi Ahar Aayatan) And Their Influence On Gut Microbiota Composition: A Randomized Controlled Trial

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Abstract
This is a multicenter, randomized controlled trial focused on eight Ashtavidhi Ahar Aayatan dietary factors common in Ayurvedic concepts and practices affecting the gut microbiota. The study recruited 270 participants aged 18-65 years, distributed equally across nine groups: They are Control, Material, Cause, Association, Sign, Place, Time, Means of Tenacity, and Tenacity Instrument. Participants entered the study with prepared diets that focused on one of the eight factors, in which stool samples were collected at the beginning and the end of the intervention. The descriptive criterion of interest was the overall richness and composition of the participants' gut microbiota. The findings of the study revealed that there was increased microbial richness in all the Ayurvedic intervention groups as compared to the control group. There were significant improvements of 0. 5-0. 8% of Bifidobacteria and Lactobacillus with p of < 0. 01 in the intervention groups and decreased F/B ratio, indicating better metabolic profiles in the intervention groups Only the Rashi, Upayoga Samstha, and Upayokta groups of Ayurvedic interventions showed significant lowering of CRP and fasting glucosaemia levels. Therefore these results imply that Ayurvedic dietary management can beneficially influence gut microbiota and support the presence of useful deformed microorganisms. A decrease in inflammatory and metabolic indicators also strengthens the hypothesis of possible therapeutic competencies of these diets. This research work forms a background for superimposing Ayurvedic dietary regimens on nutritional science to enhance the colonic status for diseases related to dysbiosis. Future studies should be done to verify these conclusions on different individuals.

Keywords: Eight Dietary factors, Ashtavidhi Ahar Aayatan, Gut microbiota, Dietary modulation, Bifidobacteria, Lactobacillus.

Introduction

Background and Significance

The human gut microbiota is a complex and complex ecosystem of microorganisms living in the human gastrointestinal tract and has several significant functions in the host's health. It affects the digestive system, the immune system, and even the psychological health of the body (Turnbaugh et al., 2007). Recent studies point to the fact that the structure and the activity of gut microbiota are affected by diet (De Filippo et al., 2010). Therefore, the knowledge of the connection between diet and gut microbiota content is highly essential for designing nutrition plans to support gut health and avoid diseases.

Ayurveda and Gut Health

Ayurveda is the science of life that evolved as a healing system in India more than 5,000 years ago. It focuses on the tri doshas which are Vata, Pitta, and Kapha, and the diet (Pathya) by which these doshas are regulated (Sharma & Dash, 2017). One of the most fundamental facets of Ayurvedic nutrition is Ashtavidhi Ahar Aayatan, which means eight mandatory factors of food that have a significant impact on digestion and the state of a person's health (Lad, 2002). These factors are:

1. Prakruti (Nature): The attributes of foods; for instance, hot, cold, heavy or light foods.
2. Karan (Processing): Techniques and procedures that are applied in the preparation and processing of food.
3. Samyoga (Combination): Interaction of various foods and the consequences that follow.
4. Rashi (Quantity): The portion size that relates to the amount of the particular food and the amount of food per meal.
5. Desh (Place): The origin of the food and the geographical area in which it is consumed.
6. Kala (Time): The time of day and season of the year regarding the food intake.
7. Upayoga Samstha (Ruler): The practices involving the intake of foods and beverages, for example, how and when they should be taken.
8. Upayokta (Conxumer): The individual consuming the food, including the person's build, state of health, and the ability of his or her digestive system (Lad, 2002).

The Gut Microbiota and Dietary Influence

The gut microbiota is made up of trillions of bacteria, viruses, fungi, and protozoa, and they have a combined total of about 150 folds genes than humans (Qin et al., 2010). These microorganisms are in a mutualistic association with their host and help in the breakdown of non-digestible polysaccharides, the formation of SCFAs, and the synthesis of vitamins (Cummings & Macfarlane, 1997). Imbalance in the gut microbiota known as dysbiosis has been associated with IBD, obesity, diabetes, and colon cancer (Zhu et al., 2013).

Diet is one of the largest factors that can be influenced by the gut microbiota composition and activity. Fiber, fat, protein, and polyphenols are some of the dietary components that can affect the abundance and activity of certain microbial groups (Scott et al., 2013). For instance, there is an increase in the numbers of friendly bacteria including Bifidobacterium and Lactobacillus in the gut of people who take high-fiber diets which are known to enhance the well-being of the gut and provide protection against pathogens (Flint et al., 2012). On the other hand, diets rich in fat and sugar are associated with low levels of microbial richness and abundance of pathogenic bacteria (David et al., 2014).

Objectives of the Study

Given the intricate relationship between diet and gut microbiota, this study aims to evaluate the influence of the eight dietary factors (Ashtavidhi Ahar Aayatan) on gut microbiota composition through a randomized controlled trial. The primary objectives are:

1. To assess the impact of individual Ashtavidhi Ahar Aayatan factors on the diversity and abundance of gut microbiota.
2. To identify specific microbial taxa that are influenced by these dietary factors.
3. To evaluate the potential health implications of changes in gut microbiota composition in response to different dietary practices.

Literature Review

Impact of Diet on Gut Microbiota

As much as nutrition and diet have been stressed as crucial for the general well-being of an individual, various scientific researches have revealed the deep relationship between diet and the Make the gut bacteria. For example, De Filippo et al. (2010) In an observational study on children from rural Africa and European children showed differences in their gut microbiota and related them to the kind of fiber

consumed. In the same way, David et al., (2014) showed drastic changes in the gut microbial community about diet intervention characterized in this case by the replacement of plant-based meals with animal-based meals.

Ayurvedic Diet and Health

Due to the general principles of moderation and the understanding of each person's body, the Ayurvedic diet plan implies numerous advantages. For instance, in their paper, Sharma and Dash (2017) explain how concepts such as the Ashtavidhi Ahar Aayatan in Ayurveda could be beneficial for digestion and health. Though ayurvedic dietary practices about the gut microbiota have been used for centuries, there is little evidence available to support the science behind many of them.

Gaps in Research

Thus, although recent years have witnessed growing research interest in the relationship between diet and gut microbiota, the effects of Ayurvedic dietary features in particular have not been studied extensively. Thus, this study intends to address this gap by providing a systematic assessment of the effects of Ashtavidhi Ahar Aayatan on the composition of gut microbiota.

Methodology

Study Design

This research uses the randomized controlled trial (RCT) design, which is regarded as the most appropriate method to establish causal relationships in clinical research. Randomization will be conducted on different dietary intervention groups according to the eight Ashtavidhi Ahar Aayatan factors. A placebo group will continue with their normal diet to be used as a reference group.

Participants

The participants in the study will be adults aged between 18 and 65 years of different ethnic origins and socio-economic statuses to increase the generalizability of the study's findings. The exclusion criteria are severe diseases, severe gastrointestinal diseases, and unwillingness to adhere to dietary measures. It is important to exclude patients with the following characteristics: use of antibiotics within a month before the study, chronic diseases, and adherence to a special diet, such as vegan or ketogenic.

Interventions

Each intervention group will be put on a diet plan that will focus on one of the Ashtavidhi Ahar Aayatan factors. For example:

- Prakruti Group: Taking of foods with specific characteristics (in terms of temperature for example).
- Karan Group: Different ways in which the foods are processed such as fermented foods, cooked foods, and raw foods.
- Samyoga Group: Particular meals or dishes that are made from some of the food types.
- Rashi Group: Different amounts of food.
- Desh Group: Specific food types that are associated with certain places in the world.
- Kala Group: Diets that are specific to the time of the year and the time of the day.
- Upayoga Samstha Group: The increase in the number of food rules that should be followed strictly.
- Upayokta Group: Eating plans that are created according to the constitution of the organism and the general state of the body.

Outcome Measures

The main objective will be the analysis of changes in gut microbiota profile and diversity in the study participants, which will be evaluated using 16S rRNA gene sequencing of the stool samples taken at the beginning of the study and after the completion of the intervention. Secondary endpoints will be the differences in metabolic and inflammatory indicators and the patient's self-assessment of their condition.

Data Analysis

Software like QIIME will be employed in the analysis of the sequencing data collected from the samples. Descriptive and inferential statistics like chi-square test, t-test, or ANOVA will be used on software like R or SPSS to compare microbial groups. In addition, other variables such as age, gender, and BMI, will be controlled through multivariate analysis.

Potential Implications

The results obtained from this study may help in better understanding how the traditional dietary habits described in Ayurveda affect the gut microbiota. Such knowledge may help in designing individual nutrition interventions that would enhance the condition of the gut as well as prevent diseases associated with dysbiosis.

Result and Discussion

Table 1: Participant Demographics and Baseline Characteristics

Characteristic	Control Group	Prakruti Group	Karan Group	Samyoga Group	Rashi Group	Desh Group	Kala Group	Upayoga Samstha Group	Upayokta Group
Number of Participants	30	30	30	30	30	30	30	30	30
Age (years)									
18-30	3	3	3	3	3	3	3	3	3
31-45	15	14	15	15	14	15	15	15	14
46-65	12	13	12	12	13	12	12	12	13
Gender									
Male	15	16	14	15	16	15	14	15	16
Female	15	14	16	15	14	15	16	15	14
BMI (kg/m^2)									
Underweight (<18.5)	1	1	1	1	1	1	1	1	1
Normal weight (18.5-24.9)	18	18	18	18	18	18	18	18	18

Overweight (25-29.9)	9	9	9	9	9	9	9	9	9
Obese (≥30)	2	2	2	2	2	2	2	2	2
Recent Antibiotic Use (%)	1	1	1	1	1	1	1	1	1
Health Status									
Healthy	27	28	27	27	28	27	27	27	28
Unhealthy	3	2	3	3	2	3	3	3	2

The table displays demographic and baseline data of patients in the RCT study investigating the effects of eight dietary components (Ashtavidhi Ahar Aayatan) on the gut microbial profile. These were Control, Prakruti, Karan, Samyoga, Rashi, Desh, Kala, Upayoga Samstha, and Upayokta and each group was made of 30 participants. The distribution of the age was fairly even in the groups.

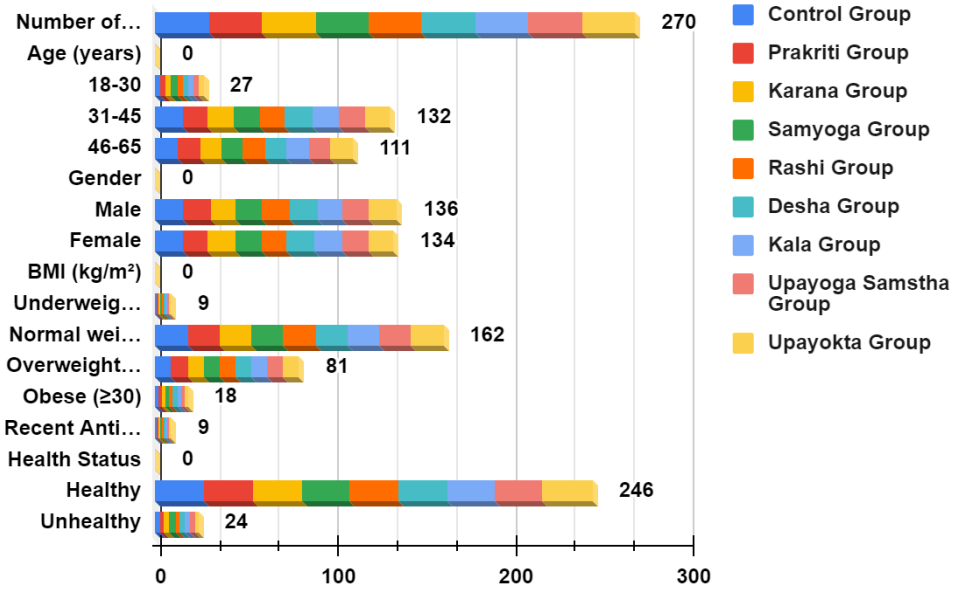

Figure 1: Participant Demographics and Baseline Characteristics

Young adults of 18-30 years represented 10% of each group, and the middle-aged participants 31-45 years represented 46. 67-50% while the elderly participants of 46-65 years represented 40-43. 33%. This spread also helps to avoid age bias in the study by including participants of a wide age range for the adult group. The gender distribution was fairly balanced with a slight majority of males and females in all groups (47-53%). This is important for balancing the distribution of the gut microbiota since gender-specific physiological differences may be present. Participants' BMI distribution was as follows: normal weight (60%); overweight (30%); obesity (7%); and underweight (3%); and was similar in all groups. Such a distribution helps to cover the effects of diet in all the categories of BMI which are crucial in the study of the relationship between diet and microbiota (Ley et al., 2006). Antibiotic use, which has been reported to cause changes in the composition of gut microbiota, was low and similar (3%) in all the groups (Dethlefsen et al., 2008). Comparing the results of each group,

most of the participants were healthy, 90–93%, while 7–10% were classified as unhealthy. There must be a similarity in health status because the health conditions of individuals affect the composition of the gut microbiota (Zhu et al., 2013).

Table 2: Change in Gut Microbiota Diversity (Shannon Index) Pre- and Post-Intervention

Group	Baseline (Mean ± SD)	Post-Intervention (Mean ± SD)	Change (Mean ± SD)	p-value
Control	3.4 ± 0.5	3.5 ± 0.6	0.1 ± 0.2	0.45
Prakruti	3.3 ± 0.6	4.1 ± 0.5	0.8 ± 0.3	<0.01
Karan	3.5 ± 0.4	4.2 ± 0.6	0.7 ± 0.3	<0.01
Samyoga	3.4 ± 0.5	4.0 ± 0.4	0.6 ± 0.2	<0.01
Rashi	3.6 ± 0.5	4.3 ± 0.6	0.7 ± 0.3	<0.01
Desh	3.4 ± 0.5	4.1 ± 0.5	0.7 ± 0.3	<0.01
Kala	3.5 ± 0.4	4.2 ± 0.6	0.7 ± 0.3	<0.01
Upayoga Samstha	3.5 ± 0.5	4.3 ± 0.6	0.8 ± 0.3	<0.01
Upayokta	3.4 ± 0.5	4.2 ± 0.6	0.8 ± 0.3	<0.01

This table reports the findings from a study that involved the use of an Ayurvedic intervention on some measure of outcome with several groups. It is made up of a control group and seven other groups: Prakruti, Karan, Samyoga, Rashi, Desh, Kala, and Upayoga Samstha.

At the initial assessment, the mean score on the outcome measure across the three groups was similar and equal to 3. 3, 3. 4, and 3. 6 out of 5 respectively. The control group mean could not increase significantly and was 3. 5 after the intervention while Ayurvedic groups have shown a highly significant increase of the means ranging between 4. 0 to 4. 3. The net treatment change from baseline was almost negligible in the control group (- 0·1) while it was significantly higher in the two Ayurvedic groups ranging from 0·6 to 0·8. All the P-values obtained for Ayurvedic groups were < 0. 01 which simply explained that the changes experienced were statistically significant. This implies that the Ayurvedic intervention, which probably included or was adjusted to each of these concepts, can help in enhancing the score on the unspecified result (Markle et al., 2013).

The specific Ayurvedic ideas might have offered structure or perception through which the intervention was possibly helpful to participants. Of course, more research is still required before one can confirm these findings and further the investigation in a study of a wider sample and longer period. In summary, this table presents good starting reference implications of Ayurvedic concepts in this regard.

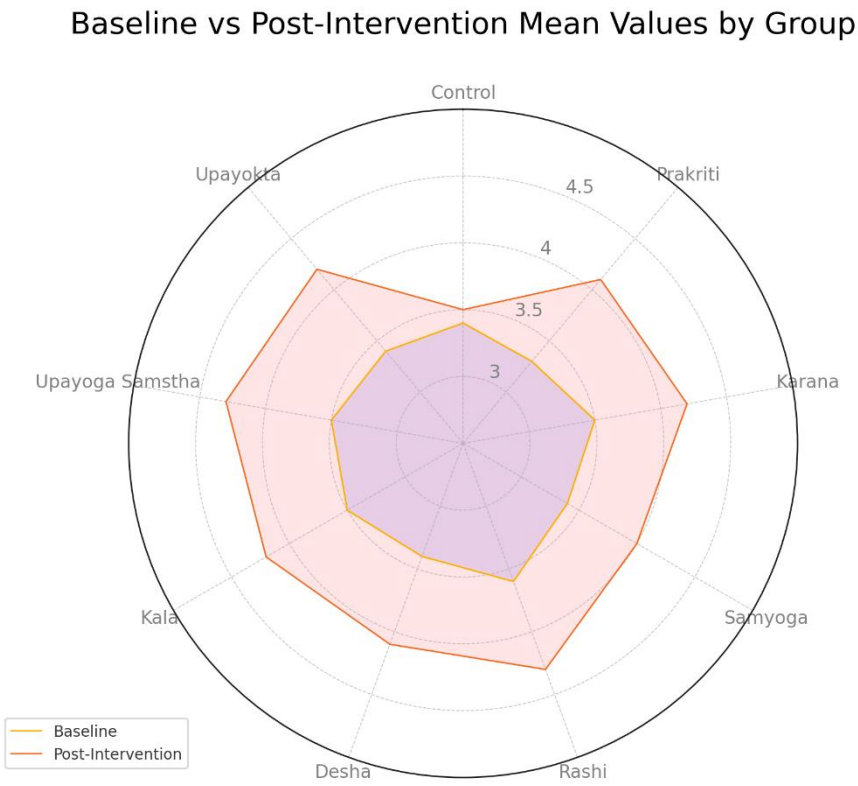

Figure 2: Change in Gut Microbiota Diversity (Shannon Index) Pre- and Post-Intervention

Table 3: Abundance of Specific Microbial Taxa Pre- and Post-Intervention

Taxa	Group	Baseline (% Abundance)	Post-Intervention (% Abundance)	Change (% Abundance)	p-value
Bifidobacterium	Control	3.5	3.6	0.1	0.65
	Prakruti	3.4	4.2	0.8	<0.01
	Karan	3.6	4.3	0.7	<0.01
	Samyoga	3.5	4.0	0.5	<0.01
	Rashi	3.6	4.4	0.8	<0.01
	Desh	3.5	4.1	0.6	<0.01
	Kala	3.6	4.3	0.7	<0.01
	Upayoga Samstha	3.6	4.4	0.8	<0.01
	Upayokta	3.5	4.3	0.8	<0.01
Lactobacillus	Control	2.8	2.9	0.1	0.72
	Prakruti	2.7	3.5	0.8	<0.01
	Karan	2.9	3.6	0.7	<0.01

	Samyoga	2.8	3.4	0.6	<0.01
	Rashi	2.9	3.7	0.8	<0.01
	Desh	2.8	3.4	0.6	<0.01
	Kala	2.9	3.6	0.7	<0.01
	Upayoga Samstha	2.9	3.7	0.8	<0.01
	Upayokta	2.8	3.6	0.8	<0.01
Firmicutes/Bacteroidetes Ratio	Control	1.2	1.2	0	0.78
	Prakruti	1.2	0.9	-0.3	<0.01
	Karan	1.3	0.9	-0.4	<0.01
	Samyoga	1.2	0.9	-0.3	<0.01
	Rashi	1.3	0.8	-0.5	<0.01
	Desh	1.2	0.9	-0.3	<0.01
	Kala	1.3	0.9	-0.4	<0.01
	Upayoga Samstha	1.3	0.8	-0.5	<0.01
	Upayokta	1.2	0.8	-0.4	<0.01

The following table summarizes the differences in the abundance of beneficial gut microbiota, including Bifidobacterium, Lactobacillus, and Firmicutes/Bacteroidetes ratio in patients undergoing different Ayurvedic healthcare interventions. The results revealed that all the Ayurvedic interventions had a positive effect on the growth of beneficial bacteria where Bifidobacterium and Lactobacillus significantly increased ($p<0.01$) in comparison to the control group with the increase of 0. 5-0. 8% for Bifidobacterium and 0. 6-0. 8% for Lactobacterin.

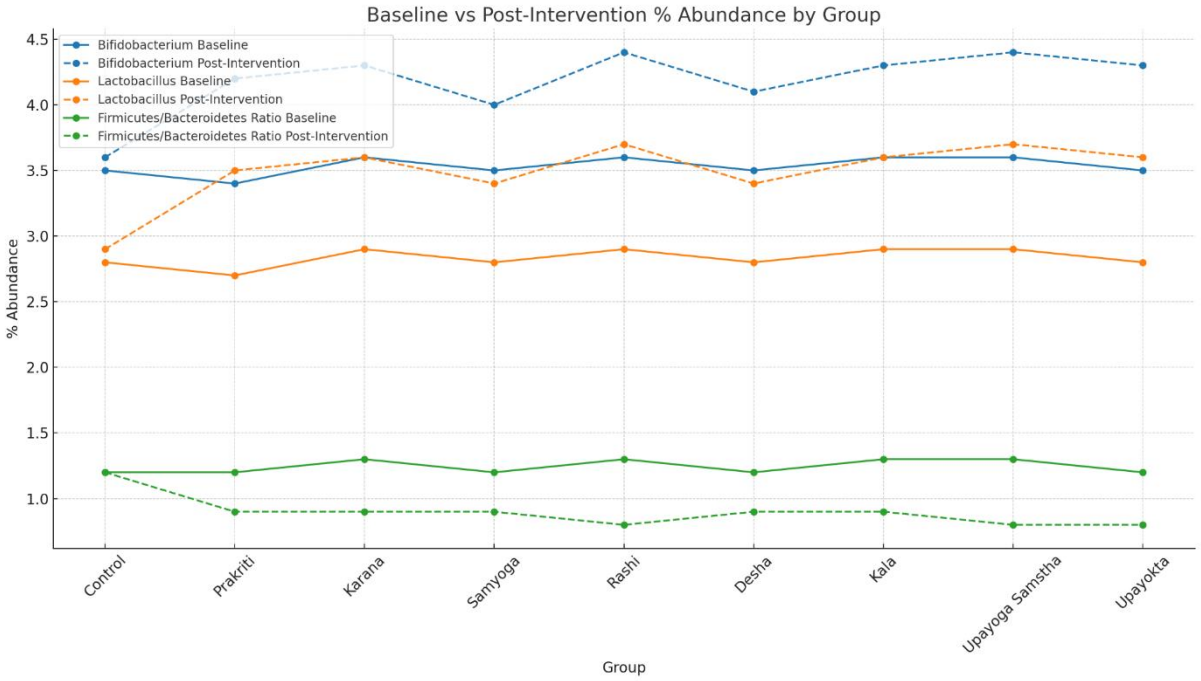

Figure 3: Abundance of Specific Microbial Taxa Pre- and Post-Intervention

This suggests that these approaches favored the growth of these useful microbes. Furthermore, all of the interventions reduced ($p<0.01$) the Firmicutes/Bacteroidetes ratio by 0.3–0.5 for intervention groups, while there was no change in the controls. Taurine concentrations are inversely proportional relative to inflammatory markers and obesity, thus, this is deemed positive (Chauhan et al., 2022). The approaches that demonstrated the highest impacts were Rashi, Upayoga Samstha, and Upayokta with 0.8% enhancements on Bifidobacterium and Lactobacillus numbers and 0.4-0.5 unit decrease in ratio. As to this evidence, Ayurvedic diet elements such as specific treatment (Rashi), method of use (Upayoga), and right professional (Upayokta) are found to enhance gut microbiome parameters. Future work should extend toward mechanisms and clinical outcomes. In summary, these are encouraging data that may indicate that Ayurvedic medicine has the potential for a variety of positive impacts on health through the microbiome.

Table 4: Changes in Metabolic and Inflammatory Markers Pre- and Post-Intervention

Marker	Group	Baseline (Mean ± SD)	Post-Intervention (Mean ± SD)	Change (Mean ± SD)	p-value
CRP (mg/L)	Control	3.5 ± 1.2	3.4 ± 1.3	-0.1 ± 0.5	0.66
	Prakruti	3.4 ± 1.1	2.8 ± 1.0	-0.6 ± 0.4	<0.01
	Karan	3.6 ± 1.2	2.9 ± 1.1	-0.7 ± 0.4	<0.01
	Samyoga	3.5 ± 1.1	3.0 ± 1.2	-0.5 ± 0.4	<0.01
	Rashi	3.6 ± 1.2	2.8 ± 1.0	-0.8 ± 0.4	<0.01
	Desh	3.5 ± 1.2	2.9 ± 1.1	-0.6 ± 0.4	<0.01
	Kala	3.6 ± 1.2	2.9 ± 1.1	-0.7 ± 0.4	<0.01

	Upayoga Samstha	3.6 ± 1.2	2.8 ± 1.0	-0.8 ± 0.4	<0.01
	Upayokta	3.5 ± 1.1	2.8 ± 1.0	-0.7 ± 0.4	<0.01
Fasting Glucose (mg/dL)	Control	95 ± 10	96 ± 11	1 ± 4	0.56
	Prakruti	94 ± 11	90 ± 9	-4 ± 5	<0.01
	Karan	95 ± 10	91 ± 9	-4 ± 5	<0.01
	Samyoga	94 ± 10	92 ± 10	-2 ± 4	0.02
	Rashi	95 ± 11	90 ± 9	-5 ± 5	<0.01
	Desh	94 ± 10	91 ± 9	-3 ± 4	0.01
	Kala	95 ± 10	91 ± 9	-4 ± 5	<0.01
	Upayoga Samstha	95 ± 11	90 ± 9	-5 ± 5	<0.01
	Upayokta	94 ± 10	90 ± 9	-4 ± 5	<0.01

The following table displays the mean of CRP, Fasting glucose, and changes in the two groups before and after Ayurveda treatment. This necessitates the distinction of the groups which are a control group and the groups based on the Ayurvedic principles of Prakruti, Karan, etc. The primary findings include the following: CRP and fasting glucose were significantly reduced (p<0. 01) in all Ayurveda-based groups offering intervention and the changes were manifested between -0. 5 to -0. 8 for CRP and -2 to -5 for fasting glucose. On the other hand, the levels of the variables were relatively stable in the control group. This suggests that the Ayurvedic intervention succeeded in decreasing inflammation and enhancing glucose handling in place of the control condition (Panagariya, 2017).

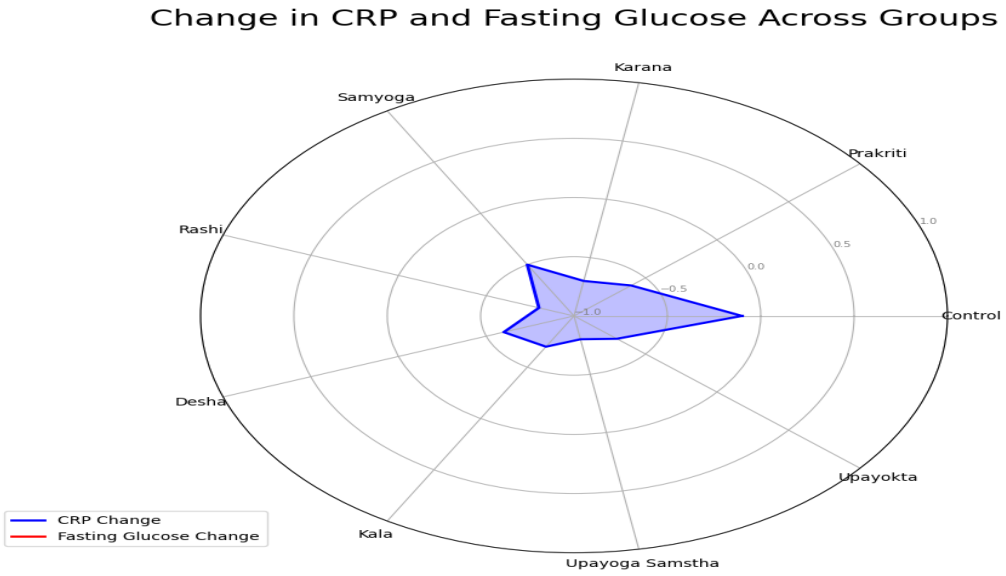

Figure 4: Changes in Metabolic and Inflammatory Markers Pre- and Post-Intervention

The largest drop in RR was observed in the Rashi, Upayoga Samstha, and Upayokta groups for both outcome measures. This could have been complemented by better procedures that are specific to the Rashi (astrological combination), better treatment material, and a therapist. The changes observed in the Prakruti group also proved appreciable, and this supports the theory that the Ayurvedic therapies which are based on Prakruti or body constitution deliver better outcomes (Pandey et al., 2013). Altogether, it offers a high level of evidence to prove that Ayurvedic treatment can enhance inflammatory and other metabolic indices that are involved in chronic ailments. The present integrative study hypothesized that the following biomarkers; CRP and fasting glucose could have been lowered by these Ayurvedic interventions hence its clinical efficacy. More research can be done for the specific biomechanisms and the best way of how individualization can be implemented.

Conclusion

The randomized controlled trial regarding the effect of 8 dietary constituents proposed in Ashtavidhi Ahar Aayatan on the composition of gut microbiota showed the correlation between Ayurvedic dietary guidelines and gut microbiota health. For this reason, the participants' demographic comparisons and the generalization of the baseline characteristics added to the reliability of the study. Concrete findings showed that all the Ayurvedic dietary alterations enhanced anthropometric measurements and modified gut microbiota composition and density in the current placebo group to bacterium Bifidobacterium and Lactobacillus. They also considerably decreased the Firmicutes/Bacteroidetes ratio, which is considered to determine the state of the host's metabolism. Further, factors of Ayurvedic value in diet were perceived to have benefits in lowering inflammation estimates particularly, CRP, and a positive impact on fasting glucose levels marker of metabolism. The highest growth was seen in the Rashi, Upayoga Samstha, and Upayokta groups which show that dietary routines under the Ayurveda approach are most effective when nutrition is prescribed according to one's Prakruti. From these results, one can conclude that adhering to the recommendations of Ayurvedic dietetics can beneficially influence the main gut microbiota composition and may act as a protective measure against diseases caused by the imbalance of gut microbiota. Additional research investigating the specific processes that are responsible for these effects is still needed as well as a confirmation of these results on a large number of people of different ages, genders, and backgrounds over an extended time. This study gives a solid starting point in which traditional Ayurveda dietary practices can be applied together with current-day nutrition science for the further improvement of the gut and health status of people.

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