Review Article

Role of Nature and Nurture in Individual Behavioural Differences in Children: Literary Evidences from Ayurveda

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ABSTRACT

Children's temperamental traits consistently forecast their cognitive and social functioning. Researchers in the field of developmental psychology have become increasingly interested in temperamental variations among children because the psychological traits that make up temperament are believed to form the cornerstone of adult personality.
Each child is born with an individual temperament which represents differences in behavior. Since long there has been a debate regarding the relative influences of genetic and environmental factors on individual differences in behavior and still it is on. Furthermore, as these temperaments during infancy and childhood have impact over the future psychological outcome, study of various influences on temperament is quite essential.
Human behavioral genetics seeks to identify and characterize both the genetic and the environmental sources of individual differences in human behavior. Ayurveda literature provides a detailed description regarding the human individual differences termed *prakriti*, its formation, determinants and influences.
Researchers should look through the concepts of Ayurveda which may provide the answer to many unanswered questions regarding the individual differences.

Key words: Ayurveda, *Prakriti*, temperament, individual differences.

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Introduction

One of the longest and at times most argumentative, debates in Western intellectual history concerns the relative influence of genetic and environmental factors on human behavioral differences, the so- called nature- nurture debate [1]. Human behavioral genetics attempts to identify and characterize both the genetic and the environmental sources of individual differences in human behavior. It is important to document the importance of all the determinants of child temperament, to track the developmental course in children in order to study temperament to problem behaviors.

Ayurveda explains the entire human behavior in terms of prakriti he *prakriti* is of two types- *sharirika* and *manasika*. Furthermore, Ayurveda regards that behaviour or the psychological aspect of an individual is determined by the status of his *manas* (mind) and *manasika prakriti*.

The present article is an effort to identify the determinants of individual differences the term for which in Ayurveda is *prakriti;* in order to understand the development course and differences in behaviour in children.

Prakriti in Ayurveda

The word *Prakriti* is a feminine term which mainly represents the nature of an individual. Ayurveda defines *Prakriti* as "inherent nature" [2]. Also scholars of Ayurveda define *prakriti* as body characteristics [3] and predominance of *dosha* since birth [4].

Ayurveda has more specifically applied the term *prakriti* to the constitution comprehending both the physical and

mental characteristics. This term has an extended use to denote health in the sense of equilibrium of the three biological units of body- the *vata*, *pitta* and *kapha*. The word refers to innate, inherent or natural rather than disturbed, deviant or perverted (*vikriti*) state of physical and psychological components [5].

Two types of *prakriti* are described in Ayurveda:

1. ***Deha Prakriti*** **(the psychosomatic constitution)**: Categorized on the basis of preponderance of the three biological constitutions of body- *vata, pitta,* and *kapha.*

2. ***Manasika Prakriti*** **(the psychic constitution)**: *Manasika prakriti* is determined by the relative variation of the three fundamental attributes of *mana* viz. *triguna*- the *suddha* (the pure), *rajas* (the passion) and *tamas* (the inertia) depending upon the dominance of any one of these attributes. The *rajasika* and *tamasika prakriti* are more prone to psychopathologies due to the presence of *rosha* part and *moha* part respectively [6].

The concept of *manasika prakriti* introduces a distinct and new classification of the individual based on the pure psychic features of different types of persons. This classification takes into account the individual's attitude, orientation, urges, inclinations, temperaments, behavioural patterns, habits, conducts, likings and disliking and many other emotional and intellectual capabilities.

Ayurveda considers a wide array of factors that determine the *prakriti* of an individual. *Dosha* status of all the factors in balanced form leads to an optimal *prakriti* in an individual. Since *dosha* are the constituents of the *prakriti*, predominance of *dosha* in an individual determines the *prakriti* that should be in pure and balance form.

Determinants of *Prakriti* (Individual Differences in Behaviour)

Ayurveda documents that whichever *dosha* is dominant at the time of union of *shukra* (sperm) and *shonita* (ovum), determine the *prakriti* of an individual [7]. Also dominant *dosha* not only in *shukra* and *shonita* but also due to the effect of *kala* (day of the menstrual period, age of parents or the season), condition of the uterus (*garbhashayaprakriti*) and due to the diet and lifestyle of the mother (*matur-ahara-vihara*) together contribute in the formation of *prakriti* [8].

1. *Shukra Prakriti* (The nature of sperm)

Shukra is considered as the indispensible tool for conception and formation of *garbha* (foetus) [9]. Ayurveda advocates that in order to have offspring, the *shukra* should be in pure form. If it is impure (afflicted with *dosha*) then measures of its purification are also described. *Shukra* comprises of an inherent *prakriti* of father, *vata*, *pitta*, *kapha* or combination of two or three *dosha*which is carried to the offspring through genes. This inherent dominance of *dosha* is influenced by another important factor i.e physiological status of *dosha* that is determined by the diet and lifestyle of the father. There is interaction between the inherent and physiological *dosha*. (Figure 1)

Besides representing the inherent *prakriti* of father, *shukra* also represents any pathological deviations due to abnormal increase of some *dosha* as a pathology. *Shukra* essentially represents these changes also and this is why a *shukra shuddhi* is recommended before one plans to conceive. Resultant dominance of *dosha* depends on the relevant strength of the individual *dosha*. *Dosha* which becomes dominant then becomes the contributor to the *prakriti*.

Twin and Adoption studies also document the heritable nature of most psychological traits. These studies suggest that individual differences in infants and child temperament are genetically influenced. [10]

2. *Shonita Prakriti* (The ovum)

Like *shukra*, *shonita* also constitutes a factor for the formation of fetus. Ayurveda describes certain

contraindications which should be avoided during the menstrual period [11].These factors lead to vitiation of *dosha* during menstrual period which further afflict the *shonita* (of the female, leading to epigenetic changes which influence the expression of genes. The afflicted *shonita* when participate in conception results into maldevelopment of the resulting fetus.

Researches also document that the inherited characters can be transported from sires to progenies via 2 kinds of vehicles: nucleus (chromosomes) and cytoplasm (mitochondrial DNA or chloroplast DNA). Since the substance of the nuclear content of egg and sperm is equivalent, inheritance through the chromosomes mean an equal determinative share by male and female in heredity. Although chloroplast is found in plants but the process of inheritance remains the same. Here the reference quoted indicates that cytoplasmic inheritance includes inheritance of DNA present in mitochondria or chloroplast. Here the reference is common for both animals or plants.

Inheritance through the cytoplasm means that the locus of the determiners or representatives of a character is the cytoplasm, and since it is the egg alone which contains any significant amount of cytoplasm, this inheritance usually is refer to as maternal inheritance [12]. Therefore, maternal inheritance has a great influence on the offspring's gene action and even on differences in behaviour.

In contrast to nuclear inheritance, cytoplasmic inheritance in mammals is derived mostly, from the maternal line. Mitochondria, and their DNA molecules (mtDNA), are the genetic units of this method of inheritance. Mitochondrial genes, in the contrast to genes in the nucleus, have an exclusively maternal mode of inheritance in mammals [13].

Study indicates that Mitochondria, Chloroplasts, explained in above comment and other cytoplasmic factors that have physiological effects throughout the life of an individual are transmitted directly from one parent to the offspring, often through the mother [14].

3. Garbhashaya prakriti (Condition of uterus)

Intrauterine environment is an optimal, stimulating and interactive environment for fetal growth and development. The atmosphere or the level of *dosha* in the uterus at the time of conception and during the complete antenatal period is also responsible for the formation of *prakriti*.

Study also provides evidence that maternal genotype can affect the child's phenotype beyond effects of classical inheritance and is explained by intrauterine environmental differences or by differences in maternal behaviour. [15]

The impact of condition of the uterus on the developing fetus is well supported by various researches. Researches document that growth and development of the fetus are complex biological events influenced by genetic, epigenetic, maternal maturity as well as environmental and other factors [16-17]. These factors influence the size and functional capacity of the placenta, uteroplacental transfer of nutrients and oxygen from mother to fetus, conceptus nutrient availability, the fetal endocrine milieu, and metabolic pathways [18-20].

4. *Kala Prakriti* (The period of conception and seasonal variations)

Age for conception has been given due importance in Ayurveda. Proper age of conception as per Ayurveda is 25 years for male and 16 years for female [21]. Others opine that optimal age for conception should be 20 years for male and 16 years for female [22].

Kala in Ayurveda, in general also refers to seasonal variations. Different seasons represent predominance of a particular *dosha*. *Dosha* occur in three states according to different seasons [23] (Table 1)viz.

Samchaya (accumulation) *Prakopa* (vitiation) *Shaman* (alleviation)

Similarly, the status of *bala* (strength) also varies with seasons [24] (Table 2) and according to different periods

of day and night [25] (Table 3).

Therefore predominance of *dosha* at that particular time of conception determines the formation of *prakriti*.

Researches also report that season of birth is related to the variations in temperamental traits and personality. [26-28]

5. *Matur-Ahar-Vihar Prakriti* (Diet and conduct of pregnant mother)

Ayurveda describes the methods of procreating offspring of the desired sex and temperament and constitution and accordingly the preparations (*purvakarma*), the regimen to be followed by a woman during menstrual period (*ritukala*), the methods and precautions adopted at the time of conception and care of the fetus and pregnant woman have been enumerated judiciously. A detail regimen and dietetic instructions have been given in Ayurveda which are to be followed by a woman to have a meritorious child.

Ayurveda documents that the diet, emotional state and behaviour of the mother at the time of conception determine the psychological constitution of the child [29].

Diet

The *rasavahanadi* of mother is connected with the *garbhanabhinadi* (umbilical cord) and the essence of the food that the mother takes reaches the foetus for its nutrition [30]. Therefore, the diet and conduct of mother practiced during pregnancy has its outcome over of *rasadhatu* which in turn nourishes the foetus.

The third month of the foetal period is crucial for the development of all the *indriya* [31] (sense organs) and the fifth month is important for the clarity / sharpness of mind [32]. Ayurveda is very specific about this aspect of development as it advocates the use of milk, mixed honey &*ghrita* in the third month and milk and *ghrita* in the fifth month [33]. Use of sweet, cold and liquid diet is indicated [34]. These diets keep all the *dosha* in a balanced state and at the same time, milk and *ghrita* nourishes the mind/ brain.

Regular intake of *vata* dominant diet by a pregnant woman leads to vitiation of *vata* in her body and reaches the *garbhashaya* (uterus) and further makes the child *jada* (idiot), *muka* (dumb), *minmin* (with nasal tang of voice), stuttering speech, limp, stunted and with loss of one or more organs and other *vata* disorders [35].

Similarly regular intake of *pitta* diet leads to a child with loss of hair, early graying hair, absence of moustaches and beard, hypo or discolouration of skin, nail and hair and other diseases of *pitta* vitiation [36].

Also, continuous intake of *kapha* dominant diet by a pregnant woman gives birth to a child with various skin disorders (*kushtha, kilas* etc.) and natal tooth along with other disorders of *kapha* vitiation [37].

Among intrauterine environmental factors, nutrition plays the most critical role in influencing placental and fetal growth. Studies also demonstrate that the nutritional environment during fetal development also influence growth, metabolism and brain development and there is increasing evidence that dietary levels of methyl- donors can epigenetically alter gene expression in offspring.[38-39]

There is growing evidence that maternal nutritional status can alter the epigenetic state (stable alterations of gene expression through DNA methylation and histone modifications) of the fetal genome. This may provide a molecular mechanism for the impact of maternal nutrition on both fetal programming and genomic imprinting. [40]

Contraindications during pregnancy

During pregnancy, alcohol, excessive hot or pungent diet and excessive stress [41] are contraindicated.

Alcohol consumption

The more alcohol a woman consumes during pregnancy,

the poorer the child's motor coordination, speed of information processing, attention, reasoning, and intelligence and achievement test scores during the preschool and school years [42-43].

Emotional Stress

It has been stated that those mothers who remain stressed during pregnancy gives birth to a fearful child having thin built and poor longevity [41]. Several recent studies show that there is profound impairment of hippocampal functioning in the offspring of mother exposed to prenatal stress [44]. Retrospective studies on children whose mothers experienced severe psychological stress or adverse life events during their pregnancy have shown long term neurodevelopmental effects on the infant [45-48]. Stress hormones cross the placenta causing dramatic rise in fetal heart rate and activity level. [49-50].

Behaviour of the mother during pregnancy

Ayurveda also advocates that the female should remain happy throughout the pregnancy as the type of psyche of the mother has an influence over the developing psyche of the fetus [51]. Sushruta states that if the parents are religious, virtuous and theistic, they produce children of the same qualities [52].

The behavior of the mother during pregnancy including activities like- listening, thinking, dreaming etc. all influence the psyche of the child. Whatever the diet, conduct and activities, the parents practice at the time of conception, the progeny acquires the qualities accordingly [53]. It is also stated that the fetus is influenced and affected even with minute aspects like, inspiration, expiration, emotional upsets and dreams of the mother [54].

Researches also prove that the fetus responds to sounds with heart rate changes, head turns and body movements as early as 25th week of gestation [55]. Evidence for fetal learning also comes from studies in which newborns appear to remember stimuli to which they were exposed prenatally; their mother's heart beats, the odor of amniotic fluid and the stories or pieces of music they heard in the womb [56-57]. Studies also document that the fetus can distinguish between familiar and novel stimuli by the 32nd or 33rd week [58]. The ability to learn in this way seems to emerge between 24 & 38 weeks [59-60].

6. *Mahabhuta Vikara Prakriti*

Ayurveda advocates that the similarities and differences in *prakriti* (constitution), *akriti* (physical built), *pramana* (body proportion), *sneha*, *deepti*, *kharadiguna* is due to the combination of these *panchmahabhutas* in different proportion. The difference arises from the deeds of the parents in the present life (diet and conducts) and also from the deeds of past life. [61]

Panchamahabhuta also form integral part of the fetus. Every matter on the earth including human being is thought to be derived from these *panchamahabhuta* [62]. Each *mahabhuta* contributes to one or more part of the fetus in appropriate proportion.

Each of these five *mahabhuta* has a dominance of one or two *mahaguna*. Thus, the *akashmahabhuta* increases the *sattva*, *vayumahabhuta* increases the *rajas* and the *prithvi mahabhuta* increases the *tama* part in the developing fetus. Therefore the contributions of these *mahabhuta* in different proportions determine the dominance of *manasikadosha* which further determine the *prakriti* of the child. *Medha* (intellect) is derived from the *agnimahabhuta* [63].

Influences on *Prakriti*

Although, the *prakriti* is formed at the time of conception it is further influenced by various factors described in Ayurveda. These include- *jati* (racial differences), *kula* (family), *desha* (geographical distribution, cultural variations), *kala* (climatic conditions), *vaya* (age differences), and *pratyatmaniyata* (individual's self) [64].

1. *Jatiprasakta* (Race differences)

Races are supposed to share genes and therefore share various temperament characteristics specific to that particular race. Studies based on racial differences in intelligence are consistent with the Ayurveda view and report that Caucasoids and the Mongoloids are the two most intelligent races [65]. However, studies also reveal that Ethnicity and socio-economic status SES account for only one fourth of the total variation in IQ. [66]

2. *Kulaprasakta* (Family)

The role of family in the development of child has been better understood in Ayurveda. Members of the same family share DNA and therefore they show specific temperament characteristics. Genetic influence is in the range of 40 to 50%, and heritability is approximately the same for different traits. [67]

3. *Deshanupatini* (Geographical variations)

The place (*desha*) where a person belongs, where he was born, what are the dietetic things used in that place, what are their strengths, the psychic trends of the people at that place, their habits, the environment of that place, all of these are considered under the factor *desha*.

Desha in Ayurveda is divided under three categories [68], based on climatic condition and vegetation:

Anupa: The place where the rainfall is heavy and water remains accumulated, rivers are in abundance, wind is cold, the mountain and vegetation is in abundance and the persons belonging to such place are by nature tender but of strong constitution and they have more tendency to develop *kaphaja* and *vataja* disorders.

Jangala: The place which is of even surface, where rainfall is less, water sources are few, vegetation includes thorny and small trees, wind is warm and the people are more stout and thin and are prone to *vataja* and *pittaja*disorders.

Sadharana: Constitutes mixed characteristics of *anupa* and *jangaladesha*.

Researches on geographical variations in personality traits indicate that there is trait variation across different geographical regions. Two variables in geographical variation are supposed to influence these variations. These are:

- Environmental influences
- Social influence

Evidences report that geographic personality difference may occur as a result of social influence according to dynamic social-impact theory, local clustering of attitudes and beliefs can occur when individuals engage in repeated social interaction with other [69-70]. As a result, attitudes become geographically clustered not because people choose to live with other who share common interests but rather as a result of social influence [69]. There is also evidence indicating that sociological variables can influence people's thought, feelings, and behaviours [71].

Evidences also document the influence of cultural variations on differences in personality. People in collectivist cultures who value family and work group above individual needs and desires, see the environment as more or less fixed (stable norms, obligations, duties) and themselves as changeable, ready to fit in, on the other hand people in individualist cultures see themselves as more or less stable (stable attitudes, personality, rights) and the environment as changeable [72-74].

Although studies directly linking the physical environment and personality are rare, there is evidence suggesting that features of the physical temperature (temperature, urbanization, crowding) are related to a few individual difference variables. (Table 4)

Kaphadosha is heavy and slow in nature which when in excess leads to heaviness and creates rigidity and fixation of thoughts, inflexibility and predisposes to

tamasikabhavas in individuals. *Tamasikabhavas* show depression, incomprehension, grief, indolence [75] etc. *Pittadosha* is sharp, penetrating and hot in quality [76]. Increased *pittadosha* therefore, leads to consuming emotions like, anger or aggressiveness.

4. *Kala Prakriti* (Seasonal variations)

Ayurveda holds the view that the status of *dosha* is influenced by the climatic changes. Climate has a significant effect on the types of activities in which individuals within a region can engage, which could as a result, influence various psychological characteristics of individuals in that region. Research on seasonal affection disorder indicates that individuals living in region that receive little direct sunlight during the cold season are prone to experiencing depression, stress, and anxiety which are all associated with neurototicism. [77-78]

5. *Vaya* (Age)

The *prakriti* is also influenced by the age of an individual. The available evidences indicate that, from emerging adulthood through middle age, conscientiousness and agreeableness show positive age trends, neuroticism shows a negative trend and extraversion and openness to experience show flat trends [83-88].

6. *Pratyatmniyata* (Individual's self)

This is personality, as a result of the individual self relating to non-shared environment. It depends upon the individual's particular diet, lifestyle, likings, avoidance etc. Every individual has his own specific make up according to which he has own preferences, likings, habits, thoughts and therefore dominance of a particular *dosha*. Therefore the individual's *prakriti* is influenced by that dominant *dosha*. Studies document that non shared environment experiences between pairs of twins seemed to be the strongest cause of attitude variances, overshadowing genetic predispositions as well as shared environment experiences[89] The study indicate that some non shared environment experiences were very much connected to attitudes and self-reports of physical characteristics and intelligence [89].

Conclusion

Ayurveda holds the view that among various factors determining the temperament heritability is one of them and researchers should look beyond the basic heritability question. All these factors discussed here determine the *prakriti* of an individual. Researchers should look through the concepts of ayurveda which may provide the answer to many unanswered questions regarding the individual differences.

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Conflicts of Interest

Author declares no conflict of interest.

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Table1: Showing status of *doshas* according to seasonal variations [23]

***Kala/ Ritu* (Season)**	***Dosha avastha* (Status of *Dosha*)**		
	***Samchaya*(Accumulation)**	***Prakopa* (Vitiation)**	***Shaman* (Alleviation)**
Shishir (Late Winter)	*Kapha*		
Vasant (Spring)		*Kapha*	
Grishma (Summer)	*Vata*		*Kapha*
Varsha (Rains)	*Pitta*	*Vata*	
Sharad (Autumn)		*Pitta*	*Vata*
Hemant (Early Winter)			*Pitta*

Table 2: Showing status of strength according to seasonal variations [24]

Kala (Season)	***Bala* (Strength)**
Shishir (Late Winter); *Hemant* (Early Winter)	Good
Vasant (Spring); *Sharad* (Autumn)	Medium
Grishma (Summer); *Varsha* (Rains)	Poor

Table 3: Showing status of *doshas* according to periods of day and night [25]

Day	**6 a.m – 10 a.m**	**10 a.m – 2 p.m**	**2 p.m – 6 p.m**
Status of *doshas*	*Kapha*	*Pitta*	*Vata*
Night	**6 p.m.- 10 p.m.**	**10 p.m. –2.a.m.**	**2 a.m. – 6 a.m.**
Status of *doshas*	*Kapha*	*Pitta*	*Vata*

Table 4: Physical Environment –personality relation

Environmental Factors	**Effects**	**Effect on *Dosha***	**Reported Studies**
Direct Sunlight during cold season	Depression, stress anxiety (Neuroticism)	*Kaphadosha*	Magusson 2000, Okawa et al , 1996[77-78]
Hot climate (*Jangaladesha*)	Aggressive behaviour	Increased *Pittadosha*	Anderson , 1989; Anderson & Anderson , 1996[79-80]
Densely populated region (*Anupadesha*)	Higher rates of psychological stress	Dominance of *Kapha- Vatadosha*	Fleming et al , 1987: Lewy&Herszog, 1978 [81-82]