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Research Article

ASSOCIATION OF *DEHA PRAKṚTI* (BODY CONSTITUTION) WITH EXPRESSION OF SELECTED INFLAMMATORY MARKERS IN PATIENTS WITH CHRONIC KIDNEY DISEASE (CKD) - WESTERN PROVINCE, SRI LANKA

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ABSTRACT

Deha prakṛti is a fundamental concept in Āyurveda, offers a promising approach to prevent and manage Chronic Kidney Disease (CKD) through an integrated perspective. While *Deha prakṛti* is widely recognized for its applications in predicting disease susceptibility, facilitating early detection, guiding treatment plan and influencing dietary and behavioral patterns, there is a notable gap in scientific evidence supporting its associations with various aspects of chronic disorders such as CKD. One such aspect is the immunological impairment in CKD patients, which is a significant concern that needs to be addressed immediately and no scientifically proven studies found in relation to the above in previous literature. In order to address this research gap, present study investigated the relationship between *Deha prakṛti* and specific inflammatory markers- namely Erythrocyte Sedimentation Rate (ESR), C- Reactive Protein (CRP), Interleukin-6 (IL-6) and Tumor Necrosis Factor-alpha (TNF-α) in CKD patients, Western Province, Sri Lanka. An assessment of the association between *Deha prakṛti* and the expression of selected inflammatory markers in CKD patients would provide insights to successfully manage the disease by developing targeted treatment modalities focusing on inflammatory markers. The study involved 113 diagnosed CKD patients and their *Deha prakṛti* type was assessed using ĀyuSoft software. ESR and CRP levels were determined according to the Westergren method and CRP latex slide agglutination method respectively, while IL-6 and TNF-α levels were quantitatively measured using Enzyme Linked Immunosorbent Assay (ELISA) based on the sandwich principle. It was observed that the types of *Deha prakṛti* in CKD patients are significantly associated with the levels of ESR and IL- 6 indicating that the levels of ESR and IL - 6 inflammatory markers depend on the types of *Deha prakṛti* in CKD patients. However, it was also noticed that the types of *Deha prakṛti* were not significantly associated with the levels of CRP and TNF-α. This will lead the Āyurveda physicians to plan and develop specific treatment regimens with accurate drug dosage and dietary - behavioral patterns targeting the above inflammatory markers related to the *Dehaprakṛti* types of the CKD patients. Since it was also observed that CKD patients with *Pitta* and *Vāta pradhāna prakṛti* types are more susceptible to elevated levels of inflammatory markers, it is advisable to implement precautions during the early stages of the disease based on the specific type of *Deha prakṛti* in order to prevent the progression of the disease to End stage Renal Disease (ESRD).

INTRODUCTION

CKD has become a considerable disease burden worldwide, even in Sri Lanka. According to the Global Burden of Disease Study conducted in 2015, kidney disease ranks as the 12th most common cause of mortality, resulting in roughly 1.1 million fatalities across the globe. It is also reported that the global estimated prevalence of CKD is 13.4% (11.7–15.1%) [1]. A recently conducted study in a Sri Lankan population revealed that the Western Province has the most significant proportion of CKD patients, accounting for 68.5% of the total cases [2].

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Furthermore, a separate cross-sectional epidemiologic study conducted in Western Province found that the prevalence of CKD is high in Western Province and it is comparable to the majority of CKD in regions of the country that are endemic to CKDu (Chronic Kidney Disease in Unknown Etiology) [3]. Although the early stages of CKD are asymptomatic [4], it is very challenging to diagnose the disease early. In cases where the disease is diagnosed through elevated serum creatinine levels, it is possible that the renal parenchyma may sustain reversible or irreversible damage exceeding 40% to 50%, as noted by Rysz et al. (2017) [5]. As the identification of the disease takes time, it badly affects the disease prognosis and management. However, the statistical data regarding the increased incidence and prevalence rate of CKD have already proven that there is still no identification of a permanent cure or solution instead of renal replacement therapy for disease management. This remains a tremendous challenge for Western and Āyurveda medical systems. However, early detection, planning and applying proper treatment strategies for the disease from the very beginning is essential to prevent developing ESRD (End Stage Renal Disease), which is very difficult to manage only with conservative ESRD care (without renal replacement therapy). Therefore, it is high time to identify Āyurveda and Western medicine integrated, innovative strategies to approach the disease successfully.

The science of life – Āyurveda is well nourished by thousands of concepts linked with theories and hypotheses that play a crucial role in creating pathways towards successful disease management, especially when dealing with chronic illnesses. A proficiently practiced Āyurveda medicine followed by its basic concepts can yield reliable and optimal results when applied to all means of disease management. Furthermore, the concepts are specifically focused not only on disease management but also on disease prevention. Discovering unidentified or hidden associations between the concepts and relevant parameters of a disease, in particular, would open up avenues to progress toward the disease rather than spending plenty of time and money to discover a single drug to manage the condition. In the context of chronic diseases, particularly those that are challenging to manage, such as CKD, it may be possible to identify previously unknown associations between disease - related concepts and parameters. Such associations can be leveraged to facilitate early detection of CKD, predicting disease susceptibility, optimize disease management, developing targeted treatment strategies and prevent progression to ESRD through appropriate interventions. This study has been specifically built up by focusing on two selected Āyurveda concepts; *Deha prakṛti* (body constitution) and *Vyādhikṣamatva* (immunity) as well as their interrelationships in the context of CKD. The concepts of *Deha prakṛti* and *Vyādhikṣamatva* have been discussed elaborately in Caraka Saṃhithā Vimānastāna 8th chapter – 94th stanza[6] and in Caraka Saṃhithā Sūtrasthāna 28th chapter – 7th stanza[7] respectively. The effort to emphasize the associations between the chosen concepts would definitely lend a hand to facilitating the effective implementation of strategies for the prevention and management of CKD.

Prakṛti is one of the most imperative and practical evidence - based concepts mentioned under *Daśavidha āthura parīkṣā* (ten - fold examination of the patient) in Caraka Saṃhithā Vimānastāna 8th chapter – 94th stanza. [6] In Āyurveda, the term *Prakṛti* refers to *Deha prakṛti* or it has always been used to describe *Deha prakṛti*. The assessment of *Deha prakṛti* holds significant importance in the patient examination protocol outlined in the Āyurveda medical practice. It will basically facilitate early detection, forecast susceptibility to diseases, prognosticate disease progression, determine optimal treatment protocols and potentially resulting in significant reductions in mortality rates. Therefore, determining the type of patients' *Deha prakṛti* and its association with various clinical and non - clinical aspects (i.e., specific markers in blood/urine, the severity of clinical features, dietary and behavioral patterns, etc) of the disease will be essential for the prevention and management of chronic diseases such as CKD.

The concept of *" Vyādhikṣamatva"* discussed in Caraka Saṃhithā Sūtrasthāna 28th chapter – 7th stanza, can be correlated with immunity in Western medicine. The process of preventing disease development and the capacity to resist diseases are jointly known as *" Vyādhikṣamatva"*, according to Caraka Saṃhithā Sūtrasthāna 28th chapter – 7th stanza. Furthermore, it describes that all individuals are not equally capable of withstanding the disease[7]. That means *Vyādhikṣamatva* varies from individual to individual depending on their nutritional, environmental, physical and mental status. As the status of *Deha prakṛti* is also variable individually, there can be a correlation between the *Deha prakṛti* status and the level of *Vyādhikṣamatva*. Practically, the assessment of the immune status (as per Western medicine) or *Vyādhikṣamatva* (as per Āyurveda medicine) of an individual is complicated as both concept areas are cosmic. Therefore, the study will concentrate on specific inflammatory markers due to their significant role in modulating the immune response of the body in order to address the aforementioned issue.

CKD is closely associated with low grade chronic inflammation, which can also lead to the development of CVDs (Cardiovascular Disorders), protein energy wasting and mortality [8]. Inflammation is the body's innate response to a physical injury or an

external irritant. Inflammatory markers are specific proteins released into the blood stream during inflammation. In clinical practice, the inflammatory markers that are frequently measured are C-Reactive Protein (CRP) and Erythrocyte Sedimentation Rate (ESR). Besides CRP and ESR, cytokines (a large group of proteins, peptides and glycoproteins- signaling molecules secreted by immune cells) are also considered as inflammatory markers that play a crucial role in initiating the inflammatory response and regulating the host defense against pathogens mediating the innate immune response. Prevalence of inflammation is recorded as high in CKD patients with elevated levels of serum CRP, proinflammatory cytokines such as Interleukin - Six (IL – 6), Interleukin - Eight (IL – 8), Tumor Necrosis Factor - alpha (TNF – α) and anti - inflammatory cytokines such as Interleukin - Ten (IL – 10) [9]. Human beings are born with innate immunity and a specific type of *Deha prakṛti* according to the predominance of *Doṣa* (*Vāta, Pitta* and *Kapha*) at the time of conception. At the same time, inflammatory markers play a significant role mainly in regulating innate immunity. Therefore, an assessment of the association between *Deha prakṛti* and the expression of selected inflammatory markers in CKD patients would provide immense support to successfully manage the disease by developing targeted treatment modalities focusing on inflammatory markers.

As previously pointed out, patients with CKD exhibited increased levels of inflammatory markers, including CRP, IL - 6 and TNF – α [9]. In addition, elevated levels of ESR were found in chronic inflammatory conditions such as rheumatoid arthritis, polymyalgia rheumatica, myeloma, osteomyelitis, pelvic inflammatory disease and many others [10]. Therefore, ESR is regarded as a marker of chronic inflammation. Since CKD is also associated with low - grade persistent inflammation, ESR was also considered as one of the parameters of the study. Collectively, ESR, CRP, IL - 6 and TNF – α were selected as inflammatory markers for the study because they had not been assessed with the types of *Deha prakṛti* of CKD patients in the existing literature.

As there is no evidence - based scientific studies have conducted to find out the association between *Deha prakṛti* and the status of immunity, this study is focused explicitly on assessing *Deha prakṛti* and its association with the status of immunity, especially related to the expression of selected inflammatory markers of the patients with CKD. The efforts created for assessing *Deha prakṛti* in patients with CKD and its association with different aspects linked with physiological mechanisms in the body can prove to be beneficial in terms of prevention, early diagnosis, planning and development of treatment modalities for CKD. Simply, it might become less challenging to conquer the disease, not entirely eradicated, but at least to run off from the current burden.

OBJECTIVES

The study was planned to assess the association between *Deha prakṛti* and the levels of each selected inflammatory marker i.e., ESR and CRP, including cytokines (IL-6 and TNF-α) in CKD patients in Western Province, Sri Lanka.

MATERIALS AND METHODS

Ethical consideration

Ethical approval for the study was obtained from the Ethics Review Committee, Faculty of Indigenous Medicine, University of Colombo (ERC/20/103) on 29.01.2021 and by the Research and Ethics Review Committee, University of Kelaniya (UOK/ERC/21/IM/004) on 21.05.2021.

Selection of participants Inclusion and exclusion criteria

CKD patients between 18 to 80 years of age, who have been attending the clinics at the University Nephrology clinic - National Hospital, Sri Lanka and the Renal clinic of Bandaranaike Memorial Āyurveda Research Institute, Maharagama, Sri Lanka, residing in the Western Province and having a documented diagnosis of CKD were included if they had either an estimated Glomerular Filtration Rate (eGFR) below 60ml/min/1.73m2 or proteinuria irrespective of eGFR.

CKD patients, below 18 years and above 80 years, who are suffering from Human Immunodeficiency Virus (HIV) infection, malignant disorders, psychiatric disorders, dementia, etc., who had immunotherapy for the last six months, who had chemotherapy for the last two years, females who are pregnant or breastfeeding, who unwilling to give informed consent, patients with Acute Kidney Injury (AKI) were excluded from the study.

Sampling method

The purposive simple random sampling method was used as the sampling method.

Sample size – 134[11]

Data collection

Assessment of *Deha prakṛti* (body constitution) types in the participants

ĀyuSoft software which is in the form of a questionnaire, was used to assess the types of *Deha prakṛti* (body constitution) of the research participants. ĀyuSoft software is a standardized and validated software which has been used by a significant number of authors in published studies [12 - 17]. The assessment of *Deha prakṛti* was executed using weightage configuration in ĀyuSoft. It provided percentage - wise scores for *Tridoṣa*; *Vāta, Pitta* and

Kapha separately and at the end of the assessment, automatically determine the type of *Deha prakṛti* according to the percentage scores of *Vāta, Pitta* and *Kapha doṣa*. The research participants were mainly categorized into four groups according to the types of *Deha prakṛti* as *Vāta pradhāna prakṛti*, *Pitta pradhāna prakṛti*, *Kapha pradhāna prakṛti* and *Sama doshaja prakṛti* (*Vāta pradhāna prakṛti* type included *Kevala vāta*, *Vāta pitta*, *Vāta kapha prakṛti* types. *Pitta pradhāna prakṛti* type included *Kevala pitta*, *Pitta kapha* and *Pitta vāta prakṛti* types, whereas *Kapha pradhāna prakṛti* type included *Kevala kapha*, *Kapha pitta* and *Kapha vāta prakṛti* types, *Sama doshaja prakṛti* type included those who had equal proportions of *Vāta, Pitta* and *Kapha dosha*).

Sample Collection and Processing

5ml of blood was collected through venipuncture from each participant by a trained phlebotomist under aseptic conditions. Serum separation was done by centrifuging the samples at 1500-2000 gravitational units (g) (Analytical Instrument (Pvt) Ltd, USA)) for 5 minutes.

Staging of CKD

Staging of CKD was done based on KDIGO (Kidney Disease Initiative Global Outcome) criteria [18]. After performing the creatinine levels of the serum samples and along with the levels of eGFR, 21 participants of 134 were excluded due to eGFRs being > 60ml/min/1.73m2 and no evidence of proteinuria.

Therefore, the study included 113 CKD patients.

Assessment of the inflammatory marker levels

Assessment of erythrocyte sedimentation rate (esr)

Assessment of ESR levels were done based on the Westergren method [19].

Assessment of C – Reactive Protein (CRP) levels

The test was performed according to the manufacturer's information provided by the CRP Reagent Set (Teco Diagnostics, USA) and was based on the principle of latex agglutination.

Assessment of serum IL – 6 levels and TNF – α levels

Serum samples were tested for serum IL – 6 and TNF – α levels in patients with CKD using commercially available Human IL – 6 and TNF – α Enzyme Linked Immunosorbent Assay (ELISA)kits (Elabscience, USA) based on the sandwich principle.

Statistical Data Analysis Designs

Microsoft Excel 2007 version and appropriate statistical analysis software were used to analyze the collected data. Data analysis included descriptive statistics, correlation analysis, comparison of two medians (Mann – Whitney U test) and comparison of multiple medians (Kruskal Wallis test). However, *Sama doshaja prakṛti* type had to be removed from the *Deha prakṛti* classification due to the underrepresentation of participants and only the three main types i.e., *Vāta pradhāna*, *Pitta pradhāna* and *Kapha pradhāna prakṛti* types were considered to come up with the more precise and reliable output.

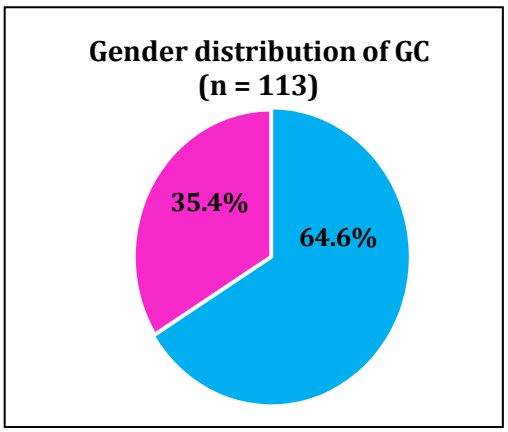
OBSERVATIONS AND RESULTS

Demographic information and descriptive statistics on age - gender and stage wise distribution of CKD patients

Age distribution of CKD patients

The age categories ranging from 46 to 85 years exhibited a significantly greater proportion (92.1%) of patients diagnosed with CKD in comparison to the patient distribution reported across the age categories of 16 to 45 years. It was 7.9%. The mean age of the CKD patients was reported as 60.9 years with a standard deviation of 12.1 years.

Gender distribution of CKD patients



Males outnumbered females (64.6%) in terms of CKD patients. Female patients made up 35.4% of the total. The ratio of males to females was 1.8:1, with a mean age of 60.8 with a standard deviation of 12.7 years among males and it was 60.9 with a standard deviation of 10.9 years among females.

Figure 1: Gender distribution of CKD patients

Distribution of Chronic Kidney Disease (CKD) patients according to stages of the disease

Figure 2 depicts the distribution pattern of patients according to CKD stages.

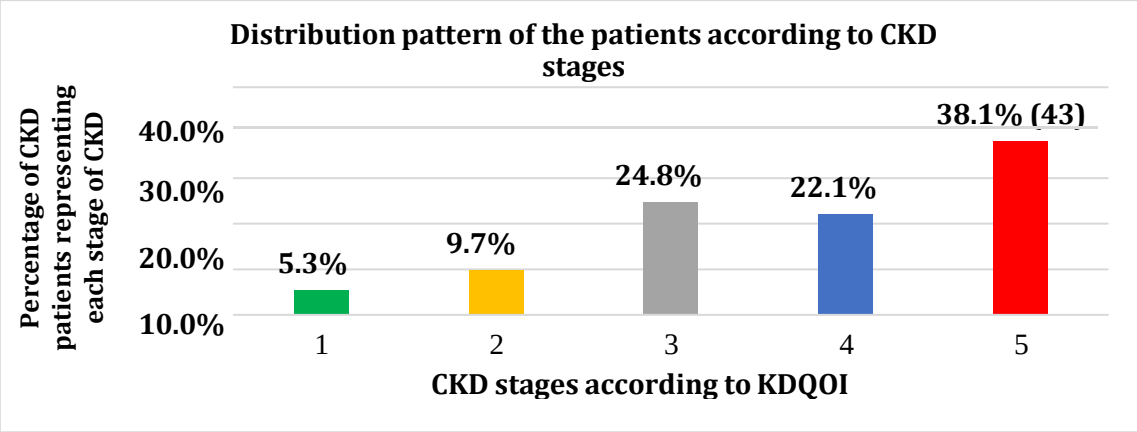


Figure 2: Distribution of Chronic Kidney Disease (CKD) patients according to the disease stages (n = 113)

*KDOQI Criteria: Kidney Disease Outcome Quality Initiative Criteria [20]

As depicted in Figure 2, a substantial proportion (85%) of CKD patients were recorded in stages 3, 4, and 5 compared to the proportion of the study population represented in stages 1 and 2. Only 15% of CKD patients were reported from stages 1 and 2.

Prevalence of *Deha prakṛti* (body constitution) types among the patients with CKD

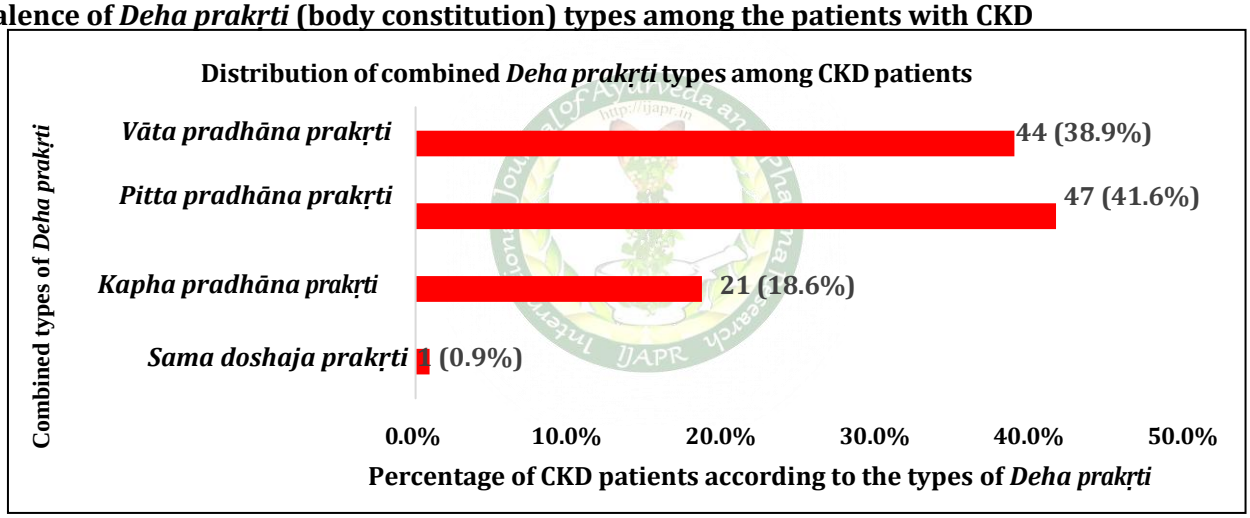


Figure 3: Distribution of combined *Deha prakṛti* (body constitution) types among CKD patients (n = 113)

The study results indicate that the patients with *Pitta pradhāna prakṛti* types were the most associated (41.6%) with CKD followed by *Vāta pradhāna prakṛti* types whereas, *Kapha pradhāna* and *Sama doshaja prakṛti* type were least associated (18.6% and 0.9% respectively) with CKD. Among the two types of *Kapha pradhāna* and *Sama doshaja prakṛti, Kapha pradhāna prakṛti* types were more prevalent than the *Sama doshaja prakṛti* type.

Demographic information and descriptive statistics related to inflammatory markers in patients with ckd

Distribution pattern of Erythrocyte Sedimentation Rate (ESR) among CKD patients

The central dispersion measures of Erythrocyte Sedimentation Rate (ESR) levels in CKD patients

Table 1: The central dispersion measures of ESR levels in CKD patients

	CKD patients (n = 113)			
	Male		Female	
	Below 50 yrs	50 yrs and above	Below 50 yrs	50 yrs and above
Mean (mm/hr)	39.3	40	64.7	39.1
Median (mm/hr)	46	37	51.5	35.5
Standard Deviation	17.4	26.3	40.2	22.5

The range of ESR in CKD patients was from 1 to 130 mm/hr. When the age groups in Table 1 were considered, the mean ESR levels of CKD patients were higher than the reference range for all age groups according to Smith & Samadian, 1994[21].

Erythrocyte Sedimentation Rate (ESR) ranges according to the types of *Deha prakṛti* (body constitution) in CKD patients

It was observed that 78.8 % of CKD patients had elevated levels of ESR, while 21.2 % were within the normal range.

Figure 4 further discusses the main types of *Deha prakṛti* associated with elevated ESR levels in CKD patients.

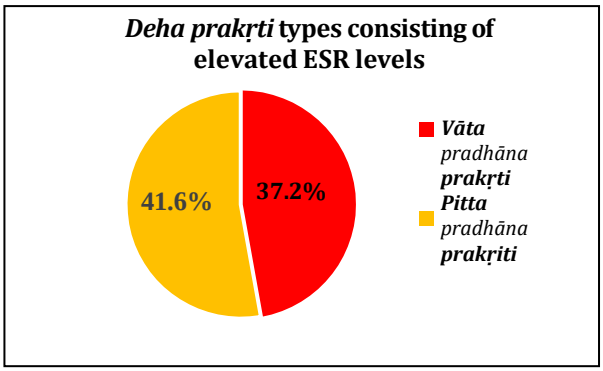


Figure 4: Distribution of *Deha prakṛti* types among CKD patients with elevated ESR) levels (n = 89)

Among the above mentioned 78.8 % of CKD patients who had elevated levels of ESR, only the patients with *Pitta pradhāna* (41.6%) and *Vāta pradhāna prakṛti* types (37.2%) were reported to have elevated ESR levels, whereas none of the *Kapha pradhāna prakṛti* patients were reported to have elevated ESR levels among CKD patients.

The sequence of *Deha prakṛti* (body constitution) types based on Erythrocyte Sedimentation Rate (ESR) ranges in CKD patients

The sequences of *Deha prakṛti* types according to the ESR ranges (from high to low) in patients with CKD are illustrated in Table 2.

Table 2: The sequence of *Deha prakṛti* types according to the ESR levels in CKD patients

Types of *Deha prakṛti*	Range of ESR Values
Kevala pitta	92 to 130 mm/hr
Pitta vāta	45 to 110 mm/hr
Vāta pitta	47 to 60 mm/hr
Kevala vāta	42 to 44 mm/hr
Pitta kapha	28 to 49 mm/hr
Vāta kapha	12 to 40 mm/hr
Kapha pitta	5 to 17 mm/hr
Kapha vāta	8 to 13 mm/hr
Kevala kapha	1 to 5 mm/hr
Sama doshaja	2 mm/hr

ESR values are between the normal range

ESR values are between normal and above normal range

ESR values are above normal range

The maximum value for the normal range of ESR was determined as 20mm/hr, irrespective of the age and gender of the individual according to Kumar and Clark (2012) [22] as the age and gender of the CKD participants did not affect the ESR values related to the study.

Furthermore, ESR levels were found to be elevated in CKD patients with *Kevala pitta*, *Pitta vāta*, *Vāta pitta* and *Kevala vāta prakṛti* types (92 to 130 mm/hr, 45 to 110 mm/hr, 47 to 60 mm/hr and 42 to 44 mm/hr respectively), despite being within the standard ESR ranges based on age and gender. Furthermore, it was also observed that *Pitta* and *Vāta pradhāna*, *Kapha anubandha* (associated) types remained in the middle of the sequence as the ranges varied between normal to above average levels of ESR. The patients with *Sama doshaja prakṛti* type and *Kapha pradhāna prakṛti* types have lower ESR levels compared to *Pitta* and *Vāta pradhāna prakṛti* types.

Distribution pattern of serum c – reactive protein (CRP) levels among CKD patients

Distribution of serum CRP levels among the types of *Deha prakṛti* (body constitution) in CKD patients

When the serum CRP levels of the CKD patients were analyzed, majority - 84.1% of CKD patients had CRP levels within the normal range, while 15.9 % had elevated levels.

Figure 5 depicts the distribution pattern of *Deha prakṛti* types among CKD patients with CRP levels above the normal range.

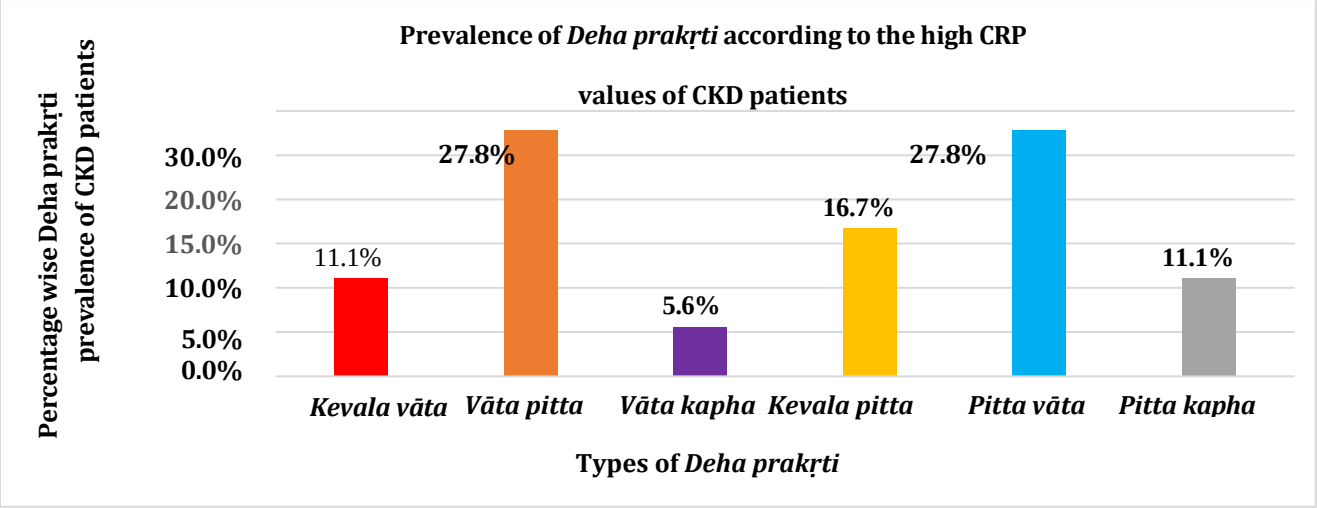


Figure 5: Distribution pattern of *Deha prakṛti* types among CKD patients who had elevated CRP levels (n = 18)

Most patients with CRP levels above normal were observed as *Pitta* and *Vāta pradhāna prakṛti* types. It was 55.6% and 44.4% respectively. There were no CKD patients with *Kapha pradhāna prakṛti* types who had increased CRP levels.

Distribution pattern of serum interleukin – 6 (IL – 6) in CKD patients

The central dispersion measures of serum IL - 6 levels in CKD patients with the minimum and maximum IL – 6 levels reported

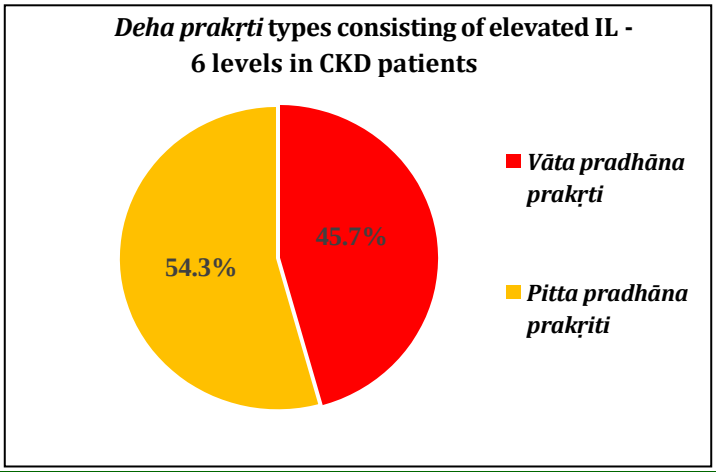
Table 3 details the central dispersion measures of serum IL - 6 levels for CKD patients; including the minimum and maximum IL - 6 levels reported.

Mean	59 pg/ml
Median	24 pg/ml
Mode	5 pg/ml
The minimum level of serum IL – 6 reported	0 pg/ml
The maximum level of serum IL – 6 reported	942 pg/ml

According to Table 3, the serum IL - 6 in CKD patients ranged from 0 to 942 pg/ml in CKD patients.

Furthermore, 40.7% of CKD patients had IL - 6 levels above the normal range. Figure 6 illustrates the distribution pattern of *Deha prakṛti* types among the CKD patients who had elevated IL – 6 levels.

Figure 6: *Deha prakṛti* types consisting of elevated IL – 6 levels in CKD patients (n = 46)



The above figure shows both *Pitta* and *Vāta pradhāna prakṛti* types were only associated with elevated levels of IL – 6. No CKD patients were found with *Kapha pradhāna* or *Sama doshaja* types with elevated IL – 6 levels.

The sequence of *Deha prakṛti* (body constitution) types based on Interleukin – Six (IL –6) ranges of CKD patients

The sequence of *Deha prakṛti* types of CKD patients according to the IL - 6 ranges have been illustrated in Table 4.

Table 4: The sequence of *Deha prakṛti* types according to serum IL – 6 levels of CKD patients

Types of *Deha prakṛti*	IL - 6 ranges
Kevala pitta	163 to 942 pg/ml
Pitta vāta	47 to 249 pg/ml
Vāta pitta	45 to 103 pg/ml
Kevala vāta	45 to 49 pg/ml
Pitta kapha	5 to 40 pg/ml (except 02 values; i.e 246 pg/ml and 260 pg/ml)
Vāta kapha	5 to 39 pg/ml
Kapha pitta	11 to 19 pg/ml
Kapha vāta	4 to 9 pg/ml
Kevala kapha	2 to 3 pg/ml
Sama doshaja	0 pg/ml

L - 6 values are within the normal range

IL - 6 values are above normal range

The patients with *Kevala pitta*, *Pitta vāta*, *Vāta pitta* and *Kevala vāta prakṛti* types had higher serum IL - 6 levels (163 to 942pg/ml, 47 to 249 pg/ml, 45 to 103pg/ml and 45 to 49 pg/ml respectively) compared to the others. It was observed that CKD patients with *Kevala pitta* or *Vāta* and also those who consisted of both *Pitta* and *Vāta* associated *Prakṛti* types except *Pitta kapha* or *Vāta kapha* can have high levels of serum IL – 6 levels. Among them, the patients with *Pitta pradhāna prakṛti* types except *Pitta Kapha* have the highest serum IL – 6 levels.

Furthermore, it was observed that the serum levels of IL – 6 of the patients who had *Kapha dosha* in their *Prakṛti* as either *Pradhana dosha* or *Anubandha dosha*, fluctuated within the normal range except for two in *Pitta kapha prakṛti* types.

Distribution pattern of serum Tumor Necrosis Factor – alpha (TNF – α) among CKD patients

The central dispersion measures of serum Tumor Necrosis Factor – alpha (TNF – α) levels for CKD patients including the minimum and maximum Tumor Necrosis Factor – alpha (TNF – α) levels reported

Table 5: The central dispersion measures of serum TNF – α levels for the patients with CKD including the minimum and maximum TNF – α levels reported

Mean	36 pg/ml
Median	35 pg/ml
The minimum level of serum TNF - α reported	0 pg/ml
The maximum level of serum TNF - α reported	112 pg/ml

Distribution pattern of elevated levels of Tumor Necrosis Factor – alpha (TNF – α) in CKD patients

According to the reference range, the majority, 51.3% of CKD patients, had high levels of serum TNF – α.

Distribution pattern of *Deha prakṛti* (body constitution) among CKD patients with elevated levels of serum Tumor Necrosis Factor – alpha (TNF – α)

Figure 7 describes the proportions of *Deha prakṛti* types in CKD patients consisting elevated TNF – α levels.

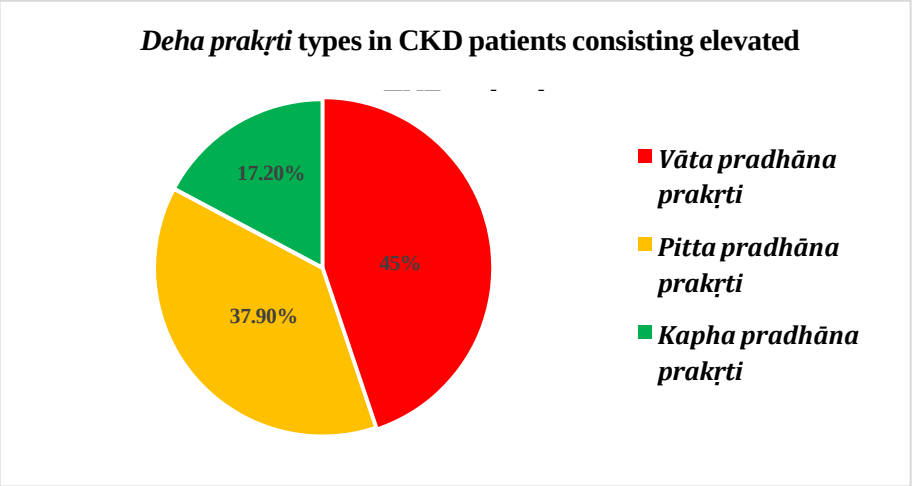


Figure 7: The proportions of *Deha prakṛti* types in CKD patients consisting of elevated TNF – α levels.

According to Figure 7, 45% of CKD patients with elevated TNF - α were *Vāta pradhāna prakṛti* types, 37.9% of CKD patients were *Pitta pradhāna prakṛti* types and there was a low proportion (17.2%) of *Kapha pradhāna prakṛti* types who had elevated TNF – α.

Significance of the Findings

Associations between the types of *Deha prakṛti* (body constitution) and levels of selected inflammatory markers in CKD patients

Table 6: Associations between the type of *Deha prakṛti* and levels of selected inflammatory markers in CKD patients (n = 112)

Type of Association	Whether the associations are significant or not
Association between ***Deha prakṛti* and ESR levels**	**Significant** (Kruskal Wallis test, p-value < 0.05)
Association between ***Deha prakṛti* and IL - 6 levels**	**Significant** (Kruskal Wallis test, p-value < 0.05)
Association between ***Deha prakṛti* and CRP levels**	**Not significant** (Fisher's exact test, p-value > 0.05)
Association between ***Deha prakṛti* and TNF - α levels**	**Not Significant** (Kruskal Wallis test, p-value > 0.05)

It was observed that the levels of ESR and serum IL – 6 were significantly associated with the types of *Deha prakṛti* under a 5% level of significance and the levels of serum CRP and TNF – α were not significantly associated with the types of *Deha prakṛti* under a 5% level of significance.

Associations between each type of *Deha prakṛti* (body constitution) and levels of ESR in CKD patients (n = 112)

Table 7: Associations between each type of *Deha prakṛti* in relation to ESR levels

Type of associations	Whether the associations are significant or not
Association between the **ESR** levels of ***Vāta*** *pradhāna* **and *Kapha*** *pradhāna* ***prakṛti*** types	**Significant** (Mann – Whitney U test, p-value < 0.05)
Association between the **ESR** levels of ***Pitta*** *pradhāna* **and *Kapha*** *pradhāna* ***prakṛti*** types	**Significant** (Mann – Whitney U test, p-value < 0.05)
Association between the **ESR** levels of ***Vāta*** *pradhāna* **and *Pitta*** *pradhāna* ***prakṛti*** types	**Significant** (Mann – Whitney U test, p-value < 0.05)

It was considered that the ESR levels were significantly associated with *Vāta pradhāna* and *Pitta pradhāna prakṛti* types, *Vāta pradhāna* and *Kapha pradhāna prakṛti* types and *Pitta pradhāna* and *Kapha pradhāna prakṛti* types in CKD patients – Western Province, Sri Lanka under a 5% level of significance. Moreover, the mean and median values of ESR related to *Kapha pradhāna prakṛti* types were the lowest among all the three types of *Deha prakṛti*.

The mean and median ESR values of *Vāta pradhāna prakṛti* types remained in the middle and the highest mean and median values of ESR could be observed in *Pitta pradhāna prakṛti* types in CKD patients.

Associations between each type of *Deha prakṛti* (body constitution) and levels of IL - 6 in CKD patients (n = 112)

Table 8: Associations between each type of *Deha prakṛti* in relation to serum IL - 6 levels

Type of associations	Whether the associations are significant or not
Association between the **IL - 6** levels of ***Vāta*** *pradhāna* **and *Kapha*** *pradhāna* ***prakṛti*** types	**Significant** (Mann – Whitney U test, p-value < 0.05)
Association between the **IL - 6** levels of ***Pitta*** *pradhāna* **and *Kapha*** *pradhāna* ***prakṛti*** types	**Significant** (Mann – Whitney U test, p-value < 0.05)
Association between the **IL - 6** levels of ***Vāta*** *pradhāna* **and *Pitta*** *pradhāna* ***prakṛti*** types	**Significant** (Mann – Whitney U test, p-value < 0.05)

It was considered that the IL-6 levels were significantly associated with *Vāta pradhāna* and *Pitta pradhāna prakṛti* types, *Vāta pradhāna* and *Kapha pradhāna prakṛti* types and *Pitta pradhāna* and *Kapha pradhāna prakṛti* types in CKD patients – Western Province, Sri Lanka under a 5% level of significance. Moreover, the mean and median values of IL-6 related to *Kapha pradhāna prakṛti* types were the lowest among all the three types of *Deha prakṛti*. The mean and median IL-6 values of *Vāta pradhāna prakṛti* types remained in the middle and the highest mean and median values of IL-6 could be observed in *Pitta pradhāna prakṛti* types in CKD patients.

DISCUSSION

As the elderly age in developing countries is considered to be 60 years old [23], 92.1% of the population in the current study belongs to the middle - aged and elderly category. Among them, 73.5% were at the age of sixty or over, representing the elderly population according to the elderly age defined in developing countries. It seems that more than half of the patients selected for the study belonged to the elderly group. Therefore, it can be said that the study results are consistent with the previous literature. According to previous literature, a significant proportion of the elderly population is diagnosed with CKD[24-25] as the prevalence of CKD risk factors such as Diabetes Mellitus (DM), hypertension, obesity, atherosclerosis, etc., increases in the elderly population[26-27].

The majority (64.6%) of CKD patients were males and only 35.4% represented the females. Several studies have reported on the gender distribution among patients with CKD, with a consistent finding that males exhibit a higher prevalence of CKD compared to females [28-33]. This may be due to the rapid degrading of kidney functions of males than the females, lifestyle patterns (especially the unwholesome dietary - behavioral habits followed by males), high exposure to occupational hazards than the females, differences in sex hormones (the protective effects of oestrogen on the vasculature, or the harmful effects of low testosterone) and the structural differences in kidney anatomy such as the large size of kidney and a large number of glomeruli in men, etc. [34 - 37]

The study revealed that majority (85%) of the patients were at later stages of CKD. According to the previous literature, several studies conducted in different countries in the world, including Sri Lanka, have revealed that CKD stages 4 and 5 were the stages represented by the majority of CKD patients [38-41]. The lack of prominent symptoms may contribute to the failure in early detection of patients with CKD. Therefore, this result highlights the importance of early detection of the diseases.

The prevalence of *Pitta pradhāna prakṛti* was the highest (41.6%) and *Sama Doṣaja* (0.9%) types were the lowest among CKD patients. There were 38.9% of *Vāta pradhāna prakṛti* types whereas 18.6% of *Kapha pradhāna prakṛti* types. Considering the patients' proportions of *Pitta* and *Vāta pradhāna prakṛti* types collectively (80.5%), the proportion of *Kapha pradhāna prakṛti* types (18.6%) appears to be substantially low. As mentioned by *Acarya* Caraka in Caraka Saṃhitha Vimanasthana 8th chapter – 96th stanza, *Śleshmala* persons (the persons having a predominance of *Kapha dosha*) are strong and long-lived[42]. Therefore, individuals with *Kapha pradhāna prakṛti* types should have maximum *Deha bala*, high disease resistance and an excellent mentality. Caraka Saṃhitha Vimanasthana 8th chapter – 97th stanza quotes that persons with a predominance of *Pitta dosha* are moderate in strength and life span[43]. According to Caraka Saṃhitha Vimanasthana 8th chapter – 98th stanza, persons with a predominance of *Vāta dosha* mostly have low strength, leading to more diseases and a shorter life span[44]. If the above scenario fits the scenario shown in Figure 3, then the claim in the literature regarding the characteristics of individuals with each type of *Deha prakṛti* seems almost appropriate.

In the present study, the median and mean ESR values of CKD patients were higher than the given reference ranges according to the study by Smith and

Samadian (1994) for all age groups[21]. This suggests that ESR is a reliable indicator of CKD - related chronic inflammation. As CKD is also a disease condition characterized by persistent - low - grade inflammation, the patients with CKD can be expected to have high ESR levels. Table 2 illustrates the sequence of *Deha prakṛti* types according to the ESR levels of CKD patients. As illustrated, the lowest ESR ranges were reported among the participants with *Sama doshaja prakṛti* type. Participants with *Kapha pradhāna prakṛti* types have the second - lowest ESR ranges, whereas their ESR ranges are slightly greater than those of *Sama doshaja* types. When comparing the ESR ranges of *Sama doshaja* and *Kapha pradhāna prakṛti* types, it was evident that both were within the normal ranges. Therefore, it can be concluded that the ESR values of CKD patients with *Sama doshaja* and *Kapha pradhāna prakṛti* types in the present study have not increased due to the disease condition, even though the disease is considered to consist of low-grade, persistent inflammation.

As discussed above, the finest type of *Prakṛti* is *Sama doshaja*, which is considered as disease –free and *Kapha pradhāna prakṛti* types are the best among the three types of *Deha prakṛti*; *Vāta pradhāna*, *Pitta pradhāna* and *Kapha pradhāna* [42-44]. Due to the characteristic of being less prone to diseases, even if inflammation occurs, individuals with *Sama doshaja* and *Kapha pradhāna prakṛti* types may be able to resist it. Therefore, their ESR values may be very low compared to other *Prakṛti* types. Furthermore, it was also observed that *Pitta* and *Vāta pradhāna*, *Kapha anubandha* types remained in the middle of the sequence as their ESR levels ranged from normal to above average. Among the *Pitta kapha* and *Vāta kapha* types, some patients had ESR levels within the normal range, while others had ESR above the normal range. The ESR values of these two *Prakṛti* types are higher than those of the *Sama doshaja* and *Kapha pradhāna prakṛti* types, probably due to the nature of their *Pradhana dosha*; *Pitta* and *Vāta*. According to the literature, *Pitta* and *Vāta pradhāna prakṛti* types may have a higher risk of getting diseases due to the moderate and low strength they encompass[43-44].

The associated *Kapha dosha* in both *Deha prakṛti* types would be why the ranges fluctuate from normal to above normal but do not reach an extremely high range. It is believed that *Anubandha kapha dosha* reduces the intensity of inflammation in CKD patients with *Pitta kapha* and *Vāta kapha prakṛti* types.

As *Pitta prakṛti* individuals are more likely to be associated with inflammatory conditions, this would be the reason for reporting the highest ESR ranges among the participants with *Kevala pitta*. Patients with *Vāta pradhāna prakṛti* types remained in the middle of the sequence, as indicated by Table 2. *Vāta pradhāna prakṛti* types should be placed at the top of the hierarchy since they are considered to be the weakest of the three *Deha prakṛti* varieties, according to the literature[44]. But since the study is basically focused on the inflammatory markers associated with inflammation in CKD, it is evident that *Pitta pradhāna* types were higher in the *Deha prakṛti* types hierarchy as *Pitta dosha* is more closely associated with inflammation than *Vāta dosha*.

Figure 4 supports the above scenario by showing that patients with *Pitta* and *Vāta pradhāna prakṛti* types had elevated ESR levels, while no patients with *Kapha pradhāna* or *Sama doshaja* types had elevated ESR levels.

The Kruskal Wallis Test revealed statistically significant associations between the types of *Deha prakṛti* and the levels of ESR in CKD patients indicating that the ESR levels depend on the type of *Deha prakṛti.* It was also found that there were significant associations between the ESR levels in *Vāta pradhāna* and *Pitta pradhāna prakṛti* types, *Vāta pradhāna* and *Kapha pradhāna prakṛti* types as well as *Pitta pradhāna* and *Kapha pradhāna prakṛti* types in CKD patients – Western Province, Sri Lanka. According to the statistical evidence and general observation in relation to ESR levels, it can be said that the degree of CKD inflammation is highest among the *Pitta pradhāna prakṛti* types and no inflammatory conditions were reported among the *Kapha pradhāna prakṛti* types.

Comparable to ESR values, there were participants with IL - 6 levels ranging from normal to above normal. However, 40.7% of CKD patients were reported with elevated IL – 6 levels, whereas the majority (59.3%) remained within the normal range. All the patients with elevated IL – 6 levels belonged to *Pitta pradhāna* as well as *Vāta pradhāna prakṛti* types and the above result was comparable to that of ESR distribution levels among *Deha prakṛti* types in CKD patients.

The sequence obtained by lining up the *Deha prakṛti* types according to the IL - 6 ranges is the same as the sequence obtained by lining up the *Deha prakṛti* types according to the ESR ranges. The *Sama doshaja* and *Kapha pradhāna prakṛti* types remained at the bottom of the sequence. *Pitta kapha* and *Vāta kapha* types were in the middle, while *Kevala pitta, Pitta vāta*, *Vāta pitta*, and *Kevala vāta* types had extremely high IL - 6 levels. The only difference is that the IL - 6 values/ranges of *Pitta kapha* and *Vāta kapha* types are also in the normal range in terms of IL - 6, whereas the ESR ranges of the same *Deha prakṛti* types were in the normal to above normal ranges. However, it is evident that the *Kapha dosha*, which acts as either the *Pradhana* or *Anubandha dosha* in any type of *Deha*

prakṛti may suppress the elevation of IL – 6 levels in the serum of CKD patients and keep the levels within the normal range. But it was found that there were two CKD patients with *Pitta kapha Deha prakṛti* who had abnormally high levels of IL – 6 (246 pg/ml and 260 pg/ml). Further consideration should be given to the possibility that these patients may be experiencing severely immunocompromised diseases other than chronic kidney disease (CKD).

The types of *Deha prakṛti* in which *Kapha dosha* is not associated as either *Pradhana* or *Anubandha dosha* consist of the highest IL – 6 levels, especially in patients with *Pitta* - associated *Deha prakṛti* as *Pitta dosha* is closely related to inflammatory conditions.

In addition, the Kruskal - Wallis test confirmed a statistically significant association between the types of *Deha prakṛti* and the levels of IL – 6 in CKD patients. The same results were observed here also, as discussed earlier in relation to the associations between ESR levels and types of *Deha prakṛti*. Significant associations were found between the IL - 6 levels of *Vāta pradhāna* and *Pitta pradhāna prakṛti* types, *Vāta pradhāna* and *Kapha pradhāna* types as well as *Pitta pradhāna* and *Kapha pradhāna prakṛti* types. Moreover, it was observed that *Kapha pradhāna* CKD patients had considerably lower IL – 6 levels than *Vāta* and *Pitta pradhāna* types whereas *Pitta pradhāna* types exhibited the highest.

Pitta pradhāna prakṛti types had the highest median and mean IL – 6 levels among the three types of *Deha prakṛti*. Thus, confirming the previously discussed facts, it is understood that CKD inflammation is more severe among *Pitta pradhāna prakṛti* types than in the other two types.

However, statistically significant associations could not be observed in CRP levels and the TNF – α levels with *Deha prakṛti* types indicating that those levels are not depending on the types of *Deha prakṛti* of CKD patients.

When considering the distribution pattern of *Deha prakṛti* types according to elevated TNF – α in CKD patients, the majority (82.9%) of *Vāta pradhāna* and *Pitta pradhāna prakṛti* types had elevated TNF – α levels. Furthermore, 17.2% of *Kapha pradhāna prakṛti* types also had high levels of TNF – α. It was an opposing finding compared to the obtained results concerning ESR, CRP and IL – 6 regarding *Kapha pradhāna prakṛti* types.

CONCLUSION

In the light of observations and results, below conclusions have been made according to the findings of the selected population of CKD patients of the present study. The types of *Deha prakṛti* in CKD patients are significantly associated with the level of ESR and IL - 6 under a 5% significance level, indicating that the levels of ESR and IL - 6 inflammatory markers depend on the types of *Deha prakṛti* of CKD patients. This will lead the Āyurveda physicians to plan and develop specific treatment regimens including dietary and behavioral patterns targeting the above inflammatory markers and related *Deha prakṛti* types of the CKD patients. Furthermore, as among the three types of *Deha prakṛti*, CKD patients with *Kapha pradhāna prakṛti* are found to have the lowest ESR and serum IL – 6 levels, whereas *Pitta pradhāna prakṛti* types were found to have the highest ESR and serum IL – 6 levels, drug dosages can be determined easily. Moreover, since it can be concluded CKD patients with *Pitta pradhāna deha prakṛti* types are more associated with CKD inflammation compared to CKD patients with *Vāta pradhāna* and *Kapha pradhāna deha prakṛti* types, they can be advised and prescribed to follow wholesome dietary and behavioral patterns along with the drugs which are suitable and not to get the condition worse.

REFERENCES

1. Lv JC, Zhang LX. Prevalence and disease burden of chronic kidney disease. Renal fibrosis: mechanisms and therapies. 2019: 3 -15.
2. Wijewickrama ES, Weerasinghe D, Sumathipala PS, Horadagoda C, Lanarolle RD, Sheriff RM. Epidemiology of chronic kidney disease in a Sri Lankan population: experience of a tertiary care center. Saudi Journal of Kidney Diseases and Transplantation. 2011 Nov 1; 22(6): 1289-1293.
3. Wijewickrama E, Jayasinghe S, Constantine G, Katulanda G, Katulanda P. SUN-124 Prevalence of chronic kidney diseases and its associated risk factors from a non-CKDu endemic area of Sri Lanka. Kidney International Reports. 2020 Mar 1; 5(3): S252-253.
4. Berns JS. Routine screening for CKD should be done in asymptomatic adults selectively. Clinical Journal of the American Society of Nephrology. 2014 Nov 1;9(11):1988-1992.
5. Rysz J, Gluba-Brzózka A, Franczyk B, Jabłonowski Z, Ciałkowska-Rysz A. Novel biomarkers in the diagnosis of chronic kidney disease and the prediction of its outcome. International journal of molecular sciences. 2017 Aug 4; 18(8): 1702.
6. Sharma PV, Caraka Samhita (Agnivesa's treatise refined and annotated by Caraka and redacted by Drdhabala): Chaukhambha Orientalia, 2014, p. 375
7. Sharma PV, Caraka Samhita (Agnivesa's treatise refined and annotated by Caraka and redacted by Drdhabala): Chaukhambha Orientalia, 2014, p. 228
8. Akchurin OM, Kaskel F. Update on inflammation in chronic kidney disease. Blood purification. 2015 Jan 20; 39(1-3): 84-92.
9. Suliman ME, Stenvinkel P. Contribution of inflammation to vascular disease in chronic kidney

disease patients. Saudi Journal of Kidney Diseases and Transplantation. 2008 May 1; 19(3): 329-345.

10. Saadeh, C. (1998). The erythrocyte sedimentation rate: old and new clinical applications. Southern medical journal-Birmingham Alabama, 91, 219–226.
11. Kelsey JL. Methods in observational epidemiology. Monographs in Epidemiology; 1996.
12. Bhushan P, Kalpana J, Arvind C. Classification of human population based on HLA gene polymorphism and the concept of Prakriti in Āyurveda. Journal of Alternative & Complementary Medicine. 2005 Apr 1; 11(2): 349-353.
13. Ghodke Y, Joshi K, Patwardhan B. Traditional medicine to modern pharmacogenomics: Āyurveda Prakriti type and CYP2C19 gene polymorphism associated with the metabolic variability. Evidence-Based Complementary and Alternative Medicine. 2011; 2011(1): 249528.
14. Mahalle NP, Kulkarni MV, Pendse NM, Naik SS. Association of constitutional type of Āyurveda with cardiovascular risk factors, inflammatory markers and insulin resistance. Journal of Āyurveda and integrative medicine. 2012 Jul; 3(3): 150.
15. Rotti H, Guruprasad KP, Nayak J, Kabekkodu SP, Kukreja H, Mallya S, Nayak J, Bhradwaj RC, Gangadharan GG, Prasanna BV, Raval R. Immunophenotyping of normal individuals classified on the basis of human dosha prakriti. Journal of Āyurveda and integrative Medicine. 2014 Jan; 5(1): 43.
16. Rotti H, Raval R, Anchan S, Bellampalli R, Bhale S, Bharadwaj R, Bhat BK, Dedge AP, Dhumal VR, Gangadharan GG, Girijakumari TK. Determinants of prakriti, the human constitution types of Indian traditional medicine and its correlation with contemporary science. Journal of Āyurveda and integrative medicine. 2014 Jul; 5(3): 167.
17. Thaker SJ, Gandhe PP, Godbole CJ, Bendkhale SR, Mali NB, Thatte UM, Gogtay NJ. A prospective study to assess the association between genotype, phenotype and Prakriti in individuals on phenytoin monotherapy. Journal of Āyurveda and integrative medicine. 2017 Jan 1; 8(1): 37-41.
18. Decreased GJ. Definition and classification of CKD. Kidney Int. 2013; 3: 19-62.
19. Gilmour D, Sykes AJ. Westergren and Wintrobe methods of estimating ESR compared. British medical journal. 1951 Dec 12; 2(4746): 1496.
20. Decreased GJ. Definition and classification of CKD. Kidney Int. 2013; 3: 19-62.
21. Smith EM, Samadian S. Use of the erythrocyte sedimentation rate in the elderly. British journal of hospital medicine. 1994 Apr 1; 51(8): 394-397.
22. Kumar P, Clark ML. Kumar and Clark's clinical medicine E-Book. Elsevier health sciences; 2012 Jun 4.
23. Dyussenbayev A. Age periods of human life. Advances in Social Sciences Research Journal. 2017 Apr 1; 4(6).
24. Locatelli F, Pozzoni P. Chronic kidney disease in the elderly: is it really a premise for overwhelming renal failure?. Kidney international. 2006 Jun 2; 69(12): 2118-2120.
25. Xue JL, Ma JZ, Louis TA, Collins AJ. Forecast of the number of patients with end-stage renal disease in the United States to the year 2010. Journal of the American Society of Nephrology. 2001 Dec 1; 12(12): 2753-2758.
26. Cutler, J. A., Sorlie, P. D., Wolz, M., Thom, T., Fields, L.E., & Roccella, E. J. (2008). Trends in hypertension prevalence, awareness, treatment, and control rates in United States adults between 1988-1994 and 1999–2004. Hypertension, 52(5), 818-827. https://doi.org/10.1161/hypertensionaha. 108.113357
27. Wild, S., Roglic, G., Green, A., Sicree, R., & King, H. (2004). Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care, 27(5), 1047–1053. https://doi.org/10.2337/ diacare.27.5.1047
28. Carrero JJ, Hecking M, Chesnaye NC, Jager KJ. Sex and gender disparities in the epidemiology and outcomes of chronic kidney disease. Nature Reviews Nephrology. 2018 Mar; 14(3): 151-164.
29. Jayasekara KB, Dissanayake DM, Sivakanesan R, Ranasinghe A, Karunarathna RH, Kumara GW. Epidemiology of chronic kidney disease, with special emphasis on chronic kidney disease of uncertain etiology, in the north central region of Sri Lanka. Journal of epidemiology. 2015 Apr 5; 25(4): 275-280.
30. Rao AS, Phaneendra D, Pavani CD, Soundararajan P, Rani NV, Thennarasu P, Kannan G. Usage of complementary and alternative medicine among patients with chronic kidney disease on maintenance hemodialysis. Journal of Pharmacy and Bioallied Sciences. 2016 Jan 1; 8(1): 52-57.
31. Venkata RK, Kumar S, Krishna RP, Kumar SB, Padmanabhan S. Tuberculosis in chronic kidney disease. Clinical nephrology. 2007 Apr 1; 67(4): 217-20.
32. Yang W, Xie D, Anderson AH, Joffe MM, Greene T, Teal V, Hsu CY, Fink JC, He J, Lash JP, Ojo A. Association of kidney disease outcomes with risk factors for CKD: findings from the Chronic Renal Insufficiency Cohort (CRIC) study. American journal of kidney diseases. 2014 Feb 1; 63(2): 236-

243.
33. Zimmermann J, Herrlinger S, Pruy A, Metzger T, Wanner C. Inflammation enhances cardiovascular risk and mortality in hemodialysis patients. Kidney international. 1999 Feb 1; 55(2): 648-658.
34. Carrero JJ, Hecking M, Chesnaye NC, Jager KJ. Sex and gender disparities in the epidemiology and outcomes of chronic kidney disease. Nature Reviews Nephrology. 2018 Mar; 14(3): 151-164.
35. Goldberg I, Krause I. The role of gender in chronic kidney disease. Emj. 2016 Apr 5;1(2):58-64.
36. Seliger et aSeliger SL, Davis C, Stehman-Breen C. Gender and the progression of renal disease. Current opinion in nephrology and hypertension. 2001 Mar 1; 10(2): 219-225.
37. Silbiger, S. R., & Neugarten, J. (1995). The impact of gender on the progression of chronic renal disease. American Journal of Kidney Diseases, 25(4), 515-533.https://doi.org/10.1016/0272-6386(95)90119-1
38. Amoako YA, Laryea DO, Bedu-Addo G, Andoh H, Awuku YA. Clinical and demographic characteristics of chronic kidney disease patients in a tertiary facility in Ghana. The Pan African Medical Journal. 2014; 18.
39. Perlman RL, Finkelstein FO, Liu L, Roys E, Kiser M, Eisele G, Burrows-Hudson S, Messana JM, Levin N, Rajagopalan S, Port FK. Quality of life in chronic kidney disease (CKD): a cross-sectional analysis in the Renal Research Institute-CKD study. American journal of kidney diseases. 2005 Apr 1; 45(4): 658-666.
40. Senanayake, S., Gunawardena, N., Palihawadana, P., Senanayake, S., Karunarathna, R., Kumara, P., & Kularatna, S. (2020). Health related quality of life in chronic kidney disease; a descriptive study in a rural Sri Lankan community affected by chronic kidney disease. Health and Quality of Life Outcomes, 18(1), 1–9. https://doi.org/10.1186/s12955-020-01369-1
41. Wijewickrama ES, Weerasinghe D, Sumathipala PS, Horadagoda C, Lanarolle RD, Sheriff RM. Epidemiology of chronic kidney disease in a Sri Lankan population: experience of a tertiary care center. Saudi Journal of Kidney Diseases and Transplantation. 2011 Nov 1; 22(6): 1289-1293.
42. Sharma PV, Caraka Samhita (Agnivesa's treatise refined and annotated by Caraka and redacted by Drdhabala): Chaukhambha Orientalia, 2014, p.376
43. Sharma PV, Caraka Samhita (Agnivesa's treatise refined and annotated by Caraka and redacted by Drdhabala): Chaukhambha Orientalia, 2014, p. 376
44. Sharma PV, Caraka Samhita (Agnivesa's treatise refined and annotated by Caraka and redacted by Drdhabala): Chaukhambha Orientalia, 2014, p. 377

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