



Assessment of *Apar Ojas* Expressions in the Subjects of *Madhumeha*; type 2 Diabetes Mellitus Using Self-Developed *Ojas* Assessment Tool (OAT) And Its Evaluation Using Immunological Marker IgG; A Cross-Sectional, Pilot Observational Study

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(Received: 05 January 2026

Revised: 15 February 2026

Accepted: 05 March 2026)

KEYWORDS

Ojas, Dhatu, Bala, Immunity, IgG, Diabetes mellitus

ABSTRACT:

Introduction: Ojas is the quintessential component of the Saptadhatu (the seven fundamental constitutional elements) of the human body. It is a crucial indicator for determining the complete well-being of an individual's body and mind. Assessment of Ojas can comprehensively reveal the physical, mental, and physiological status of an individual at any cross section of time. A decline in the Ojas expression is a chief underlying characteristic observed in the pathogenesis of Madhumeha disease (Type 2 Diabetes Mellitus). This research study attempted to record the same using a self-developed tool for Ojas assessment.

Objectives: The primary objective of this research study was to develop an Ayurveda parameter based subjective proforma that could record the Apar Ojas expressions in both diseased and healthy individuals irrespective of age and gender. The secondary objective was to compare the status of Apar Ojas and immunological marker Serum Total IgG in the diabetic subjects with that of non-diabetic apparently healthy individuals. The study also analysed the associations between the Age, Chronicity of Diabetes, Apar Ojas and Serum Total IgG expressions.

Methods: This research study was a cross sectional, pilot study with a sample size of 40 participants in total. Twenty individuals prediagnosed with Madhumeha (Type 2 Diabetes Mellitus) and twenty apparently healthy non-diabetic individuals were enrolled in this research. Clinical features of Madhumeha as described in Ayurveda classics, Fasting Plasma Glucose concentration (FPG \geq 126mg/dl), Blood Sugar Level (post meal) (PPBS \geq 200mg/dl) and Glycosylated Haemoglobin level (HbA1c \geq 6.5 %) formed the criterion of diagnosis for the enrolment of subjects.

Results: This research study recorded significantly decreased Apar Ojas expression (25.70 v/s 33.65, t-test = 8.43, $p < 0.001$) and significantly increased Serum Total IgG (12.03 v/s 9.77, t-test = 2.79, $p < 0.01$) in the Type 2 Diabetes subjects when compared with expressions in non-diabetic apparently healthy individuals. A significantly hampered Physical Ability (2.35 vs. 2.85, t-test = 2.94, $p < 0.01$), Voice Quality (2.00 vs 2.90, t-test = 4.47, $p < 0.001$), Skin Quality (1.50 vs 2.55, t-test = 4.62, $p < 0.001$), Audition Ability (1.75 vs 2.80, t-test = 5.73, $p < 0.001$), Optical Ability (1.85 vs 2.75, t-test = 4.13, $p < 0.001$), Gustation Ability (2.60 vs 3.00, t test = 2.63, $p < 0.05$), Excretion Ability (1.70 vs 2.80, t-test = 4.67, $p < 0.001$), Libido Ability (1.25 vs 2.40, t-test = 3.83, $p < 0.001$) and Higher Mental Functions Ability (2.70 vs 3.00, t-test = 2.85, $p < 0.01$) was recorded in the Type 2 Diabetes subjects when compared with non-diabetic individuals of this study. However, no significant differences were recorded in the Nutrition Score, Stimulation Ability and the Olfaction Ability of the subjects between the two groups. A moderate positive non-significant association between the age and the Serum Total IgG expressions ($r = 0.433$, $p = 0.056$), a moderate negative significant association between the age and Apar Ojas expressions ($r = -0.465$, $p = 0.039$) and a moderate negative non-significant association between the Apar Ojas and the Serum Total IgG expressions ($r = -0.356$, $p = 0.123$) was recorded in the diabetic subjects in this research study.

Conclusions: The Ojas Assessment Tool (OAT) can help in assessment of Apar Ojas status in individuals of any age or gender. The level of Apar Ojas declines in the patients suffering from Madhumeha. Thus, consideration of Ojas Vardhak Chikitsa (Ojas enhancing treatment) can give additional relief in the diabetic patients. The OAT may be validated through multicentric exploratory study to rule out geographical variables, and by taking larger sample size.

Trial Registration No.: The research study was prospectively registered in the Clinical Trial Registry of India (Registration no. CTRI/2019/10/021564, dated October 9, 2019) and approved by the Institutional Ethical Committee (Protocol number IEC/2018/PG-78).



Introduction

The phenotypical characteristics of Type 2 Diabetes, as quoted in contemporary scientific literature, and the *Madhumeha* disease, as documented in ancient Indian Ayurvedic literature, bear vast resemblance.[1] According to Ayurveda classics, *Ojas* is the quintessential component of the *Saptadhatu* (the seven fundamental constitutional elements) of the human body. There are two variants of *Ojas*: *Par Ojas* (the primary or supreme form of *Ojas*) and *Apar Ojas* (the secondary form of *Ojas*), which exist in an individual's body. The *Par Ojas* is '*Ashtha Bindu*' (8 drops) in amount and is concentrated in the heart of an individual.[2] Its depletion can be fatal for human life. Whereas, the *Apar Ojas* is *Ardha Anjali* ('*Anjali*' is the cavity formed by putting two hands together of individuals, such that it can hold maximum quantity of any liquid. '*Ardha anjali*' here refers to half the quantity of that cavity) in quantity and is localized throughout the body in all the *Saptadhatu*. [3]

Ayurveda classics have described numerous principles, such as *Ksheeradadhi Nyaya*, *Kedarikulya Nyaya*, and *Khalekapota Nyaya*, in the context of food digestion and *Saptadhatu* nourishment.[4] The *Ksheeradadhi Nyaya* (law of transformation) suits best for understanding the origin of *Apar Ojas* in the *Saptadhatu* of an individual. As per this principle, the food consumed by humans is broken down into three micro portions: *Prasada Roopi Rasa Bhaga* [essential microportion], *Kitta Bhaga* [non-juicy microportion], and the *Mala Bhaga* [refuse portion].[5] The *Prasada Roopi Rasa Bhaga* is responsible for the production of *Dhatvojas* in the *Saptadhatu*. The primary functions of *Ojas* are to provide *Bala* [immunity/strength/physical endurance], *Tushti* [satisfaction], *Pushti* [proper body nourishment], and to maintain a state of *Dehasthitinibandhanam* [preservation of *Dosha-Dhatu-Mala* component equilibrium] in the individuals.[6] It is evident from these characteristics that the status of *Ojas* can be helpful in determining the overall strength and capabilities of an individual.

Due to the complexity of the *Ojas* concept and the scarcity of information, only a handful of research studies involving it have been conducted to date. *Ojas* is the only aspect of the human body that can comprehensively determine the status of an individual's structural strength and physiological capabilities. This observation is also illustrated by the predictors of the

Ojas Assessment Tool in this research. Hence, a scale for assessing *Ojas* was desperately needed. A subjective proforma based on Ayurveda parameters was developed and primarily validated for this purpose. One previous Ayurvedic literature review closely attributes the *Apar Ojas* with the immunological aspect of an individual.[7]

To test for any association between *Apar Ojas* and immunity, the immunological marker IgG was selected for this research. IgG is one of the primary antibodies of the secondary immune response in humans.[8] It is secreted by plasma cells in the blood, and its main function is to trigger the opsonization process, which counters foreign particles through various phagocytic activities within the individual's body.[9] Its abundance in blood and a longer shelf life compared to other IgG variants make it an appropriate choice for evaluating the immunological response in subjects of this research study. In a healthy adult, the average serum concentration of Total IgG is $7.36(\pm 3.12)$ g/L.[10] The nonenzymatic glycosylation of IgG in the pathogenesis of Type 2 Diabetes Mellitus has already been documented in previous research.[11]

1. Objectives

The primary objective of this study was to develop an Ayurveda-based subjective proforma that can be used to assess *Apar Ojas* expressions in both diseased and healthy individuals, irrespective of age and gender. The secondary objective of this study was to compare the *Apar Ojas* expressions and Serum Total IgG expressions of diabetic subjects with those of non-diabetic, apparently healthy individuals. The correlations between the age, chronicity of *Madhumeha* (Type 2 Diabetes Mellitus), *Apar Ojas* expression, and Serum Total IgG expression were also studied in this research.

2. Methods

Study Design

This research study was a cross-sectional, observational (non-interventional) pilot clinical study with a 1:1 allocation ratio in two groups. Since both groups comprised subjects of different characteristics, no randomization sequence was necessary for subject allocation.



Study Setting

This research study was conducted in the All India Institute of Ayurveda (AIIA), New Delhi, India. All subjects were enrolled from the Kayachikitsa OPD and other institute premises for this study. The study duration was 16 months and required no follow-up assessments of the participants.

Study Participants

Pre-diagnosed cases of *Madhumeha* (Type 2 Diabetes Mellitus) between 40 and 70 years of age, receiving Insulin therapy with or without oral hypoglycaemics, irrespective of disease chronicity, constituted Group 1 for this research. Subjects suffering from autoimmune conditions, metabolic disorders, tuberculosis, cancer, jaundice, thyroid disorders, hepatitis, and non-willing participants were excluded from this research. For Group 2, non-diabetic, apparently healthy subjects between 40 and 70 years old were enrolled in this research.

Study Variables

The *Apar Ojas* expression of the subjects, as assessed using the *Ojas* Assessment Tool (OAT), was the primary outcome of this research. In contrast, the Serum Total IgG expressions of all subjects, as evaluated through the ELISA technique, were set as the secondary outcome in this research. The research constituted a total of 14 parameters i.e., *Apar Ojas* expressions (assessed from OAT score), Serum Total IgG expressions (assessed using ELISA technique), Nutrition Score, Physical Ability Score, Voice Quality Score, Skin Quality Score, Audition Ability Score, Stimulation Ability Score, Optical Ability Score, Gustation Ability Score, Olfaction Ability Score, Defecation Ability Score, Libido Ability Score and Higher Mental Functions Ability Score (all assessed from OAT score).[Table 1] A basic Case Reporting Format (CRF) was used to record the details about the initiation and progression of disease, specifics of medical examinations, treatments, related prior illnesses, habits, addictions, and vitals of all the participants. Only suitable candidates meeting the aforesaid inclusion criterion were enrolled in this research. The criterion used for the diagnosis of subjects was: 1) Presence of Clinical features of *Madhumeha* as described in Ayurveda classics [during disease progression][10] 2). Fasting Plasma Glucose concentration (FPG ≥ 126 mg/dl) 3). Blood

Sugar Level (post meal) (PPBS ≥ 200 mg/dl) and 4). Glycosylated Haemoglobin level (HbA1c ≥ 6.5 %) [11]

Data Sources / Measurements

The *Ojas* scores of the subjects were assessed using the OAT.[Table 2] The detailed characteristics of *Bala* as mentioned in *Sushruta Samhita*, i.e., '*Sthiropchitamamsata*', '*Sarvachesthasvapritighata*', '*Svara-Varna-Prasadata*', and '*Bahayanam-Abhyantranam Atmakaryapratipatti*' were used for the generation of the 7 domains, 5 sub-domains, and 15 predictors of the OAT [12]. Repeated predictors were excluded, leaving the OAT confined to only 12 final predictors. Since the predictors were Ayurveda terminologies, they were translated using the Sanskrit-English dictionaries Amarakosha, Shabdakalpadruma, Vachaspatyam, and Monier-Williams to form the final OAT. For scoring, each subdomain was graded into four categories (0, 1, 2, and 3), representing severe decline in ability, moderate decline in ability, mild decline in ability, and no decline in ability of the system. The maximum score on the OAT was 36, and a higher score represented a higher expression of *Apar Ojas* in the subject. The instrument underwent the primary form of validation, i.e., face validation and pretesting, before being implemented in this research. The detailed, stepwise information about OAT development, including Domain Identification and Item Generation steps, is to be communicated in a separate paper to the journal. The blood samples of the subjects were collected in the clinical pathology laboratory of the institute, adhering to all recommended good laboratory practices. The serum from the sample was separated and stored at -80°C , and later evaluated for Total IgG expression in the institute's Biochemistry Lab.

Bias

The biases reported were concerned with the missing data. The number of subjects screened was 30 for each group; however, only 20 subjects met the inclusion criterion, so 10 subjects were excluded from statistical analysis.

Study Size

The study was conducted as a pilot study with a sample size of 40 participants (20 participants in each group). As a cross-sectional study, there was no attrition; hence, the sample size of 40 was fixed for the study.



Qualitative Variables

Apar Ojas expressions, Nutrition Score, Physical Ability Score, Voice Quality Score, Skin Quality Score, Audition Ability Score, Stimulation Ability Score, Optical Ability Score, Gustation Ability Score, Olfaction Ability Score, Defecation Ability Score, Libido Ability Score, and Higher Mental Functions Ability Score are the qualitative variables that were studied in this research.

Quantitative Variables

Serum Total IgG expression is the only quantitative variable that was studied in this research.

Statistical Methods

The collected data were analysed using SPSS version 26. The t-test for independent samples (unpaired) was used to analyze the parametric data. [13] The data were additionally subjected to Pearson Correlation Coefficient analysis to examine the associations between age, chronicity of disease, *Apar Ojas*, and IgG expressions in the affected individuals.

3. Results

Participants Characteristics

The mean \pm SD age of subjects in Group 1 was 43.65 \pm 4.81 years, while it was 55.20 \pm 10.55 years in Group 2. All enrolled subjects in both groups practiced the Hindu religion (100%, n = 40). In Group 1, the majority of the subjects were female (55%, n = 11), married (100%, n = 20), educated (80%, n = 16), and had a *Pitta-Vata Dosha* predominant *Prakruti* (40%, n = 8). In comparison, in Group 2, the majority of subjects were male (65%, n = 13), married (80%, n = 16), uneducated (55%, n = 11), and had a *Pitta Dosha* predominant *Prakruti* (40%, n = 8). Furthermore, in Group 1, 45%(n=9) of the subjects had an addiction to tobacco chewing/smoking, whereas in Group 2, only 25%(n=5) of the subjects were found to be addicted to tobacco. The study was conducted in three stages: enrolment, data collection, and sample collection of the subjects. (Figure 1)

Baseline Characteristics

The mean values of HbA1c, FBS, and PPBS for Group 1 subjects were 9.75(\pm 2.43)%, 208.40(\pm 5.52)mg/dl and 317.10(\pm 109.47)mg/dl respectively. In comparison to the Group 2 subjects, the mean values were 5.34(\pm 0.38)%,

91.15(\pm 6.31)mg/dL, and 101.25(\pm 14.05)mg/dL, respectively.

Key Results

Analysis of the research data collected revealed that the mean OAT score of the Group 1 subjects was significantly lower than that of the Group 2 subjects (25.70 vs. 33.65, t-test = 8.43, p < 0.001). Similarly, the difference in the mean IgG expressions of the two groups indicated that the IgG expressions in the Group 1 subjects were significantly higher (12.03 vs 9.77, t-test= 2.79, p<0.01) than those of Group 2. [Table 3]

A significantly hampered Physical Ability Score (2.35 vs. 2.85, t-test = 2.94, p<0.01), Voice Quality Score (2.00 vs 2.90, t-test= 4.47, p<0.001), Skin Quality Score (1.50 vs 2.55, t-test= 4.62, p<0.001), Audition Ability Score (1.75 vs 2.80, t-test= 5.73, p<0.001), Optical Ability Score (1.85 vs 2.75, t-test= 4.13, p<0.001), Gustation Ability Score (2.60 vs 3.00, t test= 2.63, p<0.05), Defecation Ability Score (1.70 vs 2.80, t-test= 4.67, p<0.001), Libido Ability Score (1.25 vs 2.40, t-test= 3.83, p<0.001) and Higher Mental Functions Ability Score (2.70 vs 3.00, t-test= 2.85, p<0.01) was recorded among the Group 1 subjects. No significant differences were recorded in the Nutrition Score (2.10 vs 2.65), Stimulation Ability Score (2.90 vs 2.95), and the Olfaction Ability Score between the two groups. [Table 4]

A moderate positive non-significant association between the age and the Serum Total IgG expressions (r= 0.433, p= 0.056) and a moderate negative significant association between the Age and *Apar Ojas* expressions (r= -0.465, p=0.039) was recorded in the Group 1 subjects. Contrastingly, these associations were weakly positive and non-significantly associated, respectively, in the Group 2 subjects (r = 0.020, p = 0.934) and (r = 0.262, p = 0.264). [Table 5] A moderate negative non-significant association between the *Apar Ojas* expression and the Serum Total IgG expression (r= -0.356, p= 0.123) was recorded in the Group 1 subjects in comparison to the Group 2, where it was weak positive and non-significantly associated (r= 0.188, p= 0.427). [Table 6]. With respect to the chronicity of *Madhumeha* (Type 2 Diabetes Mellitus), a weak negative non-significant association between the disease chronicity and OAT scores (r= -0.035, p= 0.882) and a moderate positive significant association between the disease chronicity



and Serum Total IgG expressions ($r = 0.485$, $p = 0.030$) was recorded in this research. [Table 7]

4. Discussion

This research study recorded a significant decline in the *Apar Ojas* expression of the Type 2 Diabetes subjects. Ayurveda classics have described this phenomenon as *Mahattyaikatva* or *Mahti Chahaya Avastha* [a crucial phenomenon observed during the pathogenesis of *Madhumeha* disease, indicating a severe decline in the strength of the *Saptadhatu*].[14] Any alteration in the anatomical or the physiological characteristics of *Saptadhatu* must be understood as an indicator of the decline of *Apar Ojas* expressions in the individual. This condition is also cited as *Ojaskshaya* [decline of *Ojas* in quantity or quality] vis-à-vis *Dhatukshaya* [a quantitative or qualitative decline of any/all the seven constitutional elements of the human body]. The evidence of physiological deficits in various systemic processes in the Type 2 Diabetes subjects in the current study further corroborates this statement.

The results of this research showed a significant increase in IgG expression in diabetic subjects compared to non-diabetic healthy individuals. IgG is one among many other components belonging to the *Rasa-Rakta Dhatu* complex [serum/plasma]. Ayurveda classics quote *Rasa Dhatu Dushti* (manifestation in Serum/Plasma) as a major feature in the pathogenesis of *Madhumeha* disease.[15] A rise in IgG expression demarcates immune system activation, but an immunologically stressed state in the individual. The non-diabetic individuals in this research did not develop any significant immunological response; therefore, when the IgG expressions of the two groups were compared, substantial disparities were noted. The evidence strongly suggests that subjects having *Madhumeha* (Type 2 Diabetes Mellitus) experienced an immune deficit but higher immunological response-like characteristics because of the disease's protracted nature.

Significantly hampered physical abilities, voice quality, skin quality, audition ability, visual ability, gustatory ability, defecation ability, libido ability, and higher mental functions ability were recorded among the diabetic subjects in this research. Movement of all components, coordination, and control activities in the human body are regulated by *Vyana Vayu* (the fourth variant of *Vata Dosha*).[16] Manifestation of *Rakta*

Dhatu (blood components) responsible for skin dermopathy is a key finding in *Madhumeha* disease [17]. *Udana Vayu* (the second variant of *Vata Dosha*) regulates the process of speech in individuals.[18] *Prana Vayu* (the first variant of *Vata Dosha*) plays a crucial role in regulating all the internal senses in an individual.[19] Ayurveda explains defecation as the primary function of the *Apana Vayu* (fifth variant of *Vata dosha*).[20] A decline in libido can be attributed to *Shukra Dhatu Dushti* in affected individuals.[21] *Pitta* and *Kapha Dosha*, which are responsible for *Dhriti* (judgment) and *Medha* (intelligence), including higher mental functions in an individual, are primarily involved in the *Doshic* components of the pathogenesis of *Madhumeha* disease.[22] Obesity is one of the most common characteristics observed in Type 2 Diabetes patients.[23] Contrastingly, in this research, no significant differences were recorded in the Nutrition Score and weights of the individuals; however, their physical abilities were found to be significantly different across both groups. This could be due to the combined action of *Dhatukshaya*, i.e., a vitiated *Meda Dhatu* (altered lipid status) and a distorted *Vyana Vayu* in the individuals. The results of this research support the concept of “Morphological rise but Qualitative decline” of the *Meda Dhatu* (*Abaddha Meda*) in diabetic individuals.

A moderate, negative, and significant association was observed between age and *Apar Ojas* in the diabetic subjects, whereas in the non-diabetic group, a weak, positive, and non-significant association between age and *Apar Ojas* was recorded. These results suggest that as these *Madhumeha* (Type 2 Diabetes Mellitus) affected subjects aged, their *Apar Ojas* levels declined. In non-diabetic, apparently healthy individuals, there was no significant impact of age on *Apar Ojas* levels, and their *Ojas* could likely improve over time; this may be possible through practices targeting *Yuktikrita Bala* (strength-enhancing practices). However, if the same practices can be effective in diabetic subjects, their efficacy needs to be validated through *Bala/Apar Ojas*, enhancing intervention-based randomized clinical trials. A moderate, non-significant negative association was observed between age and immunity in the diabetic group subjects, whereas among the non-diabetic subjects, the association was weak and non-significant. These results indicate that as the diabetic subjects grew



older, they exhibited a significant decline in their immunity and *Apar Ojas*.

In comparison, the non-diabetic, apparently healthy subjects exhibited a marginal but non-significant decline in their immunity, accompanied by an improvement in their *Apar Ojas* scores. Improper dietary and lifestyle patterns, including tobacco addiction-like factors, could be the possible reason why the decline of immunity in such individuals was observed. A moderate, non-significant positive association was observed between *Apar Ojas* and the immunity of the subjects in the diabetic group, whereas in the non-diabetic group, the association was weak and negative, but non-significant in nature. However, since all the correlations were statistically non-significant in non-diabetic healthy individuals, the direction of the relationship observed in diabetic individuals may be indicative of an underlying biological phenomenon, probably relating to *Ojas*, which could explain the disparities in parameters between the two groups. These results further corroborate the fact that *Apar Ojas* and the immunity of a subject, though related, are two different aspects of the human body. A non-significant weak negative association was found between the chronicity of Diabetes and *Apar Ojas*, and a significant negative correlation was observed between the disease chronicity and the individual's immunity. This research indicates that the progression of diabetes can be associated with a decline in both *Apar Ojas* and the individual's immunity.

Limitations

Future studies with a larger sample size, a wider array of parameters, or interventions in different geographical locations could help in learning other more important aspects related to the *Ojas* component of the human body.

Conclusions

The *Ojas* Assessment Tool (OAT) can aid in assessing the status of *Ojas* in individuals of any age or gender, including the level of *Ojas* and the decline in immunity in patients suffering from *Madhumeha*. Thus, consideration of *Ojas Vardhak Chikitsa* (*Ojas*-enhancing treatment) can provide additional relief for diabetic patients. Although related, *Apar Ojas* status must not be attributed solely to the immunity factor, as there is a significant decline in physical, mental, and physiological abilities in such patients. These factors can be useful in

understanding the in-depth characteristics and functioning of the *Apar Ojas* component in individuals. The OAT may be validated through a multicentre exploratory study to rule out geographical variables and by taking a larger sample size.

Funding

All India Institute of Ayurveda, New Delhi, funded the study.

Conflict of Interest

There are no conflicts of interest.

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**Table 1: List of Domains, Sub-Domains, and Predictors of *Ojas* Assessment Tool (OAT)**

S.No.	Domain	Sub-Domain	Predictor
1.	<i>Sthiropchita</i> <i>Mamsta</i>	-	Nutrition
2.	<i>Sarvacheshtha</i> <i>Svapratighaata</i>	-	Physical, Mental, Vocal Activity
3.	<i>Svara Prasadata</i>	-	Voice Quality
4.	<i>Varna Prasadata</i>	-	Skin Quality
5.	<i>Bahayanam-</i> <i>Karnanam</i> <i>Aatmakaryapratipatti</i>	<i>Shravana Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Auditory Function
		<i>Sparshana Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Stimulatory Function
		<i>Darshana Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Optic Function
		<i>Rasana Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Gustatory Function
		<i>Ghrana Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Olfactory Function
6.	<i>Abhyantranam-</i> <i>Karnanam</i> <i>Aatmakaryapratipatti</i>	<i>Vaka Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Speech Function
		<i>Paani Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Functions of Upper Limbs
		<i>Pada Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Functions of Lower Limbs
		<i>Payu Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Excretion Function
		<i>Upastha Indriye</i> <i>Aatmakaarya-Pratipatti</i>	Libido Function
7.	<i>Buddhi Evum Mana</i> <i>Aatmakaryapratipatti</i>	-	Higher Mental Functions
Total	7 Domains	5 Sub Domains	15 Predictors

**Table 2: Ojas Assessment Tool (OAT) and scoring system**

Predictor	Grading	Score
Nutrition	BMI 18.5 – 24.9	3
	BMI 25 – 29.9	2
	BMI \geq 30	1
	BMI < 18.5	0
Physical Ability	grade4 (movement against gravity & resistance)	3
	grade3 (movement against gravity)	2
	grade2 (movement with gravity eliminated)	1
	grade1 (flicker only)	0
Voice Quality	clear & phonate (normal/high pitch)	3
	clear but non-phonate (low pitch)	2
	unclear & blurred (normal/ high pitch)	1
	unclear & non-phonate (low pitch)	0
Skin Quality	lustrous(shiny) appearance without spots, marks, or abnormal discoloration	3
	non-shiny with/without spots, marks, abnormal discoloration	2
	dull appearance without/with some spots/marks/abnormal discoloration	1
	rough appearance without/with many spots/marks/abnormal discoloration	0
Audition Ability	can hear very low & very high frequency sounds	3
	can hear low & high intensity sound	2
	cannot hear low-intensity sounds	1
	cannot hear the sounds of either frequency	0
Stimulation Ability	sensitive to all three sensations (Touch/Temperature/Pain)	3
	sensitive to any two sensations out of three	2
	sensitive to only one sensation out of three	1
	sensitive to none of the three sensations	0
Optical Ability	6/6	3
	6/12 - 6/24	2
	6/24 - 6/36	1
	< 6/60	0
Gustation Ability	able to sense all 6 tastes normally	3
	able to sense only astringent/sweet/bitter taste throughout the year	2



	able to sense only one taste, sweet/sour	1
	no taste in normal food/ <i>Katu</i> taste substance like <i>Maricha</i> (black pepper)	0
Olfaction Ability	able to sense all 7 types of smell	3
	able to sense 2-3 types of smell only	2
	no smell of incense stick (<i>Agarbatti</i>)	1
	no smell, even after a pungent smell stimulus	0
Defecation Ability	no difficulty in passing stool	3
	Difficulty in passing stool	2
	not able to pass a stool without the use of laxatives	1
	not able to pass stool easily, even with the use of laxatives	0
Libido Ability	feeling of having sexual intercourse (2-3times/week)	3
	feeling of having sexual intercourse (once a month)	2
	no feeling for sexual intercourse for 1-2 months	1
	no feeling for sexual intercourse even after stimulus	0
Higher Mental Functioning	all 7 functions intact	3
	1-2 functions altered	2
	3-4 functions grossly impaired	1
	5-7 functions grossly impaired	0
Ojas Assessment Tool Score = (Apar Ojas Expression)		Maximum Score 36
Assessment of Nutrition Score, Physical Ability Score, and Optical Ability Score		
<ul style="list-style-type: none"> The Nutrition Score was measured using the Body Mass Index. BMI = weight in kgs / (height in metres)² The Physical Ability Score was measured using the Medical Research Council (MRC) Muscle Grading Score. The Optical Ability Score was assessed using Snellen's Chart for Visual Activity. 		
Assessment of Higher Mental Functions Ability Score		
<ul style="list-style-type: none"> Higher Mental Functions were assessed using data on consciousness, Behavior, Intelligence, Memory, Orientation, Speech, and hallucination-like factors from the patient's history details. 		
Assessment of <i>Vachika Chestha</i> (Vocal Activity) and <i>Mansika Chestha</i> (Mental Activity)		
<ul style="list-style-type: none"> <i>Vachika</i> and <i>Mansika Chestha</i> were repeated predictors; hence, they were assessed only once using the Voice Quality Score and Higher Mental Functions Ability Score, respectively. 		
Assessment of <i>Paani, Pada Atmakaryapratipatti</i> (Upper and Lower Limb Function)		



- The *Paani* and *Pada Indriya Atmakaryapratipatti* was a repeated factor and was assessed while performing the MRC Test for Physical Ability Score.

Table 3: Comparison of *Apar Ojas* and Serum Total IgG expression between Group 1 and Group 2 subjects

S.No.	Predictor	Group 1 Mean \pm SD (n=20)	Group 2 Mean \pm SD (n=20)	T-test value	P value
1	OAT score (<i>Apar Ojas</i> Expression)	25.70 \pm 3.74	33.65 \pm 1.95	8.43	0.000
2	Serum Total IgG level	12.03 \pm 2.40	9.77 \pm 2.71	2.79	0.008
Group 1 vs Group 2					
<i>Apar Ojas</i> in Group 1 subjects < <i>Apar Ojas</i> in Group 2 subjects					
Serum Total IgG in Group 1 subjects > Serum Total IgG in Group 2 subjects					

Table 4: Comparison of other impacted systemic aspects between Group 1 and Group 2 subjects

S.No.	Predictor	Group 1 Mean \pm SD (n=20)	Group 2 Mean \pm SD (n=20)	T-test value	P value
1	Nutrition Score	2.10 \pm 0.85	2.65 \pm 0.93	1.95	0.059
2	Physical Ability Score	2.35 \pm 0.67	2.85 \pm 0.36	2.94	0.006
3	Voice Quality Score	2.00 \pm 0.85	2.90 \pm 0.30	4.47	0.0001
4	Skin Quality Score	1.50 \pm 0.82	2.55 \pm 0.60	4.62	0.0001
5	Audition Ability Score	1.75 \pm 0.71	2.80 \pm 0.41	5.73	0.0001
6	Stimulation Ability Score	2.90 \pm 0.30	2.95 \pm 0.22	0.60	0.560
7	Optical Ability Score	1.85 \pm 0.87	2.75 \pm 0.44	4.13	0.0001
8	Gustation Ability Score	2.60 \pm 0.68	3.00 \pm 0.00	2.63	0.012
9	Olfaction Ability Score	3.00 \pm 0.00	3.00 \pm 0.00	NA	NA
10	Defecation Ability Score	1.70 \pm 0.97	2.80 \pm 0.41	4.67	0.0001
11	Libido Ability Score	1.25 \pm 1.16	2.40 \pm 0.68	3.83	0.0001
12	Higher Mental Functions Ability Score	2.70 \pm 0.47	3.00 \pm 0.00	2.85	0.007

**Table 5:** Association between Age, *Apar Ojas*, and Serum Total IgG expression in Group 1 and Group 2 subjects

Group	Relationship	Pearson Correlation (r)	P value
Group 1 (n=20)	Age \propto 1/ <i>Apar Ojas</i> (moderate negative and significant association)	-0.465	0.039
	Age \propto Serum Total IgG (moderate positive non-significant association)	0.433	0.056
Group 2 (n=20)	Age \propto <i>Apar Ojas</i> (weak positive non-significant association)	0.020	0.934
	Age \propto Serum Total IgG (weak positive non-significant association)	0.262	0.264

Table 6: Association between *Apar Ojas* and Serum Total IgG expression in Group 1 and Group 2 subjects

Group	Relationship	Pearson Correlation (r)	P value
Group 1 (n=20)	<i>Apar Ojas</i> \propto 1/Serum Total IgG (moderate negative non-significant association)	-0.356	0.12
Group 2 (n=20)	<i>Apar Ojas</i> \propto Serum Total IgG (weak positive non-significant association)	0.188	0.43

Table 7: Association between Chronicity of *Madhumeha* (T2DM), *Apar Ojas*, and Serum Total IgG expression in Group 1 subjects

Group	Relationship	Pearson Correlation (r)	P value
Group 1 (n=20)	Chronicity of <i>Madhumeha</i> \propto 1/ <i>Apar Ojas</i> (weak negative non-significant association)	-0.035	0.882
	Chronicity of <i>Madhumeha</i> \propto Serum Total IgG (moderate positive significant association)	0.485	0.030



Figure 1: Stages of this Research Study

Stage 1: Screening Stage

