

**DEVELOPMENT OF REGRESSION EQUATION TO PREDICT
KHO-KHO PERFORMANCE WITH THE HELP OF DIGIT
RATIO, STRESS-VULNERABILITY AND SELECTED
ANTHROPOMETRIC VARIABLES**

A

Thesis

Submitted to



For the award of

DOCTOR OF PHILOSOPHY (Ph.D)

In

Physical Education

By

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Supervised By

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LOVELY FACULTY OF BUSINESS AND ARTS

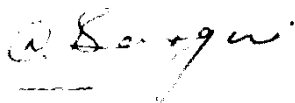
LOVELY PROFESSIONAL UNIVERSITY

PUNJAB

2019

DECLARATION

I hereby declare that the thesis entitled “Development of Regression Equation to Predict Kho-Kho Performance with the help of Digit Ratio, Stress-Vulnerability and Selected Anthropometric Variables” submitted for the Doctor of Philosophy in Physical Education degree is entirely my original work and all ideas and references have been duly acknowledged. It does not contain any work for the award of any other degree or diploma.



Date: 19th August 2019

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CERTIFICATE

I certify that Mr. Deepak Bangari has prepared his thesis entitled **“Development of Regression Equation to Predict Kho-Kho Performance with the help of Digit Ratio, Stress-Vulnerability and Selected Anthropometric Variables.”** for the award of Ph.D. degree of Lovely Professional University, under my guidance. He has carried out the work at the School of Physical Education, Lovely Professional University, Phagwara, Punjab.



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ABSTRACT

The purpose of the study was to develop regression equations to predict Kho-Kho players' performance with the help of digit ratio, stress-vulnerability and selected anthropometric variables. Hundred Junior and hundred senior Kho-Kho players were selected randomly as the subjects for the study. The subjects were selected from various states of India. The ages of the subjects were 15-18 for junior's and above 18 years for senior's'. The data was collected by the method of the tests for the chosen variables. All the tests had been conducted at National Level Junior and Senior Kho-kho players. The researcher, personally visited the venues of Junior and Senior National tournaments, Invitational tournaments and coaching camps. Moreover, if necessary the research scholar also approached the subjects personally. To find out correlation between Independent Variables (Finger Ratio (2D:4D), Anthropometric Variable and stress vulnerability) and Dependent Variable (Kho-kho performance), partial correlation were used, for joint contribution of Independent Variables and for dependent variable (Kho-kho performance) multiple correlation were used. Further, for prediction on basis of independent variables to dependent variable, multiple regressions were formulated. Four models are established by multiple regression analysis. These models are discussed below.

Model I: Performance = 9.198 +.064 * Stress Vulnerability

Model II: Performance = -6.233 +.58* Stress Vulnerability + 15.12 * Digit Ratio

For estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio, Body Ratio and Stress Vulnerability in junior level male kho-kho players and established model 1 is : Performance = 9.198 +.064 * Stress Vulnerability and model 2 is -6.233 +.58* Stress Vulnerability + 15.12 * Digit Ratio. The relationship between Height and Digit Ratio (R= -.30 p= .03), Height and Body Ratio (R= .75 p= .00), Height and Stress Vulnerability (R= .30 p= .03), Calf Girth and Thigh Girth (R=.33 p=.01), Thigh Girth and Digit Ratio (R= -.33 p=.01), & Body Ratio and Stress Vulnerability (R= .45 p=.00) were found positive correlation at .05 level of significance. On the other hand, height and leg length, height and calf girth, height and thigh girth & height and waist

circumference; leg length and calf girth, leg length and thigh girth, leg length and waist circumference, leg length and digit ratio, leg length and body ratio & leg length and stress vulnerability; calf girth and waist circumference, calf girth and digit ratio, calf girth and body ratio & calf girth and stress vulnerability; thigh girth and waist circumference, thigh girth and body ratio, & thigh girth and stress vulnerability; waist circumference and digit ratio, waist circumference and body ratio & waist circumference and stress vulnerability; digit ratio and body ratio & digit ratio and stress vulnerability no relationship were found.

$$\text{Model III: Performance} = -27.071 + 33.544 * \text{Digit Ratio}$$

$$\text{Model IV: Performance} = -18.196 + 25.842 * \text{Digit Ratio} + -.023 * \text{Stress Vulnerability}$$

For estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in junior level female kho- kho players and established model III is: $\text{Performance} = -27.071 + 33.544 * \text{Digit Ratio}$ and model IV is: $-18.196 + 25.842 * \text{Digit Ratio} + -.023 * \text{Stress Vulnerability}$. The relationship between Height and body ratio ($R = .56$ $p = .00$), leg length and body ratio ($R = -.79$ $p = .00$), calf girth and stress vulnerability ($R = -.27$ $p = .05$) & digit ratio and stress vulnerability ($R = -.67$ $p = .00$) were found significant relationship. On the other hand, insignificant relationships were found among height and leg length, height and calf girth, height and thigh girth, height and waist circumference, height and digit ratio, height and stress vulnerability, leg length and calf girth, leg length and thigh girth, leg length and waist circumference, leg length and digit ratio, leg length and stress vulnerability, calf girth and thigh girth, calf girth and waist circumference, calf girth and digit ratio, calf girth and body ratio, thigh girth and waist circumference, thigh girth and digit ratio, thigh girth and body ratio, thigh girth and stress vulnerability, waist circumference and digit ratio, waist circumference and body ratio, waist circumference and stress vulnerability, digit ratio and body ratio & body ratio and stress vulnerability.

$$\text{Model V: Performance} = -29.531 + 35.202 * \text{Digit Ratio}$$

$$\text{Model VI: Performance} = -28.151 + 31.458 * \text{Digit Ratio} + .073 * \text{Calf Girth}$$

$$\text{Model VII: Performance} = -12.152 + 24.828 * \text{Digit Ratio} + .061 * \text{Calf Girth} + -.054 * \text{Height}$$

For estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio, Body Ratio and Stress Vulnerability senior level male kho kho players and established model V is $\text{Performance} = -29.531 + 35.202 * \text{Digit Ratio}$, model VI is $\text{Performance} = -28.151 + 31.458 * \text{Digit Ratio} + .073 * \text{Calf Girth}$ and model VII is $\text{Performance} = -12.152 + 24.828 * \text{Digit Ratio} + .061 * \text{Calf Girth} + -.054 * \text{Height}$ The relationship between Height and leg length ($R = .71$ $p = .00$), Height and calf girth ($R = -.65$ $p = .00$), Height and thigh girth ($R = -.67$ $p = .00$), Height and digit ratio ($R = -.90$ $p = .00$), Height and body ratio ($R = .69$ $p = .00$), Height and stress vulnerability ($R = -.39$ $p = .00$); leg length and calf girth ($R = -.61$ $p = .00$), leg length and thigh girth ($R = -.66$ $p = .00$), leg length and digit ratio ($R = -.70$ $p = .00$), leg length and body ratio ($R = .62$ $p = .00$); calf girth and thigh girth ($R = .57$ $p = .00$), calf girth and digit ratio ($R = .65$ $p = .00$), calf girth and body ratio ($R = -.56$ $p = .00$); thigh girth and digit ratio ($R = .70$ $p = .00$), thigh girth and body ratio ($R = -.69$ $p = .00$); digit ratio and body ratio ($R = -.68$ $p = .00$), digit ratio and stress vulnerability ($R = .48$ $p = .00$); & body ratio and stress vulnerability ($R = -.34$ $p = .01$) were found positive correlation at .05 level of significance. On the other hand, height and waist circumference, leg length and waist circumference, leg length and stress vulnerability, calf girth and waist circumference, calf girth and stress vulnerability, thigh girth and waist circumference, thigh girth and stress vulnerability, waist circumference and digit ratio, waist circumference and body ratio & waist circumference and stress vulnerability were found no relationship among the variables.

$$\text{Model VIII: Performance} = -25.29 + 32.03 * \text{Digit Ratio}$$

$$\text{Model IX: Performance} = -13.801 + 28.716 * \text{Digit Ratio} + -.051 * \text{Height}$$

For estimating Kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in senior level female Kho kho players and established model VIII is $\text{Performance} = -25.29 + 32.03 * \text{Digit Ratio}$ and model IX is $\text{Performance} = -13.801 + 28.716 * \text{Digit Ratio} + -.051 * \text{Height}$ The relationship between height and leg length ($R = .34$ $p = .01$), height and calf girth ($R = -.46$ $p = .00$), height and thigh girth ($R = -.27$ $p = .05$), height and digit ratio ($R = -.55$ $p = .00$), height and body ratio ($R = .56$ $p = .00$); leg length and calf girth ($R = -.61$ $p = .00$), leg length and thigh girth ($R = -.66$ $p = .00$), leg length and digit ratio ($R = -.70$ $p = .00$), leg length and body ratio ($R = .39$ $p = .00$), leg length and stress vulnerability ($R = .28$ $p = .05$); calf girth and thigh girth ($R = .57$ $p = .00$),

calf girth and digit ratio ($R = .65$ $p = .00$), calf girth and body ratio ($R = -.43$ $p = .00$), calf girth and stress vulnerability ($R = -.38$ $p = .00$); thigh girth and digit ratio ($R = .69$ $p = .00$), thigh girth and body ratio ($R = -.47$ $p = .00$), thigh girth and stress vulnerability ($R = -.33$ $p = .01$); waist circumference and body ratio ($R = -.27$ $p = .05$), digit ratio and body ratio ($R = -.43$ $p = .00$) & digit ratio and stress vulnerability ($R = -.35$ $p = .01$) were found significant relationships. On the other hand, no relationships were found between height and waist circumference, height and stress vulnerability, leg length and waist circumference, calf girth and waist circumference, thigh girth and waist circumference, waist circumference and digit ratio, waist circumference and stress vulnerability & body ratio and stress vulnerability.

Key Words: Regression equation, Digit ratio, Body ratio, stress-vulnerability, anthropometric variables.

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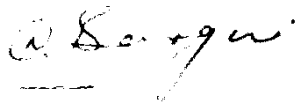
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Deepak Bangari

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CHAPTER – I

INTRODUCTION

“Children can benefit if their talent is identified at the right age. If the talent is identified at an early age, parents can work towards polishing it. Such recognition can help children in long-run and they can have a better and bright future.”

Evidence of physical activities like games, sports, exercise, and dance etcetera is found in anthropology rudiments, art and literature from the earliest of times to foremost eras. These events were easy and entertaining hobbies but still were impulsive contests or competitions. People in a lot of regions and in various periods seem to own prearranged events with diverse roles or finishes in sight, relying upon whatever sensed because of the utmost vital desires. As evolution progressed, they were accustomed to fulfilling the socio-nationalistic desire besides a lot of new necessities to fulfil personal and communal advancement. These physical events in varied practices are employed through human societies throughout the planet from primitive periods to the foremost eras for existence, competition, prize, fitness, personal and common development etc.

Almost all the countries nowadays are taking earnest concern in sports and games due to the multifarious assistance they create towards personal and public development. At present, day sports and games have taken diverse procedures and they fulfil a major part in the life of masses. Sports, as well as games, are supposed to be a product of the culture of every civilization. Sports, as well as games, replicate the cultural values of a civilization. There’s an awful sturdy mutual inter-relationship between sports and the culture, as they effectively impact one another. Games and sports became an elementary culture in each fashionable community wherever completely diverse individuals take part in them with a varied function which was visible. Physical activities within the primitive societies were primarily targeted on survival, defiance of the community, competitions, rewards, recreation, fitness, and health. Some of those physical activities that received people acclaim were remodelled as sports and games in the course of our time. Several folk in every society and culture, therefore, are collaborating in various sports and games.

Because of multifaceted contributions in games and sports have been rendering to humans and the presence of several other activities akin to sports and games, people in different fields of endeavour have ventured to define and conceptualize their synonym.

Play, games, sports, and physical activity are the four terms which lie at the bottom of this space. Every one defines, severally, or as a reciprocal, it is at best elusive, but with the common intuitive understanding which all individuals have, one of these terms basic part to begin with upon examination.

Physical activities can be an act which includes specific body organization and ancient contextual rules, which should outline the target and restrict the pattern of human behaviour; it contains competition and/or challenge, and a precise consequence predominately determined by the activity.

Games can be termed as activities can be considered as an associate agreed-on organization of your span of time utilized for the particular activity, house and parcel of land, with regulation and rules that outline the target and restricted pattern of human behaviour, the end result, that to work out a champion and a loser, has been attained by totalling or collecting quantitatively secured points or successes.

Play can be termed as pleasurable expertise etymologizing from actions which are self-motivated and self-initiated in agreement with special objectives or communicatory wishes; it bears all arrays of movement capacities; its rules are spontaneous; it's a temporal sequence however no pre-set ending; it results into tangible outcome, victory, or reward.

In the modern days, there is public awareness about the need, values and the importance of sports. Sports in the present day society have become an inseparable part of the day-to-day life of a human. Sports are considered as a respected arena of a human's competitive instinct to excel and establish superiority in the present day competitive society. The desire to challenge and establish new records has become a matter of impulse and instinct. Sports in the present day materialistic world have attained prestigious propositions. A sportsperson throughout the world is treated in high esteems.

Every advanced society in the modern world treat sports equally with other areas of education in the upbringing of the individual and eventually the society.

Sports provide for the health, recreation, harmonious development of personality, human relations, developing moral character, individual and social development, democratic way of life, national and international cultural integration, and transmission of individual and social values and education of the masses more seriously. They also help in attempts of nations to excel and show superiority over other nations. Sports have become an object of universal attention in contemporary society and a means of achieving status and prestige in society.

Nowadays virtually every single country ascribes pronounced significance to the improvement of games with a motive to progress the country's healthiness as well as for the betterment of future generation. Some developed countries like USA and Russia try to project the pre-eminence of their social-political ideologies and systems using the medium of sports. If we analyse the position of sports in India which is commonly considered as a developing country, it has also tried to implement such level of valuable performance which attained by developed countries. It is also worth mentioning that the efforts have achieved success in some of the games such as Cricket, Hockey, Kabaddi, Badminton, Kho-Kho etc. Mainly in Kho Kho, India has earned a distinctive appellation at international competitions by consistently winning the Asian championships and SAF Championship'.

Our culture is the most ancient culture in this world. it has gifted several things to the present world. Literature, arts, sports, philosophy, scientific theories and social, political and economic thoughts unfold within the world were originated from Indian culture. The foremost ancient and holy non-secular written material 'Rig-Veda' which is the national quality of Asian nations. Greatest epics, sacred writings, and Ramayana are from the Asian nation. For the welfare of humans, the idea of Ramrajya comes from Ramayana. Within the same means, Asian nation culture is that the mother of assorted games and sports during this world. We discover reference of assorted games and sports within the ancient treatises of Asian nation essentially Kho-Kho, which is an Indian ancient game and is competing notably in rural and concrete areas. This game has become common in different states additionally. All states even have their own Kho-Kho Associations, which are attached to the Kho-Kho Federation of Asian Nation. Kho-Kho game originated in the Asian nation has a significantly long tradition. The Kho-Kho game is, at present, turning into most well-liked among

the autochthonic activities in education in the Asian nation and neighbouring nations in South Asia. In our country the competition of Kho-Kho is being controlled in class, grade inter-university level, all Asian nation inter-university level sometimes makes an attempt is being created to incorporate this Kho-Kho game within the space of competitive Sports at the international level. Historically the Kho-Kho game is competing by India as a result of it involves less monetary demand and little playfield space. Moreover, several participants will play the sport along as a team sports and may in wealthy health and fitness. Like different games and sports this Kho-Kho game is additionally organized for competition at the most of the junior and senior level even the Zonal, State and inhome State, extramural and every one Asian nation higher education stages. Kho-Kho at competitive level needs high performance that relies upon the procedure “How the player is hand-picked and means the choice criteria are reliable and valid”. Though there's a multiplicity of opinions concerning this question and as until date there's no resolution to the present, it absolutely was thought fascinating by gift investigator to style and standardize co-relation of Kho-Kho enjoying game ability check, that might be of nice use in choosing the game abilities in Kho-Kho for exhibiting prime performance Kho-Kho and Sports have a very important place in the Asian nation. Since history due to many reasons, Sports of the many types are being competed in our Country since an extended time.

Kho-Kho had its start in Maharashtra state and slowly enhance throughout the length and breadth of India and subsequently to the neighbouring nations like Nepal, Bangladesh, Sri Lanka, and Pakistan. In order to propagate and control the game, Kho-Kho Federation of India, as well as Asian Kho-Kho Federation, was formed in 1958 and 1987 respectively. In the beginning, kho-kho was played without adhering to strict guidelines. However, a group of experts shaped them in 1914 by an organization called “Deccan Gymkhana” Pune, framed certain guidelines like the court measurements and the number of players in a team. Next a number of changes in guidelines were combined; similarly, scientific techniques have also found their way into the game.

First Kho-Kho was presented as a demonstration game in the Summer Olympics by Pune team with the significant features in 1936 at Berlin. The game has

gained popularity all over the world and many countries have taken up this game seriously.

In 1987 at Kolkata, Asian Kho-Kho association came into existence after the demonstration of the game in third S.A.F. games. Kho-Kho made its entry into Universal sports ground in the first Asian Kho-Kho competition held at Kolkata in 1996 beneath of Auspicious of AKKF as well as KKFI and was planned by the West Bengal Kho-Kho organization in which our country and Bangladesh were the first and second respectively. In the second Asian Kho-Kho tournament which was held in the capital of Bangladesh in the year 2000. The participants were from our country, Srilanka, Pakistan, Nepal, Thailand, Japan as well as from organizing country (Bangladesh).

Kho-Kho could be a highly exciting and thrilling game; content between 2 groups each consisting of 9 players. A Kho-Kho court is quadrangular. It is 29 meters in length and 16 meters in breadth. There are 2 boxes on the top. Length of the parallelogram is 16 meters and therefore the dimension is 2.75 meters. Within the center of those 2 boxes, there are 2 wooden poles. The central lane is 23.5 meters long and 30 x 35 cm in dimension. 8 long cross lanes are there that lie across middle lane and dimension of the cross lanes are 16 meters with the width of 30 cm. It makes little rectangles and each of which is 16 meters long as well as a pair of 0.3 meters wide, (2 rectangles close to the wooden poles are 2.5 meters in dimension) on 90-degree angles to the middle lane and distributes in the same way into 2 components of 7.85 meters in the middle lane. On the upper part of the middle lane, the open port angle to the post-line, 2 sleek wood posts are fastened, 120 cm in height from the bottom and their circumference isn't but between 30 cm and no more than 40 cm. The instrumentality employed in Kho-Kho remain on poles, ropes, golden measurement tape, marking powder, wire plus pins, 2 stopwatches with laps, sorts of rounds having an internal perimeter of thirty cm and forty cm, whistle, and a paper for writing to find out the winner.

The game can be performed on any surface but suits on an open field. Currently, it is played on a surface prepared from mud or level turf. Needless to say that artificial surface and perform inside is on card'. As per the characteristics of the game, the players with different qualities and abilities play in a different position in

the game. These positions are based on their abilities and can be classified as chasers, Dodgers, and all-rounders. Chasers execute many skills like:

- 1) Giving Kho to side
- 2) Giving Kho after faking
- 3) Giving Advance Kho
- 4) Moving on the Cross Lane
- 5) Tapping
- 6) Ground dive
- 7) Surprise attacking
- 8) Pole turning
- 9) Pole dive
- 10) Tactics of chasers.

Dodgers execute many skills like:

- 1) Chain game
- 2) Fake
- 3) Ring game
- 4) Avoiding the post
- 5) Avoid clubbing
- 6) Face entry
- 7) Pole turning
- 8) Settling at post
- 9) Chain and ring combination
- 10) Tactics of dodging.

All-rounders execute both chasing and dodging skills in the game.

Kho Kho is played in two groups, a match consists of 2 periods of plays with every inning is of offense and defence turns of nine minutes each. One group of players kneels within the center of the ground, on a lane, with next to players face facing the opposite side. The offensive player desires the sphere simultaneously and therefore the group that consumes the minimum time-period to tap all the defensive players within the arena wins. There is a pole on every last and therefore the offensive player will drive between 2 performers. Players are inactive in zig-zag style, however, the offensive player is not permitted to show back whereas running and drive among

his/her teammates. However offensive player will move to a wooden pole and bit it and might return or move to a different aspect. It begins with eight players of the "chasing" team motion in every row within the centre of the ground in their eight boxes on the middle line, consecutively facing the other sides. 2 wooden poles install at either finish of this middle line. The last player is that the "active chaser" and he/she takes his stance next to 1 of the 2 poles, able to begin the chase. The other team arrives the sphere, in batches of 3 referred to as defensive players. These defensive players, attempt to run out the seven or nine minute's time, and therefore the offensive players attempt to dismiss them inside that point.

Defensive players can be dismissed in three ways:

- If runner is contacted by an active chaser with his forehand without doing any foul.
- If runner moves outside of the ground's limits by his own.
- If runner arrives after limited time.

An offensive player can run in only one direction around the middle line wherever eight members are in inactive position and can't move in a reverse course, and additionally can't cut across the middle line of inactive positioners, although the defensive player could move where they want. Offensive player should disport the complete row. An energetic offensive player will amendment stance with an inactive offensive player, by contacting him from the back by hand and pronouncing the word 'Kho' noisily, and at the same time, the offense is build up through a sequence of 'Kho' because the chase carries on with a relay of offensive players. Once the first group of defenders is out, the following group of three is shipped onto the rest. At the tip of the sets, there is associate degree interim of seven or nine minutes associate degree a break of five minutes, in between the turns. All sides alternate among chasing as well as defence. Kho-Kho is competing by males, females, and kids of all levels. The sport needs an awfully little part of an equally surfaced area. The target is to tag all the opponents within the shortest time possible; the fastest team.

‘Kho-Kho is one such indigenous game which requires certain levels of psychomotor factors on the part of those who play at the competitive level. Players are required to posse’s high level of fitness and proficiency in fundamental skills. The

game of Kho Kho is as fast as any of the international games or sports. When played between two teams of certain standard, the nature of the game demands sprinting, sudden stopping, changing the directions quickly, faking, diving, on the ground flat, the characteristic turning of the post, giving Kho and moving on the cross lane and a host of other movements both during offensive and defensive play. The game of Kho-Kho, like the instincts of man to express impulse of attack and defence, is also characterized by offensive and defensive movements and counteractions call for spectacular skills on the part of all player. The presentation of these skills indisputably demands the participants to accumulate a variability of physical, motor and Psychology (cognitive) qualities’.

Characteristics of Kho-Kho Players

Game of Kho-Kho is predominantly characterized by pursuing the opponent players and also players getting pursued. In the parlance of Kho-Kho game pursuing the opponent players is called Chasing, when the players of the team chase their counterparts, the ones who pursued try to escape or avoid being caught are. This act of escaping from being caught or tagged is known as Dodging. In Kho-Kho matches normally there will be two innings. In each inning, each team will chase for one duration (9 minutes / 7 minutes) and dodge for a duration (9 minutes /7 minutes). This implies that every member of a team should be chaser during a chasing turn and dodger if one gets an opportunity to dodge. Never the less it is not uncommon among teams of a standard to have a couple of expert chasers, expert dodgers and a few all-rounders who have a fair level of competency in both chasing and dodging. The roles of chasing and dodging demand from the player's different sets of physiological, motor and psychological characteristics. It may be noted that no research studies were made to distinguish chasers, Dodgers, and all-rounders in very clear terms, attempts were made by people associated with kho-kho training and coaching to identify a different category of Kho-Kho players empirically.

Chasers: Players who are bestowed with optimum movement speed, leg explosive power, the ability to change directions quickly and precisely aggressive behaviour, risk-taking ability unmindful of injuries, adventuristic attitude, muscular endurance, auditory, visual, touch perception and reaction time.

Dodgers: Players who are bestowed with better of aerobic capacity, agile movements, which are predominantly zig-zag remaining, making 1800 turning movement, sidestepping, visual and auditory perception, strength endurance and calmness.

All-rounders: Players who are endowed with a fair degree of physiological, motor and psychological characteristics of both chasers and dodgers.

Kho-Kho is a modified form of `Run Chase`. It is an Indian sport normally vies in faculties and faculties around the country. Basically, it is a kind of game in which each team contains twelve participants, even though only nine players can have their performance on the field. The toss determines which one team sits in a row down the central part of the court, with alternate players fronting reverse directions. These players are termed as chasers. The opposite side directs a participant from their team in the court as a dodger.

Kho-Kho could be a good measure to look at the participants good condition, strength, speed and stamina and dodging ability. The concept of Kho-Kho includes both physical technique and the performer's mental association with these techniques. Kho-Kho depends on footwork, explosive muscular effort, ability to quickly change the direction during running or chasing, ability to maintain a consistent speed throughout the game along with these characters. Kho-Kho is game which requires the ability to keep things simple and make yourself rational in decision making during running or chasing and for that being judgmental in a match situation is a primary requirement which heavily depends on one's ability to handle the pressure created by an opponent.

Kho-Kho and Kabaddi are 2 very fashionable games in the South Asian countries nowadays. Each sport features a fast increasing trend of recognition within the western countries and few yanks and African countries in addition. Each of the games is thought of as tiny space games. The games are easy in nature, straightforward to prepare and cheap, hence, reaches to common men. Each game needs less instrumentality. Kho-Kho is a semi-contact game which differs from others in their nature, skill, techniques, and strategies etc. Now the question is what type of requirement exists for Kho-Kho players in anthropometric measurement,

physiological and psychological profiles? The researcher is interested to investigate the above question (Carrom, 2012).

The identification of bodily features during a game modality donates to its achievement as well as permits to identify variations between players of diverse modalities that are of fine concern for sports teachers and researchers.

Game talent relies on an advanced and complex variety of variables, that embody bodily (common as well as particular conditions), psychosomatic (character and inspiration) and physique (morphology, mensuration, and structure) features. The connection among morphological features and game talent is the purpose of learning of mensuration then a crucial part is to be analysed.

Anthropometry is measuring of body dimension and ratios. It is the learning of measuring the material physique in a relation of the dimension of bone, muscle, and fitness. Determining has been wanting to assess gross structure and performance. There are varied factors that are liable for the talent of an athlete. The shape and physique structure, as well as the dimensions, form, and type, are noted to show a major part during this concern. At current, an athlete for superior talent in any games is chosen on the principle of body and body dimension.

Gualdi-Russo & Zaccagni, 2001 said that an athlete's dimension and physical features might represent vital conditions for palmy contribution in any given sport. "Various anthropometric measurements were found to be closely associated with excellent performance in Kho-Kho. The composition of sportsmen body are also the most vital element in the achievement of a team in all sportsmen endeavours" according to Wilmore, 1982.

"Excess obesity is prejudicial to talent in most games whereas, lean body, particularly muscle quantity, is mostly related to talent. Body configuration additionally creates a crucial involvement to associate person's level of good condition for talent, notably in such games that need some to hold mass over a mile, that is expedited by a big section of active tissue in regard to a tiny low ratio of fat tissue" as per Jain, 2004.

The sport is categorized by an outstanding intermittent workout, markedly with the employment of each anaerobic and aerobic energy breakdown. But, it is advised that the operable energy request in a very gathering is that the anaerobic

breakdown of lactic acid. About badminton players' physical features, several elements play in the achievement during the games, comprising technique and tactics, psychological planning and game plan (Chint et al., 1995). In 2003, Wonisch et al. focus, it is a game mode that needs anaerobic and aerobic energy systems and some parameter is openly related to rallies of long and short duration, as well as a game interval. Badminton players need to have a good physical ability, especially pace and aerobic power.

“Specific measuring characteristics are required to achieve success inbound sporting events. It's conjointly vital to notice that there are few alterations in the construction and alignment of athletes concerned in personal and team games. The responsibilities in a few activities, like field event or vertical jump, are relatively specific and completely diverse from one another than are the thriving builds. This method whereby the physical requirements of a sport result in best of body varieties best suited there to games is understood as morphological optimization.” as per Bloomfield et al. in 1995.

In 1984, Carter described that specific activities like “Track and field events” are patent by an incomparable type of period of one affair, active demands and therefore the rhythm of energy unharness. The very fact that racers have to convey their weight, suggests they have to counter the gravitational force completely at diverse distances, instructs a particular (slim) body structure as a necessity for additional economic performance during a solo event. Athletes United Nations agency have non-inheritable the optimum build for a selected affair are additional doubtless to flourish other than those that deficiency of the overall physical characteristics. “Studies on habitus of athletes, elite athletes, and Olympic athletes have usually shown that strength and speed dependent athletes cared-for be essentially athletic whereas distance dependent athletes were found to be additional ectomorphic with a restricted quantity of athletic muscularity” as per Battinelli in 2000.

A habitus may be an account of gift morphological validation. It can be stated in scores, involving 3 successive figures, invariably noted within the similar order. Every variety denotes analysis of 1 of the 3 basic elements of structure, which define a discrete difference in the morphology of human beings along with the structure.

Endomorph is a type of body which refers to relative avoirdupois and thinness of the physique; athletic is a type of body which mentions to muscular-skeletal improvement comparative to height, and somatotype is a type of body denotes to the comparative dimensionality of distinct physique as per Carter & Heath in 1990.

Body configuration in athletes quantifies a wide range of morphological characteristics and cannot be dictated by fascinating body weights. In order to improve reasonable performance, and to measure the results of coaching, it is usually believed that a lower range of body fat is a smart option for thriving tournament in a majority of games, (Sinning, 1996). Normally, as a result of extra body fat enhance the body weight while not tributary to the force or energy manufacturing competences, in turn, advises a reduction in relative power or strength. The obvious facts are that AN hyperbolic fat weight is going to be damaging in sports accomplishments wherever the physique is stirred against the force of gravity like high jump, pole vault, Kho-Kho spiking action or pushed flat like in racing etc.

Sub supreme speeds in running, the O demand is hyperbolic with increment in weight which means O consumption is hyperbolic thanks to the larger demand of energy needed to start and endure movement of bigger body weight. An aforementioned investigation has validated that athletes have less body fat allied to most other disciplines (Martin & Coe, 1997; Gore, 2000; Matkovic et al., 2003).

Body Composition considers as an anxious partly with the fatness of the individual. In mensuration, the full weight is split into 2 mechanisms: Lean weight and Fat weight. Lean weight contains muscles, bones and very important organs. The core hypothesis is that total weight is equivalent to Lean weight and Fat weight as per Verducci in 1980.

Generally, it is acknowledged that lesser comparative body fat is required for effective contribution in competition for all sporting events. Supplementary body fat enhances body weight with minimal contribution to force or energy creating abilities, which in turn can be related to a reduction in relative strength. The statement also asserts amplified fat weight will be disadvantageous in games and sports events where the body has to make movements against gravity for example games like vertical jump, pole vault, Kho-Kho smashing action or running. Morphological characteristics and body configuration have been considered as vital for excelling in physical

performance (Mathur & Salokunm, 1985). The precise athletic actions necessitate different physique and weights for utmost enactment as stated by the American Dietetic Association in 1987.

Therefore, the athletes during an explicit sport should have such typical features that are the advantage in their performance. Body composition additionally creates a very important involvement to associate degree personal's level of good condition for performance, considerably peculiar games that need one to hold body weight over a mile, which is expedited by an outsized ratio of energetic muscle in reference to a little ratio of fat tissue. Maintained the on top of ideas and findings the research worker developed the analysis drawback to review the dimensions and performances of secondary school Kho-Kho and Kabaddi sportsmen of Hyderabad Mysore area.

“Talent identification may be a method that includes creating a conclusion a few performer's talents and giving that person a chance to try and ensure one thing that he or she is suitable; gifted kids should be known on their capacity to be the simplest players within the upcoming, not their current talents,” according to Davids, Lees & Burtwitz, 2000.

“There are 5 common terms that ought to be thought about at this stage; Talent, Talent Detection, Talent Identification (TID), Talent choice (TS) and Talent Development (TD). Talent may be a marked innate ability outlined as an inventive accomplishment, talent or a capability of superior quality. Talent in sport is outlined as AN individual's special ability that's higher than average for specific functions. Physical abilities are also useful, communicatory or athletic” quoted by Peltola, 1992 and Williams & Reilly, 2000.

Experts aforementioned god blesses one and all within the world with a minimum of one talent if less. Distinguishing talent at a young age in an exceedingly is very useful because the kid is plastered for improvement and excellence from the initial days. Understanding the abilities and interests of your child and recognizing the field or space of his/her excellence, supplies a mixture feeling of pleasure and pride for any parent. Once the world of perspective for a kind is known, deliberate initiatives can be taken to cultivate and nurture that endowment by oldsters, teachers, relatives, and alternative adults. However, the most task at hand first off lies in

recognizing a gifted kid. The additional the amount of prospects a toddler gets and also the additional the number of various events he participates in, the better it'll be to spot his abilities and gifts.

Identification of talent in youth sports is usually considered as an art rather than a scientific exercise. Academicians and tutors normally have a discussion that what indicators of natural talent for a particular sport. Aspects like genetic knowledge and structure are thought to work out possible ability. A study conducted by Kumar and Chauhan in 2013, disclosed that Kho-Kho as a competitive sport contains a sure specific demand in regard to measuring. A new revealed analysis review currently argues that one thing as straightforward as finger lengths might predict athletic artistry. Because it seems that the relative lengths of the index to ring finger is also a marker of aptitude. People with extended ring fingers are also possessed, additional precocious sportsmen.

In the modern scientific age, competitive sports has become such a complex phenomenon that the subject has to go under various micro scientific investigations to achieve optimum performance. Sports scientists of various specific fields help sportsmen in one or another way to advance their performance up to the optimal level. Competitive sports has become a means to show the ascendancy of the country over the other and this trend is considered to divert the attention from accumulating the most lethal weapons which are the threat to the whole mankind.

The remarkable advancement in the platform of physical education, as well as sports, is the result of the researches and experiments done by the sports scientists with the full prop up and encouragements of the governments of the various countries. Hence, the sports programs are a very costly affair and for most of the sports advanced countries, it has become a multimillion business right from selecting their sportspersons to the Olympic Gold Medal.

“To achieve excellence in Olympics is a multi-million investment; so before investing, the first and foremost question confronting a physical education teacher or coach, when he/she assembles his/her prospective candidates at the beginning of the session is, which of sportspersons will help him/her to achieve his/her ultimate Goal. Earlier, physical performance was considered as the only reference for a player. The recent progress of sports science has prepared an accurate technique existing for the

valuation of a person's potential for a particular sports event. Sports are now dominated by a scientific breed of coaches. These new generation coaches are interested in a combination of physical talent with other qualities that not only influence performance but also help to sustain the sportsperson in their commitment of sports Jack." By H L in 1982.

The identification of future elite sportspersons in early childhood has become a necessity. The sportspersons selected for specific sports activities require suitable environment/conditions and sports facilities including advance/latest sports equipment, rational style of life and services of sports experts like well-educated and experienced coaches, sports physicians, dietitians, sports psychologists, and sports medicine specialists. Such facilities are necessary for all selected sportspersons of various sports events. Hence, precise identification, assortment, and assignment of young talents are having charming significance all over, according to Dirix A et al. in 1986.

The sports science has taken the youth of today to enable them the ecstasy of sports performance and rapidity of breaking the existing records motivates them to work beyond their physiological limits. The top-level competitions such as Olympic Games, World Championship, Asian Games, Commonwealth Games etc. enable to study various aspects of athletes, especially their genetics and anthropological characteristics. Some findings and conclusions of such studies have the applications in the field of human biology, physical education, sports medicine and indeed all humanity by providing a better understanding of human excellence and diversity. The genetics investigations included the study of chromosomes, blood group, hormone, blood protein, palm prints and fingers stated by Alfonso L. et al. in 1974.

Sportspersons are born not made, it is a normal belief, but to a certain extent, they can also be made. So if that born athlete can be identified and trained properly and systematically at an early stage, the best results can be brought in without any undue wastage of time, money and human efforts. Hence, the process of identification of sports talent must lay emphasis on identifying the general qualities, formulation of testing methods and criteria to measure the inherited qualities that are required to make an individual champion sportsperson.

Nowadays the need for studying digital fingers which is a new concept in talent identification is gaining importance in the field of genetics, psychology, physiology and in the research field of sports. Study of digital fingers can play a vital role in identifying talent in the field of sports.

Digital Finger Ratio

The digit ratio can be defined as the relative ratio of the lengths of different digits. In a more explanatory note the length of the fingers of the hands or the fingers of the toes. The aforementioned lengths can typically measure from the point where the finger joins the hand to the fingertip. It has been proposed by some researchers that the dividend ratio of two finger digits have a particular interest, the digits are known as 1D (thumb), 2D (Index finger), 3D (Middle finger), 4D (Ring finger) and 5D (Small finger). The 2nd and 4th finger is affected because of its exposure to androgens such as testosterone (Pheleps, 1952) and the 2D:4D ratio between index finger and ring finger has been considered as a crude degree for prenatal androgen exposure or this ratio can be used to assess the level of testosterone in the body of an individual.

In a more investigative term, in men the mean 2D:4D has been found to be lower as compared to their female counterparts as stated by Phelps (1952). This difference of the figure digit ratio has been controlled by Homeobox or Hox genes (the posterior-most Hoxd and Hoxa genes) which as an additional function to control the difference in testes and ovaries. The mentioned statements are scientifically explained by Peichel et al. (1997) and Herault et al. (1997). Advanced elimination of subsequent Hox gene function ends up in loss of digits, genital bud derivatives Kondo et al. (1997); Peichel et al. (1997); Mortlock & Innis, (1997). Manning et al. (1998) recommended that the restriction of the distinction of the gonads and figures may also look into as that the operational capacity of the previous might have a chance to be reflected in the development of the latter. The 2D:4D ratios patterns hence may replicate features of gonadal utility such as the generation of hormones namely testosterone and oestrogen.

In 1983 Dr. John Herschel Glenn Jr. Wilson of King's faculty, U.K printed an investigation probing into the association among positives in ladies and the digit

quantitative relation. This primary investigation gazes at the relationship amongst digit quantitative relation and psychosomatic attribute at intervals diversity of the identical sex.

Wilson planned that anatomical construction and temperament were at the same time tormented by a hormone in utero. Digit quantitative relation analysis has since detonated with an awfully active and in progress programme of analysis by John Manning World Health Organization is additionally celebrated as an academician of fingers, in city and March Breedlove in an American state. John Manning done an incredible adds the sphere of digital fingers. He compared the digital finger with several aspects of human physiology and human psychological science.

In 2002 the book authored by John Manning, brief his examination on the subject to and the endorsing the part of antepartum androgen on digit quantifiable association and the psychological links correlate to this.

2D:4D is sexually pleomorphism systematic distinction in type between people of different sexes within the same species by Baker in 1888 & Martyr in 1930. The second finger digit of men inclines to be the smaller than the 4th and the 2nd finger digit of women be likely to be the identical size or somewhat longer than the 4th. This attribute is also higher which represented as a sexually differentiated instead of sexually dimorphic is in acknowledgment of the actual fact that the outcome size is fairly little (2D:4D scattering of the 2 sexes overlay to an excellent grade), particularly as paralleled to alternative sexual pleomorphism qualities like tallness.

Digit quantitative relation analysis typically connects with a substantial degree of skepticism because of the similar planes to chiromancy, bioscience and alternative discredited traditions at intervals the sphere of the measurement. Millet K. et al. in 2006 reportable that 2D:4D is expounded to antepartum androgen levels. Low quantitative relation has been related to a variety of fitness connected factors like position in good sports as well as in music. Currently, proofs recommend that the 2D:4D is additionally associated with an economic higher cognitive process.

“The clarity to digit quantitative relation must be inclined by antepartum hormones. There is proof of comparable mannerisms e.g. otoacoustic emissions and arm-trunk length quantitative relation, that shows similar effects. The Hox genes are to blame for these effects i.e. each digit and endocrine growth is concerned during this

pleiotrophy” according to Peichel et al. (1997) & Herault et al. (1997). As an alternative, a direct impact of sex hormones on bone growth can be responsible.

Evidence of androgenic hormone Effects on Digit quantitative relation

“Women with innate adrenal dysplasia (CAH) have lower masculinized 2D:4D Brown et al. (2002) CAH results in greatly elevated androgenic hormone concentration in utero. The quantitative relation of androgen to estradiol measured in amino samples correlates with the child’s consequent 2D:4D quantitative relation” as per Lutchmaya et al. (2004). The result of a child’s sex is bewilderingly restricted by control during this investigation. Digit quantitative relation in men relates to factor tic difference within the androgenic hormone receptor gene, by Manning et al. (2003). Male having genes that manufacture androgenic hormone receptors which are a lot of sense to androgen have lower, a lot of masculine’s, digit ratio.

In pheasants, the quantitative relation to the 2D:4D digit in the leg foot has also been revealed to be affected by influences of androgen within the egg Romano et al. (2005). This particular case reflects craniate acquaintance to the internal secretion androgen McIntyre (2007) and steroid. Another study has proved to indicate that the quantitative relation in heritable Paul et al. (2006).

The 2nd to 4th digit magnitude relation (2D:4D), a sexually dimorphous, phenotypical characteristic putatively related to prenatal androgenic hormone action, has not been to appraise the theorized connection between prenatal secretion factors as well as a spread of sexually dimorphous compartments, together with organic phenomenon psychopathology. Similar digit ratios, implicative weaker prenatal androgenic hormone action, are related to female-linked disorder (e.g. autism), and bigger digit magnitude relation, implicative weaker prenatal androgenic hormone action, have related to women-linked syndromes (e.g. unhappiness and uptake syndromes). They evaluated the imaginable association among the digit magnitude relation and one another historically feminine joined condition, nervousness, 2D:4D figure ratios were estimated in a very non-clinical taster (58=M and 52=F). Members conjointly accomplished electric battery of tension and character estimates and achieved 2 abstractions/perceptive responsibilities sometimes display a feminine benefit (psychological rotation and pointing) and 2 tasks sometimes display a

womanly advantage (position memory and three-dimensional functional memory). Men with a reasonably large amount of female pattern for organic phenomenon behaviours (inclusive of digit ratios) reported with bigger nervousness. In distinction, higher anxiety in girls was related to each female-typical and male-centred personalities and behaviours; however, no vital link between digit extent relation and anxiety was documented. The configuration of outcomes advocates that the event of tension is multiple resolute, with tributary aspects variable by gender. (Evardone M & Alexander GM, 2007)

Pokrywka L et al. (2005), Contested in the animal realm to regulate communal status absolutely involved male, which argues that androgen possibly is crucial in the growth of reasonable characters. In animal readings, the result has been published that prenatal contact to androgens may harvest everlasting change to supplementary destructive behaviour in maturity. Hence, a robust thought has emerged that female tangled in reasonable events, such as athletic, possibly comprise a great androgen level in utero. This is a strong indication that the proportion concerning the 2D:4D relates damagingly with intrauterine androgen foci and could hypothetically be employed as an indicator for prenatal androgen disclosure. They tested this theory that female involved in athletic have inferior 2D:4D, an indicator of high prenatal androgen disclosure. They dignified the 2D:4D ratio in elite and non-elite women athletes and likened them to woman publics who have not been engaged in any sporting events. Their outcomes exhibited that elite woman player has expressively inferior left-hand 2D:4D ratio associated with the regulator group ($p < 0.05$). Hence, it can be a venture that low 2D:4D ratio may relate positively with sporting latent in women.

Digital Finger Ratio (2D:4D) and Various Field of Research

Kilduff L P et al. (2013) tested the theory that 2D:4D is powerfully joined to hostility in "challenge" things can be considered as androgen redoubled. Members were projected towards aggressive as well as impact video. Anger was estimated when every video as well as secretion free androgen concentration before and when every video. In comparison with the management video, an aggressive video has related to elevated anger replies and a touch vital intensification in androgen. Left-hand 2D:4D

has been destructively correlative through violence when the hostile audio-visual and also the strong point of the association was advanced in individuals UN agency showed the best will increase in androgen. The regulator audio-visual has not stimulus testosterone attentions and therefore no links between 2D:4D to belligerence. They found that digit 2D:4D controls the impression of a destructive spur on anger so that intensification in testosterone resultant from a "challenge" is allied to a damaging connection between digit ratio 2D:4D and belligerence.

Ellis L and Hoskin A W (2013) established a substantial connection between the 2D:4D and criminality. The hypothesizes that mind disclosure to androgens endorses immersion in unlawful behaviour. The hypothesis has been supported by a series of studies of post-pubertal circulating stages of testosterone, most prominent among the male population. Furthermore, the hypothesis also prophesies that for both males and females, prenatal androgens might be confidently interconnected with stubborn antisocial, but this idea has no scientific evidence still now. The current work hence employed an indirect measurement of prenatal androgen projection to the comparative span of the right hand (r2D:4D) for the assessment of that raised prenatal androgens to stimulate unlawful inclinations in the adulthood.

Surveys based on specific questions were directed to university level scholars of Malaysia and the United States of America. Defendants described their r2D:4D comparative digit lengths sideways with participation in thirteen assemblies of disruptive and illegal routines. Statistically significant relations among the command of maximum sorts of crimes and r2D:4D proportions remained institute in males as well as females even afterward scheming for a specific group of age. It is resolute that extraordinary experience to androgens throughout prenatal growth adds to greatest arrangements of antisocial subsequent the beginning of adolescence.

Rothkopf, I and Turgeon S M (2013) detected that women-typical features in school going girls sketches remained related to by means of a feminized figure quantifiable links (2D:4D), an indicator for prenatal steroid hormone contact. On the other hand, this comment was restricted to elder women, signifying that communal features arbitrate the link amid 2D:4D and illustration to look at the theory that the impact of prenatal steroid hormone on girls' illustration is mediate through an impression of initial androgens on sex-oriented common behaviour, they inspected

2D:4D, free portrayals, and notches on the Remembered Infant identity system in a very populace of faculty pupils. Physiognomies of contestants' free portrayals were evaluated and people that exhibited sex variations were likened with 2D:4D as well as RCGI status. Males had lesser 2D:4D proportions than girls, utilized less total insignia, used rarer pinks, purples, and blues, and had sophisticated sex-typical status on the RCGI. Girls' illustrations remained additional seemingly to encompass floras and faunas and luxury station portrayals were additional seemingly to epitomize sports. Including-sex RCGI as well as 2D:4D levels weren't considerably related to. Vital with sex associations amid 2D:4D and RCGI and portrayal performance were ascertained however impacts (the consequences the results) gave the impression to be self-governing; the theory that sex-oriented common juvenile behaviour reconciles the consequence of prenatal steroid hormone on portrayal individualities wasn't sustained. Durdiakova J et al. (2013) focused that androgen was revealed to prepare brain as well as modulate psychological feature tasks. It had been presently unknown whether or not mental rotation is additionally related to prenatal androgen exposure and testosterone-related genetic polymorphisms. The intention of their study was toward research relations between mental rotation and sports performance, the particular androgen stages, the prenatal androgen stage (said as 2D:4D proportion) and also the steroid hormone receptor CAG reappear polymorphism in an intellectually precocious male. 147 male between 10-18 years with $IQ > 130$ existed. Spittle examples were together and used in lieu of ELISA of real stages of secretion androgen. The 2D:4D finger measurement quantitative relation as a pointer of prenatal androgen was recorded on each hand and averaged. Amthauer psychological rotation takes a look at was used for the calculation of this spatial capacity. The CAG reappear polymorphism within the steroid hormone receptor sequence was analysed mistreatment PCR and vessel natural process. Statistical regression discovered that 2D:4D finger measurement quantitative relation as well as the range of CAG duplicate inside the steroid hormone receptor sequence remained related to mental rotation. Actual levels of androgen didn't correlate considerably with psychological rotation. The statistical method of variance found that once modification old as a contradictory component, solely the effect of the inherent polymorphism was vital. The outcomes were in the route with their previous sequential investigation of a knowledgeable precocious male

showing the significance of CAG duplicate polymorphism within the steroid hormone receptor gene. Facts of the connections among steroid hormone sign, androgen stages and its breakdown particularly throughout the prenatal progress of brain perform stay to be clarified.

Digital Finger Ratio (2D:4D) and Sporting Ability

Manning et al. (2007) performance in coaching for endurance running (ER) was related to high antenatal androgen (T), as dignified by less 2D:4D, in male and female. In races from one to four miles, the 2D:4D elucidated concerning twenty-five of the alteration in each male as well as feminine ER. Consequently, swiftness is ER has been enthusiastic about a substitution for antenatal T. 2D:4D relates through a presentation in sports and workouts, that tests a combination of force and ability, however, the connotations are normally fairly frail thru 2D:4D office for lesser than a tenth of the modification in performance. The discovery that 2D:4D clarifies concerning twenty-five of the discrepancy in ER prompt that antenatal 'T' is very vital in deciding potency in cardiopulmonary exercise.

The 2D:4D magnitude relation (2D:4D) may be a sexual polymorphism attribute (men incline to own inferior standards as compared to women) as well as a possible biomarker for the structure (eternal) result of antenatal androgens on the humanoid intellect and body. Antenatal androgen, as mirrored by 2D:4D has several additional reproductive organ effects, as well as its connection for the establishment of the associate economical vascular system. Previous analysis, studied here, has so examined doable links of 2D:4D with sports recital. Many studies establish additional masculinized digit magnitude relation pattern to be related with great performance in race, football, and games.

This analysis verified this theory during a model of fifty-four competition fencers. For men undesirable difference in right hand and left-hand 2D:4D paralleled considerably to higher existing also as uppermost national-level fencing position, freelance of coaching concentration and fencing expertise. The average 2D:4D standards of those fencers were substantially minor and therefore the quantity of left-hander was raised compared to the native common populace. For the proper pointer, the magnitude relation was slightly minor in male saber battler than the males fencing

sword and frustrate battler's joint and considerably inferior in left-handed matched to right two-handed players of fencers. though non-significant because of low applied math power, result sizes prompt that spanned virus corresponding hand-eye and hand-foot predilections may additionally be associated with fencing show. These findings augment the proof that digit 2D:4D can be an enactment pointer for male through a range of sporting events (Voracek M et al. 2006).

Sudhakar H H et al. (2013) in the observed relations amid 2D:4D and the output performance of each male as well as feminine Nationwide Indian swimmers. Similar cluster|age bracket|cohort|people} non-athletic personnel fashioned the management group. Lengths of 2nd and 4th digits were dignified once scanning each pointer and their quantitative relation designed. Their consequences are shown inferior 2D:4D standards in males related to females ($P < \text{zero}.05$). Among male, however not feminine, swimmers had considerably ($P < \text{zero}.05$) inferior 2D:4D quantitative relation. Low 2D:4D in swimmers in male category recommended having extra prenatally automated via permanent further venereal special effects of the androgenic hormone. 2D:4D quantitative relation may be accustomed to determine inexperienced sporting personnel WHO have latent to achieve great levels of demonstration.

Joyce C W et al. (2013) conducted a study to analyse the link between aggressive tendencies with boxers' fractures. As 2D:4D quantitative relation has repercussions within the sports, educational realm, money, and sexual grounds. The aim of the revision was to look at the connotation amid minor finger span ratios (2D:4D) and boxers' fractures, in each sex, by comparison, the 2D:4D ratios in a hundred and fifty boxers fissures and compare them to coordinated panels. Boxer's ruptures were Associate in Nursing wound characteristically suffered throughout acts of bellicosity and that they hypothesized that this troop of patients would have a lesser 2D:4D quantitative relation as parallel to the conventional populace mean quantitative relation. 150 radiographs of patients with boxer's breakages subordinate to aggressive engagements were examined and also the 2D:4D quantitative relation was considered. Extra 150 X-rays by patients who are not concerned in violent actions were also used as an impact cluster as well as the 2D:4D quantitative relation was calculated within the same manner. As foretold, they found that 2D:4D in male candidates was less than that of females altogether from the teams. But, their outcomes exhibited that persons

conferring with a boxer crack thanks to Associate in Nursing hostility connected damage had a statistically vital lesser 2D:4D quantitative relation once put next into the conventional inhabitants. Boxer's cracks are wounds that usually happen from Associate in Nursing violent act. This is well recognized that an occasional 2D:4D quantitative relation is contemplative of Associate in Nursing enhanced prenatal exposure to androgens, a notably androgenic hormone. they need to be publicized that boxers' fissures are related to a reduced 2D:4D quantitative relation as compared conventional population, so signifying that people unprotected to extra levels of prenatal androgens would appear to demonstrate destructive predispositions in adulthood.

Terminal and mature testosterone may be vivacious in the formation and conservation of sex reliant aptitudes related to male bodily attractiveness. It was rumoured that quantitative relation (2D:4D) is damagingly connected to antepartum androgenic hormone, and it's additionally negatively related to ability in sports like soccer, as average '2D:4D digit ratio' in football internationals of England (N=37) =0.94; black football professionals of England (N=13) = 0.93; Brazilian professionals (N=99) = 0.93; Brazilian first team professionals (N=20) = 0.92 (Manning 2002, Manning and Taylor (2001), skiing (Manning 2002), middle distance running, and endurance running (Manning 2009a), sprinting ability (Manning & Hill 2009b) , rugby performance (Bennett et al.,2010), which are reliant on an effective cardio-vascular structure. Longman et al. (2011) have suggested that fatal testosterone disclosure has lasting possessions on behaviours allied with sports requiring high supremacy (physical strength) and well-developed cardiovascular systems whereas Voracek et al. (2006) reported similar effect in the female fencers. 2D:4D difference. The relationship between digit ratio and sports like archery and shooting has not been defined. Arms strength, calmness, concentration, accuracy and consistency are far more important virtues for an archer and shooter than aerobic endurance capacity, power, and aggression. We investigated the difference and correlation of digit ratio and salivary testosterone in elite players of Handball, Kho-Kho, Basketball, Football, Boxing, Wrestling, Judo, Shooting and Archery, which require different physiological, psychological and physical compositions.

The digit magnitude relation is that the great relation of the spans of several digits typically restrained from the underneath crumple where the finger joins the hand to the tip of the finger. It's been urged by selected scientists that the extent of 2 digits predominantly, the second as well as fourth, is overcome by introduction to androgens e.g. androgenic hormone however inside the womb which the 2D:4D degree relative are often alleged about a rough living for antenatal steroid introduction, with poorer 2D:4D proportions notify to sophisticated steroid acquaintance. The digit magnitude relation is designed separating the span of the digit of the proper hand by the span of the annually. An extended digit can end in a degree relation over one; however, a prolonged annually can end in a magnitude relation of but one.

Renowned professor in psychology of the Central Lancashire University, as well as the Liverpool University, has established a new concept concerning how digit span narrates to anthropological biology and performance. A substantial share of a model is attentive on the 'digit ratio', which again points to the full-length proportion of two fingers: 2D and 4D. In females, the span of both digits is typically about the same (2D:4D digit ratio = 1.00), though in males the ring digit is frequently somewhat lengthier (digit ratio = 0.98): John T. Manning, 2010.

Researchers from UK and FRG completed a meta-analysis of quite twenty research works that centred on the connection between 2D:4D measurable relation to diverse sporting and their performances. For the foremost half, the analysis demonstrated that people with lesser the proportions incline to own better athletic superior skill. Therefore, persons with lengthier ring digits are supplementary typically the higher sportspersons. The link appears to be robust for strength based sportspersons and feebler for race, control and power athletes. For instance, the 2D:4D relates higher with ten km competition act than by 50 minute dash time. Three different studies studied the talents of association players of football. Two other related works displayed that English skilled performers competitor the best possible levels have inferior 2D:4D quantitative relation as compared to junior performers as well as non-athletes. The other studies testified this quantifiable relation was connected to aptitude valued by the performers and by common folks. Therefore,

there appears to be a vital connection amid the 2D:4D quantitative relation with association football capability.

The minutiae for these relations have not seemed to be fully clear. Several feel that the 2D:4D quantitative relation may be an indicator of prenatal androgen. Therefore, what quantity androgen the craniate is unprotected to within this female internal reproductive organ could have an effect on the finger length quantitative relation. it's going to additionally influence a variety of physical characteristics like vessel capability. Hence, there may very well be an organic rationalization for the link between the 2D:4D quantitative relation and sporty superior skill.

Stress-Vulnerability

The vulnerability is taken into account as a distinguishing of all individuals, ecologies, and districts tackling conservational or socioeconomic pressures and, though the amount of weakness diverges wide, it's typically higher among poorer individuals Kasperson, R. E. & Dow, K.(2001). The vulnerability is interpreted in this study as the degree to which a system is likely to be wounded or experience harm from a perturbation or stress in the natural or social environment Turner, I. I. (1992). The vulnerability has been defined “as the threat of opposing consequences to receptors or contact units (human groups, ecosystems, and communities) in the face of relevant changes in climate, other environmental variables and social conditions”.

“Statement of the Problem”

“The primary focus and purpose of the study is to **“Development of Regression Equation to Predict Kho-Kho Performance with the help of Digit Ratio, Stress-Vulnerability and Selected Anthropometric Variables.”**”

“Objectives of the Study”

The underlying statements reveal the objectives of the present investigation;

1. To determine and find out the joint contribution of finger ratio, anthropometry and stress vulnerability in performance level of Kho-Kho players.
2. To predict the performance level of Kho-Kho players based on finger ratio, anthropometry and stress vulnerability.

Hypotheses

On the basis of the recent literature and understanding of the scholar, following hypothesis arranged;

H1: There will be significant relationship between digit ratio and performance level of male and female Kho-Kho players.

H2: There will be significant relationship between anthropometry and performance of male and female Kho-Kho players.

H3: There will be significant relationship between stress vulnerability and performance of male and female Kho-Kho players.

H4: There might be significant relationship of Kho-Kho performance with the digit ratio, anthropometry and stress vulnerability.

Delimitations

1. This study was delimited to male Kho-Kho players.
2. Study was further delimited to Senior and junior level National level Kho-Kho players.
3. Further the study was delimited to the two-different age group and sex of 15-18 years' junior groups, and above nineteen years' senior groups' male and female Kho-Kho players.

Limitations

As the subjects involving in this study belong to many states of India, parameters such as the geographical conditions, diet, nutrition etc. could not be controlled.

Definition and Explanation of the Terms

“Kho-Kho”

Kho-Kho is a label sports played by teams of 12 players who try to elude being touched by the players of the opposing team

“Digit Ratio”

The digit ratio is the relative dividend ratio of the spans of different digits or fingers characteristically quantified from the end crease where the finger joins the hand to the tip of the finger.

“Body Ratio”

Body ratio impels with the rational difference between standing and sitting stature of the individual.

“Stress”

Stress is that the reaction of the body to a modification that prerequisites a physical, psychological or expressive alteration or reaction.

“Vulnerability”

Vulnerability is taken into account a characteristic of all people, ecosystems, and regions try environmental or socioeconomic stresses and, though the amount of vulnerability varies wide, it's usually higher among poorer people.

“Anthropometry”

The study of the human body measurement for using anthropological classification and comparison.

“Regression Equation”

A regression equation comprehend in the form of $Y = a + bx + c$, where Y is stand for the dependent variable, X is stand for the independent variable used to predict the value of Y, where “a” is the Y-intercept of the line, and “c” is called the regression residual.

Significance of the Study

1. The study would help to determine a specific talent search on the basis of digit ratio, body ratio and stress vulnerability it would help in spotting and trace out talented young Kho-Kho players.
2. The study would be feasible to trainers, coaches as well as physical education teachers to find out easy way to talent identification.
3. The study would develop a criterion for objective measurement for Kho-Kho talent search programme on the basis of physiological and psychological measurement.
4. The conclusion of the work would provide a guideline to the future researchers' and investigators to find out the related comparing different physical, physiological ratios.

CHAPTER – II

REVIEW OF RELATED LITERATURE

This chapter mainly focuses on the detailed literature review based on the subject of research which reinforces the findings and conclusions in the subsequent sessions. A sincere effort has been made from the researcher's end to scrutinize various critical and allied literatures to gather information; this includes various books, journals, unpublished literatures, periodicals and internet sources etc. The reviewed literature has been organized in the present chapter on the basis of different major physical parameters of interest like Anthropometry, digit ratio and stress vulnerability.

Literature Review Related with Anthropometry

A substantial amount of studies in the past strengthen the requirement of specific physique for better performance in sports (Carter *et.al* (1990)). Anthropometry has been assigned as a division of discipline deals thru relative dimensions of the human physique, the measures, and the sizes and configuration. The dimensions comprise body heaviness, tallness, fringe, skin fold depth and bone breadths and stretches (Heyward, 2006). Several studies attempted to relate the performance level of specific sports to the anthropometric characteristics of the sports personals (Wilmore & Costill, 1999; Keogh, 1999; Anup *et. al* , 2014). Indeed, it can be presumed that the anthropometric characteristics of an athlete can influence the performance index of the athlete and together helps in determining the required physique for the specific sports (Carter & Heath, 1990). Hence, the anthropometric outlines designate the possibility of a performer to be appropriate for the race for the uppermost stages in a precise game (Claessens *et al.*, 1999; Reilly *et al.*, 2000; Gabbett, 2000; Slater *et al.*, 2005).

In view of the above-cited literature it can be concluded that identifying the skeletal characteristics required for specific sports will noticeably improve the performance profile of athletes at different positions of competition. The changeable (body composition) and unchangeable (skeletal size, shape and proportion) anthropometric characteristics predisposing to success will differ from

sport to sport. The physique structure of players is a significant instrument to assess the fitness of the players and thereby screen the special effects of a preparation package and to regulate optimum reasonable build mass and additional constituents of body structure (Mathur & Salokun, 1985; Prior et al, 2001). Bale (1986) suggested the knowledge of a player's body composition provides a distinct advantage for specific playing positions, especially at the elite level of competition where there is a high degree of player specialization. Hence, the anthropometric characteristics for success may not only differ from sport to sport but also influence within different playing positions in team sports. In fact, the information pertaining to the anthropometric characteristics of an athlete will help to design an effective training program for the athletes and also to select event specific talents in players. In precise standings body structure denotes to the classification of build mass in positions of complete also comparative sums of fat quantity and fat-less bulk. It is the relative percentage of muscles, fat, bone, and other tissues of the body (Kirk *et. al*, 2008). Body alignment, precisely bulk fat ratio is unique of the main bodily attributes relates to an athlete in terms of his/her performance and also is a very crucial parameter in designing specific and personalized training schemes for the athlete. Even though this particular physical attribute mentioned is often linked negatively to the athletic performance (Sigurbjorn et al., 2000; Gomez, 2004; Malina, 2007), nonetheless liable on the game, an advanced or inferior body heaviness ratio may be advantageous.

The appraisal of body composition is valuable information for both the athlete and the coach in monitoring the training and nutrition of the athletes in general and in relation to a particular sports event. The designed training plan for the player or the players based on his/her anthropometric status is important for the success of the game and directly effects the personal and team performance index (Kurt *et. al*, 2010). It is a widely agreeable argument among the experts that the high-performance index in sports can directly be attributed to suitable basic anthropometric characteristics for the event. The major anthropometric measurements include for the selection of a sportsman with superior performance include tallness, heaviness, breadth, deepness and the perimeter of the different portion of the physique.

The performance of mail Kho-Kho players in university level has been estimated based on the selected cognitive parameters by Shantharaju and S.

Mutaliagan (2012). The performance of the players for the selected cognitive parameters has been assessed based on subject's performance and descriptive statistics and regression methods has been utilized for the quantification of the results. The result obtained has extensively discussed the effect of different cognitive parameters considered on the sports performance of the subjects.

Based on available pieces of literature, the present research work focuses to formulate the influence of anthropometric characteristics of players in "Kho-Kho" and "Kabaddi" and relates it to the performance index of the team as a whole and to individual team members. Ravinder (2013) conducted a study on Ki anthropometric variables as predictors for Kho-Kho playing ability with a primary objective to determine the relationship, combined contribution and multiple regression equation of Ki anthropometric variables on playing ability of Kho-Kho players. The author conducted the study on 120 male intercollegiate Kho-Kho players of Himachal University, Shimla, India. The data for different anthropometric characteristics of the players were collected based on the Weiner and Lourie's technique (1969). Multiple correlation and multiple regression equation in dependent (playing ability) and independent variables (Ki anthropometric measurements) has been utilized for the analysis of the collected data. The correlation study conducted by Ghosh and Kundu (2014) relates designated bodily, biological and anthropometric parameters using ability of presentation in the game of Kho-Kho. The author's randomly selected male Kho-Kho players in the age of 18-20 from four different districts of West-Bengal. The subjects selected for skill performance is categorized as maximum, regular and minimum in bodily, functional and anthropometric parameters. The data collected has been analyzed using M-S regression method and this is perceived that advanced cardiorespiratory survival, quickness, and swiftness; complex VO₂ maximum and minor inactive beat frequency; normal tallness and mass; greater BMI, arm span and leg span can forecast the Kho-Kho performance of a player. A comparative study conducted (Jaiswal 2014) on 99 female Kho-Kho players participated in a Kho-Kho competition conducted at south zone for females, in the year 2011-12, prearranged via Department of Physical education and game, University of Pondicherry efforts to discover the anthropometric dimensions, physique conformation as well as somatotype changes amongst feminine Kho- Kho performers and references. The

subjects were assessed based on height, weight, breadths, girths and skinfold thickness. It is observed that the participants in this study have a sophisticated ratio bulk heavy with minor body tallness and physique mass as compared to their global complements. The authors concluded their study with a note for further extensive research on the problem to improve the performance index of Kho-Kho game.

The individual and combined effects of independent variables (explosive strength, speed, agility, flexibility and cardiovascular endurance) on dependent variable (Kho-Kho performance) have been investigated by M.M Kumar and T.J Singh (2015). The sample size used in the study is 50 intercollegiate Kho-Kho players and the sample size criteria were in a random basis. The selected fitness parameters explored in this study has been evaluated based on selected performance tests and subjective analysis by field coaches. A regression based equation has been developed based on the subject assessment to predict the dependant variable based on independent variables. The individual and combined effects of independent variables on dependant variables have studied extensively. The sample size used in this analysis has been taken as the benchmark to select the sample size for the work presented in this thesis.

Another remarkable contribution to literature in this direction has been done by Biswas and Halder (2015) where the authors selected female Kabaddi as well as Kho-Kho performers to correlates the performance status in different sports to selected anthropometric characteristics and fitness variable. The study concluded that there is no prominent difference between the selected subjects in Kho-Kho and Kabaddi. A similar study has been conducted recently by Baldev Singh (2018) for the male and Kabaddi as well as Kho-Kho performers In Haryana. The data collected among the players has been analysed using the mathematics mean- average, SD, SEM and the values of t-variables. Analysis concluded some of the significant difference between the Kho - Kho and Kabaddi male players which is in contradiction to the results obtained in their female counterparts by Biswas and Halder (2015). These studies hence state a necessity towards extensive research on the anthropometric status of players in these games in future to design tactic gaming training and training strategy which can further enhance the performance profile of the players and eventually the team as a whole.

Literature Review related with Digit Ratio

The figure digit percentage is the proportion of the span of various numbers i.e. digits of the pointers or the digits of the toes, characteristically as dignified from the lowest crumple wherever the digit seams the pointer to the gradient of the finger. The model of finger digit proportion has been primarily introduced by Baker F (1888), the ratio considering the finger lengths of 2nd and 4th digit (2D:4D) can be considered as a sexually dimorphic characteristic (Baker (1888) & George (1930)). Human 2D:4D ratios is one of the highly passionate areas of research owing to its linkage to sensual dimorphism and may be allied with different peripheral, biological and behavioural characters and activity aptitudes and therapeutic circumstances. Generally the scientists have agreed upon the fact that Men ensure suggestively extended directory and ring limb span than ladies. Men demonstrate expressively minor average 2D:4D digit relation (0.968) than ladies (1.014).

The 2D:4D digit ratio is directly related to the sporting ability of individuals by many researchers and one of the early markers in this field of research is done by Manning and Taylor (2001). The study recommends the prenatal and mature testosterone endorses the expansion and conservation of characters that are valuable in game and sports competitions and in masculine: male combat. The same group has investigated the effect of digit ratio on the performance of endurance running (ER) in competitive ER. It is found that ER is gender reliant on and the statement that males track quicker than females propose that ER is controlled and modified by testosterone (T). Hence, enactment in preparation of ER was allied with in height prenatal T, compared with small 2D:4D, in men as well as female. The study correlates 2D:4D digit ratio with recital in game and movements, a combination of strong suit and aptness, at the same time the conclusion suggest that these relations in common fairly fragile to 2D:4D secretarial for < 10% of the alteration in presentation. In 2008 Jurimane et. al (2008) examined the possible relationship between different figure digit ratios in right hand and fasting hormone concentration in young swimmers. The study was conducted among 50 young swimmers (Male=26, Female=29, age group 10-17 years of age). The extensive study carried out by the authors, has potentially predict the influence of different hormone in the finger index ratio on male and female swimmers, which hence indirectly correlates to the physical

ability of the specific sport of interest. For instance, in boys Ghrelin is mainly responsible for numerous limb length percentages (13.7-15.6% alteration) whereas in teenage girls, oestradiol has been associated to the 2D:3D percentage (25.7%) and oestradiol in amalgamation with ghrelin (2D:4D percentage (30.0%)).

Bescos R *et. al* (2009) conducted a model sample study which include multinational participants as subjects. The study conducted for eighty seven international standard women epee fencers for possible association of the 2nd to 4th digit ratio, a supposed indicator for prenatal with androgen act with sporting presentation. The study finds important in the scientific realm owing to its emphasis of female athletes and non-main stream sports selection. Lower digit ratio correlates to improved present and previous ecosphere positions even though, these connections were important for accurate hand 2D:4D finger digit percentage with references. However, longer fingers correlate strongly with to the current and past world ranking but become insignificant in with the same controls. The conclusions spread linked signal redolent of prenatal encoding of talent thru a variation of game, particularly athletics and football. The study also points out towards genital effects of prenatal testosterone which contribute significantly to the sports ability in adulthood. Voracek *et.al* (2010) extended the previous mentioned study in literature to both male and female athletes in fencing sports, while controlling for covariates. The national ranking of the Austrian tournament fencers were correlates to lower 2D: 4D but this correlation is valid to female fencers and not for their male counterparts. The possessions of noticeable concert features (oldness, BMI, fencing year, drill strength, and the character parameter attainment, regulator, damage evasion, and communal power) were measured, 2D:4D factor accounts for increased modification (12%) in fencing accomplishment. The findings of the study also reveal that the sportspersons' vigorous in the greatest destructive method (the sabre) had lesser 2D:4D than that of persons bouncing in the supplementary methods. Sports accomplishment in grown-up lifespan might be partially prenatally automated via on-going additional genital properties of testosterone.

It is a generally accepted fact that low 2D:4D ratio can be correlates to high performance in sports since 2D:4D ratio is a putative marker for prenatal testosterone. Based on the above insight Bennett M *et.al* (2010) conducted a study on 2D:4D ,

enactment in best rugby game performers. For this study the 44 players were selected and they were from the Union club of Ospreys Rugby and 44 similar age panels. From the collected data it has been observed that associated with panels, performers have higher and have well-lit 2D:4D for both the hand. Figure 2.1 shows the residual caps drawn using the observations from the present study. First figure in the image shows the residual cap on age and the second graph is based on the tries in the game. The X-axis of the graph indicates the right hand 2D:4D digit ratio.

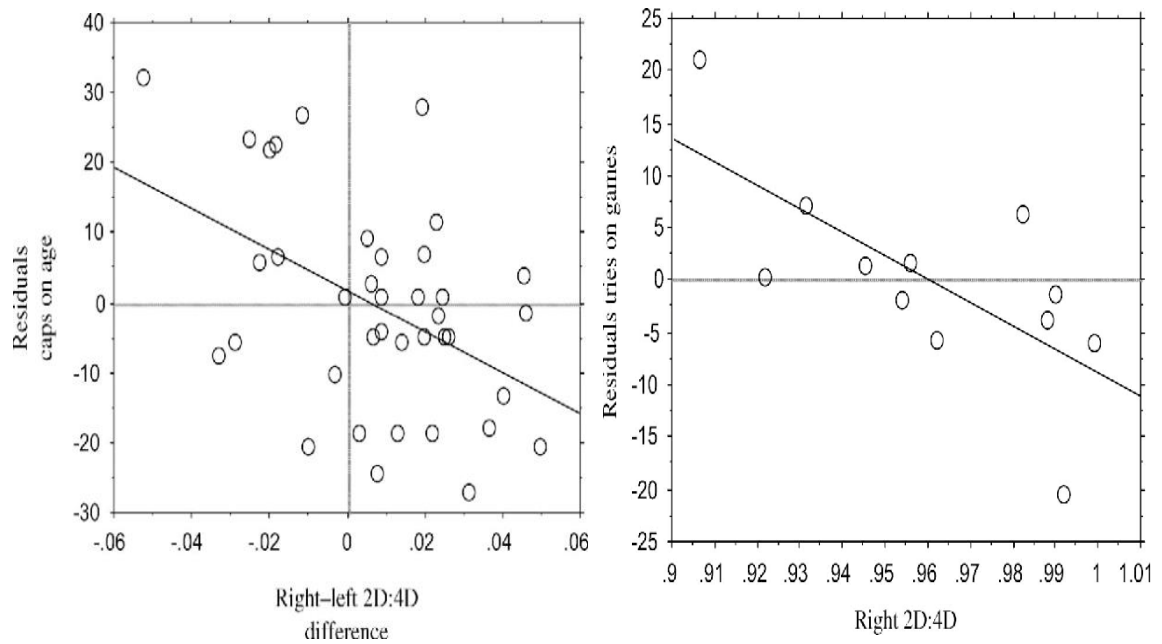


Fig. 2.1 Residual plots on caps on age and tries in games on the basis of 2D:4D Digit ratio.

From the above figures it can be concluded those performers per little 2D:4D in the right hand and little right 2D:4D associated by the left have great amount of covers, whereas little right side hand 2D:4D and little right hand – left hand 2D:4D alterations remained expressively connected with huge numbers of attempts. The study thus determined that little right hand 2D:4D and short right hand – left hand 2D:4D variances are forecasters of extraordinary sport enactment.

The correlation between digit ratios, particularly 2D:4D ratio to the sporting ability of athletes in general has been well established from the above literatures. However, conclusive studies to establish the relationship between the digit ratio particularly to Kho-Kho and Kabaddi Players in general and specifically in the

Indian subcontinent are scarce in number. Sudhakar *et. al* (2014) published their research work to understand the effect of digit ratio on the Elite Indian Kabaddi male players. The study aims to compare the 2D:4D index ratio of the Kabaddi players to the non-athletic counterparts. The authors selected both right hand and left hand Kabaddi male performers (roughly 33 in No) attendance drill base camp at the Regional Centre Bangalore of SAI . The controls are selected as a group of persons who haven't participated in any sporting activity. There is a significant difference is observed for the 2D:4D ratios between the Kabaddi players and their counterparts and as expected it has been observed that the players have a lower 2D:4D ratio as compared to their controls. Furthermore, it is observed that there is no significant variation for the specified digit ratio among the athletes and their controls. The authors concluded their study citing the need for an extensive research in this direction which will help in different phases of the team performance starting from the team selection, training, execution of game plans etc. The Proposed research work in this thesis thus pays a way for the further study on this direction concentrating the ancient Indian origin games of Kho-Kho and Kabaddi.

Literature Review related with stress vulnerability

The definition of stress can be stated as “Stress has been defined as stimulus, intervening and response to variables by different researchers. As a stimulus variable stress is a precipitator; as an intervening variable, a mediator; and as a response variable, a behaviour” by Martens *et. al* (1990). The stress can affect the performance of any individual in any ecological system and any level of profession. Similar, impact on stress can be identified in athletes which may diversify in its degree according to the external and mental conditions of the individual or a boarder sense the team as a whole. The main causes of tension that are proficient by athletic performers comprise anxiety of let-down, apprehensions about public appraisal (predominantly the coach), non-existence of willingness to accomplish, and damage of inside governor above one's situation. Tension can disturb show, the approach towards stress, and the managing of the trauma can damagingly or confidently shake the sportsperson's tension level. The above definition of tension can be demonstrated using Stress Model, Graham-Jones & Hardy (1990) shown below:

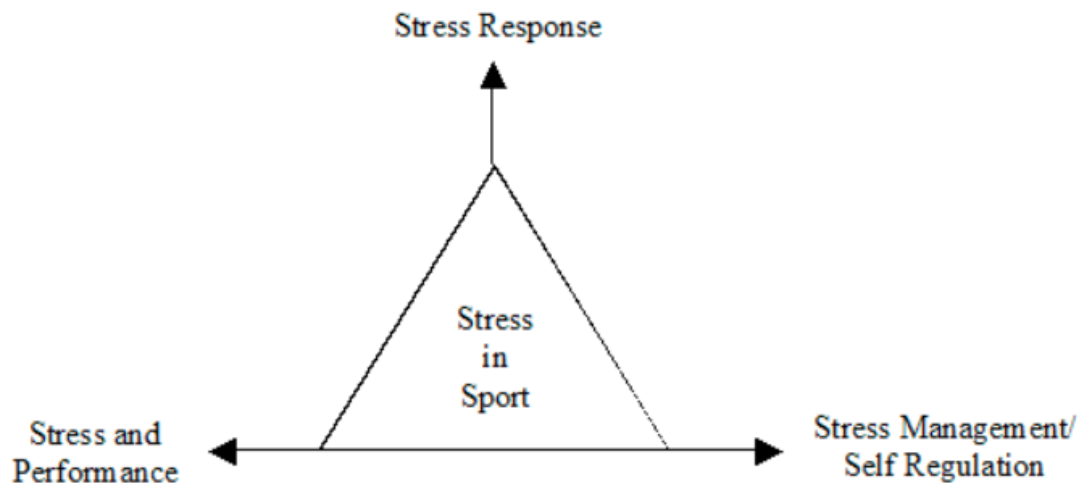


Fig. 2.2 Graham-Jones & Hardy (1990) Stress Model

The term vulnerability acquires an impressive number of definitions from different authors. Vulnerability or susceptibility is reflected a distinctive of every individuals, environments, and areas challenging ecological or socioeconomic tensions and, even though the degree of resistance diverges extensively, it is commonly complex amongst subordinate folks Kasperson, R. E. & Dow, K.(2001). Turner, I. I. (1992) interpreted vulnerability as the degree to which an organization is probable to be injured or involve damage from a agitation or anxiety in the normal or public situation. Vulnerability has also been defined as “a human condition or process resulting from physical, social, economic and environmental factor, which determine the likelihood and scale of damage from the impact of a given hazard” (Clark 2000).

The Stress Vulnerability model was first proposed by Zubin & Spring (1977), this model has been utilized as a governing theoretical outline for the content understanding of psychosis despite the fact that the model evolved through several modification over the years. The outline permits customers to have ‘vigorous role’ in the development of dipping the susceptibility to tension, and also levitation the verge for reversion by the expansion of numerous policies. In overall footings trauma defencelessness will affect the population in physical and psychological aspects of their life. A study conducted by Caredda *et. al* (2009) relates the stress vulnerability to the night eating syndrome in the general population. This is normally characterized by

a reduced intake of energy during the first part of the day and significantly augmented intake in the second part. Night eating syndrome or NES is clinically associated with obesity. The study has been administrated to 531 grownups attending at the Institution of higher education, L'Aquila. NEQ and the SVS are provided toward the subjects along with specific questionnaire to collect their Socio-demographic and anthropometric features. The scientists aim to correlates the vulnerability to cultivate NES in the common residents and to examine the theorised part of critical and prolonged tension in the pathogenesis of dysfunctional ingestion manners. The study approves a solid relationship between perceived tension, changed eating behaviours and fatness. Vulnerability to tension is allied with mental as well as the physical well-being of an individual. Amaral *et. al* (2009) examine association of stress vulnerability to the condition of health of a person and also examines the effect of interaction among the life dealings, stress vulnerability and the social backing in physio-metal signs. The sample of the study has been selected (255 subjects in general population) and regression analysis has been used to recognize the features describing the condition of health at each instant of the study. The outcomes from the study show that the stress vulnerability is a strong predictor of change for the status of physical health of individuals at any moment of time. However, the association of stress vulnerability to mental health is even more prominent when it comes to the mental health. It can also be conclude from the study that the communication among the life dealings and factor one of susceptibility clarifies the variations in the psychological fitness and the collaboration among the lifetime procedures and factor seven of susceptibility elucidates the vicissitudes in the bodily fitness.

One of the comparatively insufficient trainings assessed the relationship amongst tension, emotional suffering, psychosocial influences and menopause indications. Bauld *et. al* (2009) pressure, psychosomatic anguish, psychosocial reasons and menopause indicators. The revision appraise straight and unintended associations among tension, spiritual agony, psychosocial aspects menopause sign harshness and bodily wellbeing in women's of their middle age. 116 female participants in the age range of 45-55 has been drafted for the study through women's healthiness regions and communal administrations. The members finalized survey about pressure, emotional grief, El, arrogance to menopause, menopause indications

and bodily wellbeing. It has been observed from the study that women with extraordinary EI seem to grip additional optimistic approaches towards menopause and involvement fewer stark anxieties, emotional suffering and menopause signs and healthier bodily wellbeing and females who suppose menopause to be a undesirable involvement or remain greatly hassled or concerned may be supplementary involve an added undesirable menopause. Another study conducted in 2013 evaluate the impact if stress vulnerability on anxiety and depression (Tariq, 2013). The focus of the investigation remained to detect and calculate the changes in trauma susceptibility in patient's sensitivity nervousness and unhappiness. A sample of hundred patients, fifty men and 50 women were nominated for the study through purposive sampling as of diverse psychiatric health cares in capital of Pakistan. Fifty total patients (M=25 and F=25) experiencing anxiety were selected and Fifty patients (M=25 and F=25) feeling depression were nominated, and the patients age range has been restricted between 30-50 years. The results were interpreted mean and standard deviation method and the average was considered for marks on strain vulnerability gauge. This has been observed that the change in average scores remained become in patients feeling condition of nervousness and condition of unhappiness and among male patients than female patients feeling condition of concern as well as condition of depression.

V. Singh et.al (2012) assessed the stress vulnerability of the 150 samples from different educational releam. The study aims to compare the stress vulnerability of sports (physical education students) and non-sports (engineering and medical students). The stress vulnerability has been assessed with the help of the stress vulnerability scale developed using Lyle H. Miller and Alma Dell Smith. The analysis of collected information has been performed using descriptive statistics and significance level of up to 0.05 has been attained. The study shows that the performance of sports students in terms of stress vulnerability is higher as compared to non-sports students.

The mentioned studies related to stress vulnerability on different horizons of physical and mental health impact shows that the impact of stress vulnerability analysis is highly crucial in sports. The stress analysis of athletes in their personal front and also at different movements of the sporting effect may be turned up as bottleneck hurdle towards success. Even though the impact of stress vulnerability is a

crucial determining factor of success in sports it is one of the areas of research where little efforts have been initiated.

One of the early attempts to predict the influence of psychological attributes factors on sports injuries has been carried out by Junge (2000). The study has explored a variety of psychological attributes which is supposed to contribute towards the account of sport injuries but only competitive anxiety has been emerged as the key factor influencing the injury occurrence. Based on numerical approach the authors developed a suitable stress theory model for the athletes. Amit Kumar (2016) investigated the exhaustion and pressure susceptibility of male judo performers amongst diverse state of group. The survey conducted among 120 national level Judo male players of different categories (40 LW category, 40 MW categories and 40 HW categories). The participants remain confronted individually with closed-end questionnaires. The effort to find the significant difference in stress vulnerability between different categories considered has been materialized through DA and One-Way variance analysis as well as F-test could be employed in the designated factors (Verma, 2013). The analysed results shows that the reduce sense of accomplishment, physical exhaustion, deviation and stress vulnerability did not show any significant difference among the three groups of Judo male players. In a similar study conducted by Ivarsson et.al (2013) correlates the occurrence of injuries in sports to the parameters of player's personality stress and coping ability. Swedish Premiere League soccer players in both sex variations have been selected based on convenience sampling (56 participants, 38 male and 18 female) and suitable questionnaires were provided to gather data. A path analysis method has been employed to retrieve the desired outcome. The obtained results from the path analysis has been suitably interpreted and it can be concluded from these observations that peculiarity nervousness, adverse lifespan pressure, and everyday annoyance remained important forecasters of wound among specialized football performers, with an average of 24% of the modification. The study also warranted the need for proactive stress management technique to educate and train the athletes and coaches for better productivity and minimized risk in sporting events which will leads the path for better performance.

Meenu (2017) conducted a study on physical education students of northern India universities aiming to evaluate the stress vulnerability of students in north Indian Universities. The determination of the investigation existed to scrutinize the tension vulnerability of students of physical education from Universities in north India. The authors ensure the participation one fifty sports students from diverse university of north Indian region (M.D.U Rohtak, University of Panjab, Punjabi University Patiala, etc) and all the participants were personally interviewed with closed questionnaires for better accuracy for predictions. One Way variance analysis as well as F-test has been employed to determine significant modification among all the students. The study projected a significant difference among the hockey, kabaddi and cricket in relation to the stress vulnerability of state level male players from Utter Pradesh India. Chauhan and Sabir (2018) arrived at similar conclusions by studying a group of 45 participants from U.P region, India. The subjects were selected based on random sampling method where, there were 15 players from the sports Hockey, Kabaddi and Cricket each. Required data has been collected using standard procedures and Descriptive statistics with the Analysis of variance (ANOVA) remained employed to examine the statistics with the assistance of numerical instrument pack SPSS 22.0 version. The results obtained are in well agreement with the finding of Meenu (2016).

A detailed examination of the published literature and available sources, it is considered to be significant to examine the relationships of digit ratio (2D:4D) anthropometric measurement and/or stress vulnerability with the performance of male Kho-Kho players, where a very little conclusive information is available on the basis of scientific research. Moreover, the present study would possibly highlight some of the important Physical, Physiological and Anthropometric variables which are determinants of selection of talented Kho-Kho players and would help to bring scientific guidelines on the futuristic training programme for Kho-Kho players.

CHAPTER III

METHODS AND PROCEDURES

This chapter presents a detailed discussion on grouping and selection of subjects, sorting of observational parameters, criterion of measures, administration of test, data collection and statistical methods employed for analyzing the collected data.

3.1 Selection criteria of the subjects

At Senior and Junior Level National Tournaments, the total two hundred (200) Kho-Kho players as subjects are randomly selected, out of which hundred (100) for senior level male and female and rest hundred (100) junior level male and female were taken for this research work. Senior Level National Tournament held at Kolhapur, Maharashtra on 25th Oct 2017 and Junior Level National tournament held at Nevai, Rajasthan on 3rd December 2017. The subjects are selected from Uttar Pradesh, Uttarakhand and Madhya Pradesh. The age-group of the Junior (male or female) is 15-18 years' and for Senior (male or female), it is above eighteen years.

Senior Male (>18) years	Senior Female (>18) years	Junior male (15-18) years	Junior female (15-18) years	Total
50	50	50	50	200

3.2 Selection of variables

Based on the consultation with the experts and, gleaning through the literature available, considering the feasibility criteria in mind, finger ratio, anthropometric (height, weight, body ratio, whole leg span, upper leg span, lower leg length, calf girth, thigh girth, waist perimeter) and stress vulnerability are selected as variable for the study.

Criterion Measures

The condition procedures acknowledged for the study were as follows:

Name of Test	Purpose	Unit of score
Digit Ratio (2D:4D)	Finger Ratio	cm and mm
Body Ratio	Difference between standing and sitting height	cm and mm
Kho-Kho performance	Match performance on the basis of set Rubrics	Subjective judgment by experts in National tournaments.
Height	Stadio-meter	M
Leg length	Steel Tape	cm
Girth (Calf & Thigh)	Steel Tape	cm
Waist Circumference	Steel Tape	cm
Stress Vulnerability	By Lyle H. Miller and Alma Dell Smith constructed Stress Vulnerability Scale.	Numbers/Count

Administration of Test / Collection of Data

Data for the current study is collected by methodology of the tests for the chosen variables. All the tests are conducted at National Level Tournaments for Senior and Junior Kho-kho male and female Players. Investigator of this study visited the venues of Junior and Senior National tournaments along with three experts of this field.

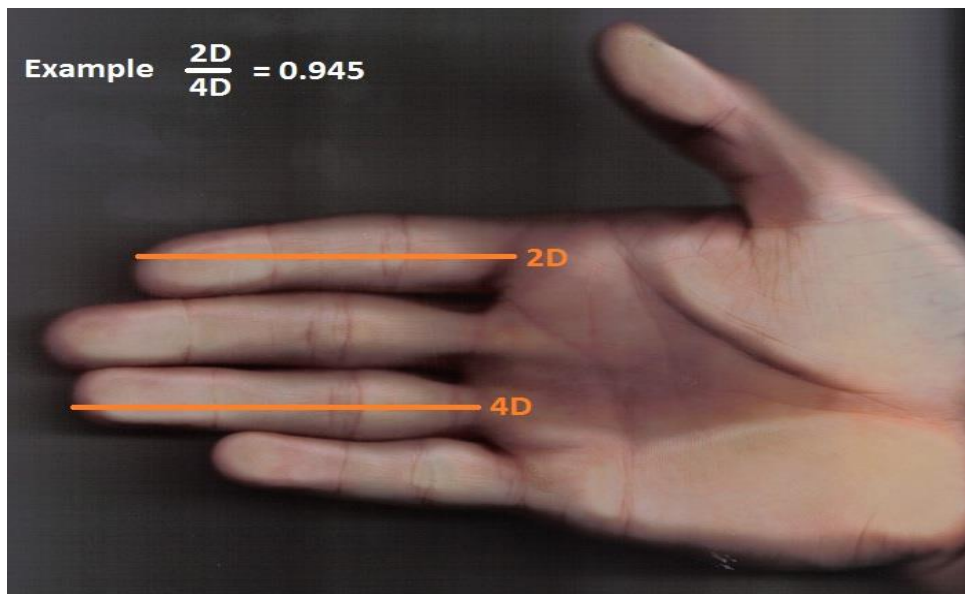
The data relating to Kho-Kho performance of players at different level is taken with the help of Kho-Kho Federation of India.

I. Digit Ratio

Equipment: Measuring Scale

Method: The connection between the 2nd and 4th finger length is termed as ratio of 2D:4D. This ratio is considered by the ratio of the length of the pointing finger (2nd digit) to the span of the fourth finger (4th digit). Investigators frequently quantify the palm area side, taking the span length from the crinkle near to the palm part of the hand to the finger top (see Figure 1). Commonly, the ratio is 1.0 (both are at same length). Though, the ratio can vary from around 1.05 (index finger-longest) to 0.85 (ring finger-longest).

Score: The measurement would be recorded from the Centimetres and millimetres.



II. Body Ratio

Standing Height: It has been the peak in height of the single when stand-up erects on a straight surface with his crown and face in F.H. (Frankfurt horizontal plane).

Equipment: Stadiometer and Anthropometry rod.

Method: The subject was instructed to view straight, plain footed on a flat straight surface contrary to a wall, with his heels, backbone of the shoulders and head touching the wall. He was requested to stretch his body upward to the maximum extent possible without his heels departure the ground. The head and face were checked for its being in F.H. plane. To get it easily, the subject was be asked to see

toward an object in front of her approximately at a height of her eyes, then the investigator adjust the tracheon and infraorbitale points in a horizontal line. The anthropometry rod was kept in the front side of the subject and the cross bar of the anthropometry was in tune so that the inferior edge touches the highest point of the subjects' crown.

Score: The measurement has recorded from the anthropometry eye correct up to 0.1 cm.

The Stress Vulnerability:

The stress vulnerability survey form has been industrialized by the psychologists at the University of Boston Medical Center, L.H. Miller and A.D. Smith, and is replicated by the SCI, NCCC, Ohio. To comprehend the survey, recite each declaration cautiously and reproduce on our representative compartments. The procedure has been followed by marking the suitable amount representing repetition the declaration implies to you using the subsequent scale. Susceptibility on the succeeding opinions measures:

- 1) Always.
- 2) Usually.
- 3) Sometimes.
- 4) Almost Never.
- 5) Never.

In replying to the vulnerability to stress measure scrutinized darken the figure on the ordinary examination after to the right of all 20 report that best tag the strength of their approaches:

- 0-10 designates the outstanding confrontation to the susceptibility to strain,
- 11-29 slight vulnerability to stress
- 30-49 some susceptibility to stress
- 50-74 serious vulnerability
- 75-80 extreme vulnerability

In replying towards to susceptibility to the term stress measure examiners are trained to designate to the way they normally sense by score the incidence of the emotional state of stress.

Administration of Questionnaires

The selected participants were referred individually and their genuine collaboration was implored. The researcher of this study stayed with the candidates and composed statistics on the designated psychosomatic parameters. In situation, where a candidate fails to understand questions in the questionnaire, he/she is explained in Hindi by the investigator keeping the reliability and validity of the questionnaire. The agreement of the trainers and managers and the readiness of the players were taken beforehand the management of questionnaires. Defendants were instructed to present in a common place in groups according to their convenience which insure sufficient enough space and time for the test. Essential directions were set to the subjects beforehand the management of tests which comprise the determination of the work and the technique for replying the surveys. The research scholar inspired the student defendants by encouraging by the promise of sending a discrete intellectual of the decisions of his study to each subject. The privacy of replies was ascertained so as to avoid the possibility of suppression of their actual approaches and they were advised to revert to every question honestly and candidly.

The study assures that the subjects followed the instructions; the forms were dispersed to the subjects. All the surveys were directed to all subjects with a supervision of the scholar. The surveys were managed in agreement with the orders placed in the guidebooks. The assessments were managed in successive fashion, after time delay of time of five to ten minutes between the different tests. The subjects were requested to carefully read and understand each and every sentence of statement in the test form. The queries arises from the subjects has been cleared on the spot by the investigator and directed the subjects for the smooth conduct of the survey. An approximate time span of 30 minute has been taken to finalize each test form. The investigator however has not provided any time limit to answer the question on the intension to obtain the real feelings from the subjects. The questionnaires have been collected from the subject after completing each and every answer by the participants.

The answer sheets are scanned thoroughly to ensure all the questions have been attempted and answered by the participants. Each questionnaire are scaled based on the instructions given in the representative manual.

Statistical Procedure

1. To find out correlation between Independent Variables (Finger Ratio (2D:4D), Anthropometric Variable and stress vulnerability) and Dependent Variable (Kho-kho performance), partial correlation were used.
2. To study the joint contribution of Independent Variables (Finger Ratio (2D:4D), Anthropometry and Stress Vulnerability) and dependent variable (Kho-kho performance) multiple correlation were used.
3. For prediction on basis of independent variables (Finger Ratio (2D:4D), Anthropometric and stress vulnerability) to dependent variable (Kho-kho performance), multiple regression were formulated.

CHAPTER IV

ANALYSIS OF DATA AND RESULTS OF THE STUDY

The statistical investigation of composed information in the form of data on physical, physiological and psychological parameters on two hundred sports persons from Kho-kho belonging to schools, colleges and universities has been discussed in this section. The data connect to numerous physical, physiological and psychological parameters has been examined by using the descriptive statistics i.e. mean, standard deviation, standard error, median, mode, sample variance, kurtosis, skewness and range. Further, regression equations were developed on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability.

Level of Significance

The significance level has to be check the relationship between the variables was set at 0.05 level, taken as an approximate and feasible consideration to meet the proposed objectives of the study.

4.1 Statistical Findings

The conclusions concerning to descriptive statistics and correlation technique for the various physical, physiological and psychological variables of two hundred sports persons have been tabulated in table No. 4.1 to 4.28.

Table 4.1: Descriptive statistics of Kho-kho performance of Junior level males

	N	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Height	50	163.3800	.69217	4.89435	-.062	.337	-1.426	.662
Leg Length	50	80.7000	.43729	3.09212	-.069	.337	-1.144	.662

Calf Girth	50	31.3600	.28250	1.99755	-.057	.337	-.799	.662
Thigh Girth	50	41.6800	.41349	2.92379	-.706	.337	-.328	.662
Waist Circumference	50	68.5600	.40321	2.85114	-.525	.337	-.012	.662
Digit Ratio	50	1.0087	.00543	.3838	-.160	.337	-.465	.662
Body Ratio	50	1.8607	.0133	.08012	.524	.337	.595	.662
Stress Vulnerability	50	41.3000	1.94417	13.7474	.537	.337	-.950	.662
Performance	50	6.5400	.23423	1.65628	.109	.337	-1.160	.662

Table- 4.1 revealed that the descriptive statistics of fifty subjects in Anthropometric, Digit Ratio, Body Ratio, Stress Vulnerability and Kho-Kho Performance with respect to kho-kho players.

1. In Height, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 163.38, 4.89, -.06 and -1.42 respectively.
2. In Leg Length, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 80.70, 3.09, -.06 and -1.14 respectively.
3. In Calf Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 31.36, 1.99, -.05 and -.79 respectively.

4. In Thigh Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 41.68, 2.92, -.70 and -.32 respectively.
5. In Waist Circumference, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 68.56, 2.85, -.52 and -.01 respectively.
6. In Digit Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 1.0087, .03838, -.16 and -.47 respectively.
7. In Body Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 1.86, .08012, -.52 and .60 respectively.
8. In Stress Vulnerability, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 41.3, 13.7474, .54 and -.95 respectively.
9. In Kho-Kho Performance, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 6.54, 1.65, .10 and -1.16 respectively.

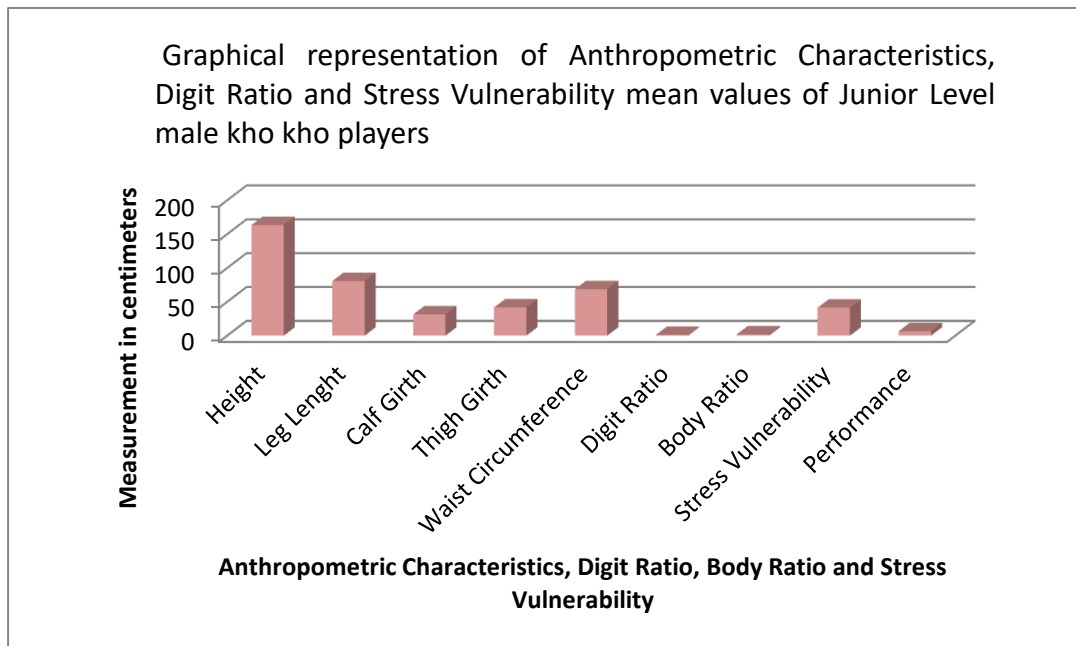


Figure 4.1: Graphical representations of anthropometric characteristics, digit ratio, body ratio and stress vulnerability mean values of junior level male kho kho players.

Table 4.2: Model summary related to estimating kho-kho performance of junior level male kho kho players on the basis of anthropometric variables, digit ratio and stress vulnerability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.534 ^a	.285	.271	1.41457	2.066
2	.637 ^b	.406	.381	1.30363	
a. Predictors: (Constant), Stress Vulnerability					
b. Predictors: (Constant), Stress Vulnerability, Digit Ratio					
c. Dependent Variable: Performance					

Table- 4.2 Shows the model no1 summary for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level male kho kho players. Two models were established by multiple regression analysis.

- I. In model 1, R of .534 is the relationship between independent variables (Stress Vulnerability) and dependent variable (kho kho Performance). Adjusted R square of .27 justifies that 27% of kho kho Performance in explained by Stress Vulnerability.
- II. In model 2, R of .637 is the relationship between independent variables (Stress Vulnerability, Digit Ratio) and dependent variable (kho kho Performance). Adjusted R square of .38 justifies that 38% of kho kho Performance in explained by Stress Vulnerability, Digit Ratio.

Table 4.3: ANOVA Table for estimating kho Kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in junior level male Kho Kho players

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.371	1	38.371	19.176	.000 ^a
	Residual	96.049	48	2.001		
	Total	134.420	49			

2	Regression	54.546	2	27.273	16.048	.000 ^a
	Residual	79.874	47	1.699		
	Total	134.420	49			
a. Predictors: (Constant), Stress Vulnerability						
b. Predictors: (Constant), Stress Vulnerability, Digit Ratio						
c. Dependent Variable: Performance						

Table- 4.3 of ANOVA is related to the utility of one established model.

- I. In model 1, F. Value of 19.176 is significant at .05 level, this model is found effective is estimating Kho-kho Performance on the basis of Stress Vulnerability.
- II. In model 1, F. Value of 16.048 is significant at .05 level, this model is found effective is estimating Kho-kho Performance on the basis of Stress Vulnerability, Digit Ratio.

Table 4.4 Coefficients of regression model for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level male kho-kho players.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	9.198	.639		14.390	.001
	Stress Vulnerability	-.064	.015	-.534	-4.379	.000
2	(Constant)	-6.233	5.036		-1.238	.222
	Stress Vulnerability	-.058	.014	-.484	-4.262	.000
	Digit Ratio	15.126	4.903	.350	3.085	.003
a. Dependent Variable: Performance						

Table- 4.4 shows the coefficients of regression model for estimating Kho-kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in junior level male kho-kho players. On The basis of table 4.4

established models are:

$$\text{Model I: Performance} = 9.198 + .064 * \text{Stress Vulnerability}$$

$$\text{Model II: Performance} = -6.233 + .58 * \text{Stress Vulnerability} + 15.12 * \text{Digit Ratio}$$

Table 4.5: Details of excluded variables for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level male kho kho players.

Model	Beta In	T	Sig.	Partial Correlation	Collinearity Statistics	
					Tolerance	
1	Height	.223 ^a	-1.782	.081	-.252	.907
	Leg Length	-.060 ^a	.480	.634	.070	.972
	Calf Girth	-.100 ^a	-.810	.422	-.117	.993
	Thigh Girth	-.104 ^a	-.845	.402	-.122	.986
	Waist Circumference	-.036 ^a	-.295	.769	-.043	.986
	Digit Ratio	.350 ^a	.3.085	.003	.410	.980
	Body Ratio	.139 ^a	-1.017	.314	.147	.797
2.	Height	-.133 ^b	-1.089	.282	-.158	.888
	Leg Length	-.004 ^b	.038	.970	.006	.948
	Calf Girth	-.044 ^b	-.384	.703	-.057	.967
	Thigh Girth	-.008 ^b	-.065	.949	.010	.886
	Waist Circumference	-.094 ^b	.818	.418	.120	.971
	Body Ratio	.66 ^b	-.512	.611	-.075	.767
a. Predictors in the Model 1: (Constant), Stress Vulnerability						
b. Predictors in the Model II: (Constant), Stress Vulnerability and Digit Ratio						
c. Dependent Variable: Performance						

Table- 4.5 Shows the details of excluded variables for estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in junior level male kho kho players.

- I. In this model, five Anthropometric variables (Height, Leg Length, Calf Girth, Thigh Girth and Waist Circumference), Digit Ratio and Body Ratio were excluded.
- II. In this model, five Anthropometric variables (Height, Leg Length, Calf Girth, Thigh Girth and Waist Circumference) and Body Ratio were excluded.

Table 4.6: Residual statistics for kho kho performance related to anthropometric variables, digit ratio and stress vulnerability

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.2011	8.9366	6.5400	1.05508	50
Residual	-2.17698	3.29366	.00000	1.27674	50
Std. Predicted Value	-2.217	2.271	.000	1.000	50
Std. Residual	-1.670	2.527	.000	.979	50
a. Dependent Variable: Performance					

Table- 4.6 Shows the residual statistics for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level male kho kho players.

In this standardised residual ranges from -1.670 to 2.527. This does not fall in the expected range, so there are outliers in this study. In table 4.2, Durbin Watson value of 2.066 justify that there is independence in data point to a great extent.

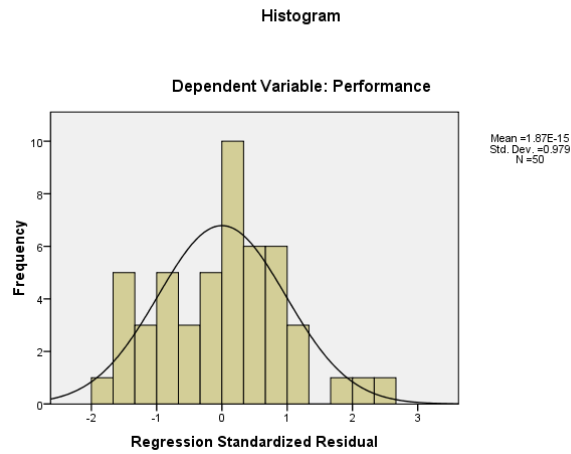


Figure 4.2: Histogram with normal curve related to the residuals of junior level male kho kho players

Figure 4.2 and 4.3 shows the histogram with normal curve and Q.Q. Plots related to junior level male kho kho players. This shows that distribution of residuals related to junior level male kho kho players are normal in nature.

Normal P-P Plot of Regression Standardized Residual

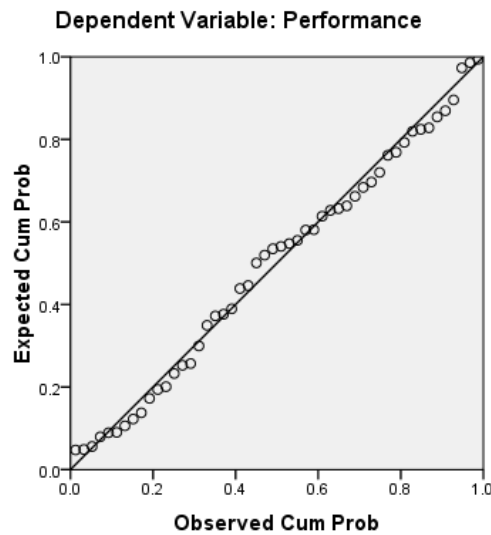


Figure 4.3: Q.Q. Plots related to the residuals of junior level male kho kho players

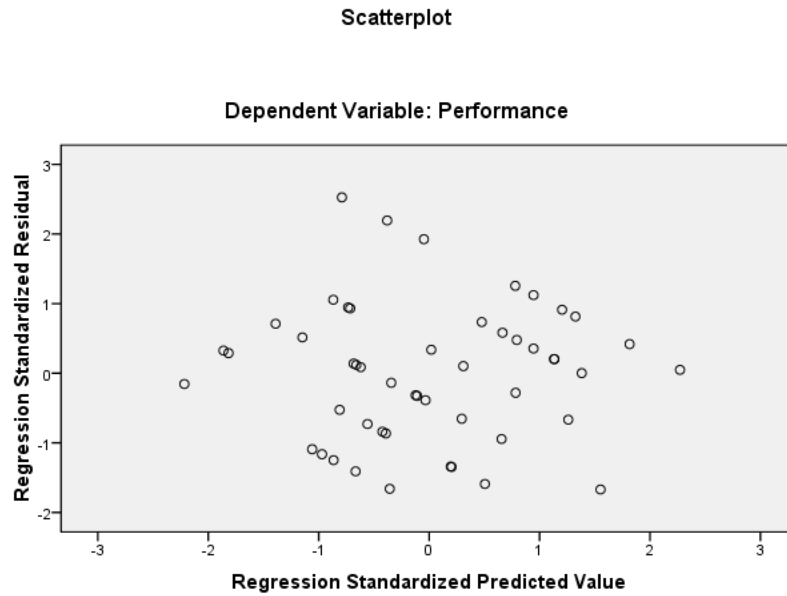


Figure 4.4: Scatter plot showing constant variance related to the residuals of junior level male kho-kho players

Figure- 4.4 of scatter plot shows that in junior level male kho kho players constant variance is found is relation to residuals. Last and fourth assumption of independent of data point is tested by Durbin-Watson test (gives in table 2). The value of 2.35 shows that neither strong negative nor is strong positive correlation was found. Since all the assumptions are fulfilled, results of the study may be generalized.

Table 4.7: Relationship between Anthropometric Characteristics, Digit Ratio, Stress Vulnerability and Kho-Kho performance of Junior Male Kho- Kho Players

		Height	Leg	Calf	Thigh	Waist	Digit	Body	Stress	Perform
Height	P. Corr.	1	.014	.011	.234	-.076	-.302*	.750**	.306*	-.366**
	Sig. (2-t)		.921	.941	.102	.602	.033	.000	.031	.009
	N	50	50	50	50	50	50	50	50	50
Leg Length	P. Corr.	.014	1	-.187	-.020	-.187	.178	-.143	-.168	.148
	Sig. (2-t)	.921		.193	.891	.195	.216	.322	.244	.306
	N	50	50	50	50	50	50	50	50	50
Calf Girth	P. Corr.	.011	-.187	1	.331*	-.244	-.148	-.067	-.084	-.054
	Sig. (2-t)	.941	.193		.019	.088	.306	.646	.561	.711

	N	50	50	50	50	50	50	50	50	50
Thigh Girth	P. Corr.	.234	-.020	.331*	1	.098	-.330*	.099	.118	-.166
	Sig. (2-t)	.102	.891	.019		.499	.019	.494	.414	.250
	N	50	50	50	50	50	50	50	50	50
Waist	P. Corr.	-.076	-.187	-.244	.098	1	-.165	.088	.061	.004
	Sig. (2-t)	.602	.195	.088	.499		.253	.544	.675	.979
	N	50	50	50	50	50	50	50	50	50
Digit Ratio	P. Corr.	-.302*	.178	-.148	-.330*	-.165	1	-.236	-.143	.420**
	Sig. (2-t)	.033	.216	.306	.019	.253		.100	.322	.002
	N	50	50	50	50	50	50	50	50	50
Body Ratio	P. Corr.	.750**	-.143	-.067	.099	.088	-.236	1	.451**	-.352*
	Sig. (2-t)	.000	.322	.646	.494	.544	.100		.001	.012
	N	50	50	50	50	50	50	50	50	50
Stress Vulnerability	P. Corr.	.306*	-.168	-.084	.118	.061	-.143	.451**	1	-.534**
	Sig. (2-t)	.031	.244	.561	.414	.675	.322	.001		.000
	N	50	50	50	50	50	50	50	50	50
Performance	P. Corr.	-.366**	.148	-.054	-.166	.004	.420**	-.352*	-.534**	1
	Sig. (2-t)	.009	.306	.711	.250	.979	.002	.012	.000	
	N	50	50	50	50	50	50	50	50	50
*. Correlation is significant at the 0.05 level (2-tailed).										
**. Correlation is significant at the 0.01 level (2-tailed).										

1. Table- 4.7 shows the partial relationship of all the related variables and Kho-Kho performance of junior level kho- kho players.
2. The relationship between Height and Digit Ratio ($R = -.30$ $p = .03$), Height and Body Ratio ($R = .75$ $p = .00$), Height and Stress Vulnerability ($R = .30$ $p = .03$), Calf Girth and Thigh Girth ($R = .33$ $p = .01$), Thigh Girth and Digit Ratio ($R = -.33$ $p = .01$), & Body Ratio and Stress Vulnerability ($R = .45$ $p = .00$) were found positive correlation at .05 level of significance.
3. On the other hand, height and leg length, height and calf girth, height and thigh girth & height and waist circumference; leg length and calf girth, leg length and thigh girth, leg length and waist circumference, leg length and digit ratio, leg length and body ratio & leg length and stress vulnerability; calf girth and waist circumference, calf girth and digit ratio, calf girth and body ratio & calf girth and stress vulnerability; thigh girth and waist circumference, thigh girth and body ratio, & thigh girth and stress vulnerability; waist circumference and digit ratio, waist circumference and body ratio & waist circumference and stress vulnerability; digit ratio and body ratio & digit ratio and stress vulnerability no relationship were found.

Table 4.8: Descriptive statistics of kho-kho performance of junior level female kho-kho players

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Height	50	155.2400	5.00024	-.739	.337	-.784	.662
Leg Length	50	67.5400	4.30572	-.363	.337	.846	.662
Calf Girth	50	25.8600	1.64143	-.516	.337	-.265	.662
Thigh Girth	50	32.6400	1.73511	-.075	.337	-1.299	.662

Waist Circumference	50	58.7600	2.12430	-.244	.337	-1.011	.662
Digit Ratio	50	.9817	.03744	-.438	.337	-.948	.662
Body Ratio	50	2.3140	.16976	.670	.337	-.209	.662
Stress Vulnerability	50	57.3800	18.65464	-.117	.337	-1.241	.662
Performance	50	5.8600	1.45700	-.036	.337	-.706	.662

Table- 4.8 Revealed that the descriptive statistics of fifty subjects in anthropometric, digit ratio, stress vulnerability and kho-kho performance with respect to kho-kho players.

1. In Height, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 155.24, 5.00, -.73 and -.78 respectively.
2. In Leg Length, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 67.54, 4.30, -.36 and .86 respectively.
3. In Calf Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 25.86, 1.64, -.51 and -.26 respectively.
4. In Thigh Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 32.64, 1.73, -.07 and -1.29 respectively.
5. In Waist Circumference, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 58.76, 2.12, -.24 and -1.01 respectively.
6. In Digit Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found .9817, .037, -.44 and -.95 respectively.

7. In Body Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 2.3140, .17, .67 and -.21 respectively.
8. In Stress Vulnerability, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 57.38, 18.65, -.12 and -1.24 respectively.
9. In Performance, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 5.86, 1.45, -.03 and -.70 respectively.

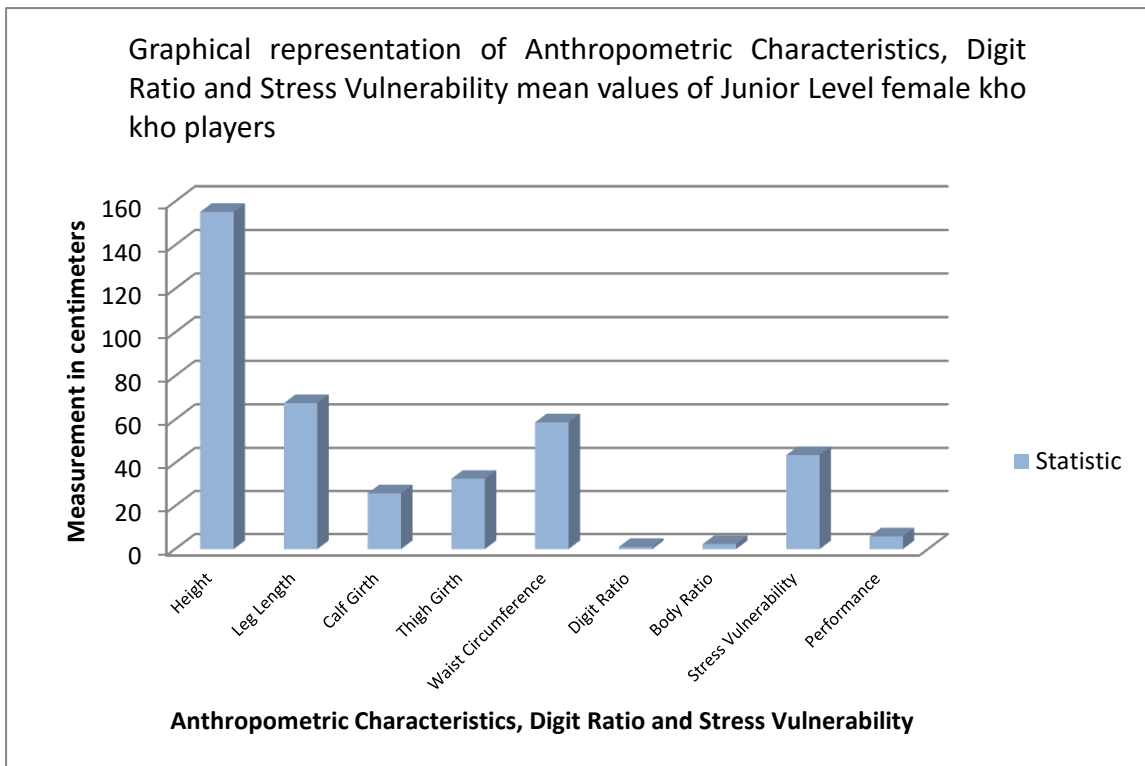


Figure 4.5: Graphical representation of anthropometric characteristics, digit ratio and stress vulnerability mean values of junior level female kho kho players

Table 4.9: Model summary related to estimating kho kho performance of junior level female kho kho players on the basis of anthropometric variables, digit ratio and stress vulnerability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.862 ^a	.743	.738	.74649	
2	.889 ^b	.790	.781	.68228	1.948
a. Predictors: (Constant), Digit Ratio					
b. Predictors: (Constant), Digit Ratio, Stress Vulnerability					
c. Dependent Variable: Performance					

Table- 4.9 shows the model summary for estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability. One model was established by multiple regression analysis.

- I. In this model, R of .86 is the relationship between independent variables (Digit Ratio) and dependent variable (kho kho Performance). Adjusted R square of .74 justify that 74% of kho kho Performance in explained by Digit Ratio.
- II. In this model, R of .89 is the relationship between independent variables (Digit Ration and Stress Vulnerability) and dependent variable (kho kho Performance). Adjusted R square of .78 justify that 78% of kho kho Performance in explained by Stress Vulnerability.

Table 4.10: ANOVA table for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level female kho- kho players

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	77.272	1	77.272	138.668	.000 ^a
	Residual	26.748	48	.557		
	Total	104.020	49			

2	Regression	82.141	2	41.071	88.229	.000 ^b
	Residual	21.879	47	.466		
	Total	104.020	49			
a. Predictors: (Constant), Digit Ratio						
b. Predictors: (Constant), Digit Ratio, Stress Vulnerability						
c. Dependent Variable: Performance						

Table- 4.10 of ANOVA is related to the utility of one established model.

- I. In model 1, F. Value of 138.668 is significant at 0.05 level, this model is found effective is estimating kho kho Performance in junior level female kho- kho players on the basis of Digit Ratio.
- II. In model 2, F. Value of 88.229 is significant at 0.05 level, this model is found effective is estimating kho kho Performance in junior level female kho- kho players on the basis of Digit Ration and Stress Vulnerability.

Table 4.11: Coefficients of regression model for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level female kho- kho players

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-27.071	2.798		-9.673	.000
	Digit Ratio	33.544	2.849	.862	11.776	.000
2	(Constant)	-18.196	3.751		-4.851	.000
	Digit Ratio	25.842	3.528	.664	7.324	.000
	Stress Vulnerability	-.023	.007	-.293	-3.234	.002

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-27.071	2.798		-9.673	.000
	Digit Ratio	33.544	2.849	.862	11.776	.000
2	(Constant)	-18.196	3.751		-4.851	.000
	Digit Ratio	25.842	3.528	.664	7.324	.000
	Stress Vulnerability	-.023	.007	-.293	-3.234	.002
a. Dependent Variable: Performance						

Table- 4.11 Shows the coefficients of regression model for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level female kho- kho players. on the basis of table 4.11 established model are:

Model 1: Performance = -27.071 + 33.544 * Digit Ratio

Model II: Performance = -18.196 + 25.842 * Digit Ratio + -.023 * Stress Vulnerability

Table 4.12: Details of excluded variables for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level female kho- kho players

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	Height	-.011 ^a	-.143	.887	-.021	.986
	Leg Length	-.077 ^a	-1.028	.309	-.148	.958

	Calf Girth	.088 ^a	1.205	.234	.173	1.000
	Thigh Girth	.021 ^a	.286	.776	.042	.990
	Waist Circumference	.065 ^a	.892	.377	.129	1.000
	Body Ratio	.023 ^a	.307	.760	.045	.991
	Stress Vulnerability	-.293 ^a	-3.234	.002	-.427	.544
	2	Height	-.033 ^b	-.482	.632	-.071
Leg Length		-.096 ^b	-1.420	.162	-.205	.951
Calf Girth		.006 ^b	.085	.933	.013	.855
Thigh Girth		-.030 ^b	-.434	.666	-.064	.938
Waist Circumference		.036 ^b	.525	.602	.077	.980
Body Ratio		.069 ^b	1.009	.318	.147	.951
a. Predictors in the Model: (Constant), Digit Ratio						
b. Predictors in the Model: (Constant), Digit Ratio and Stress Vulnerability						
c. Dependent Variable: Performance						

Table- 4.12 Shows the details of excluded variables for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in junior level female kho- kho players.

- I. In model 1, five anthropometric variables (height, leg length, calf girth, thigh girth and waist circumference), body ratio and Stress Vulnerability were excluded.
- II. In model 2, five anthropometric variables (height, leg length, calf girth, thigh girth and waist circumference) and body ratio were excluded.

Table 4.13: Residual statistics for kho kho performance related to anthropometric variables, digit ratio and stress vulnerability in junior level female kho- kho players

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.4518	8.3226	5.8600	1.29474	50
Residual	-1.73040	1.27404	.00000	.66821	50
Std. Predicted Value	-1.860	1.902	.000	1.000	50
Std. Residual	-2.536	1.867	.000	.979	50
a. Dependent Variable: Performance					

Table- 4.13 shows the residual statistics for estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in junior level female kho- kho players.

In this standardised residual ranges from -2.536 to 1.867. This does not fall in the expected range, so there are outliers in this study. In table 4.9, Durbin Watson value of 1.948 justify that there is independence in data point to a great extent.

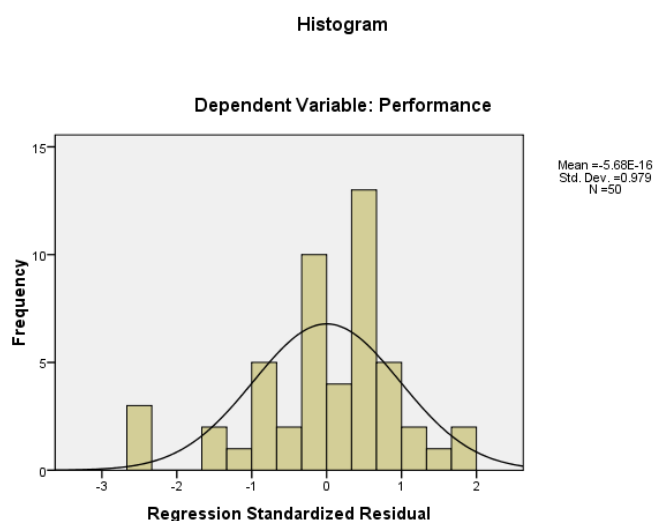


Figure 4.6: Histogram with normal curve related to the residuals of junior level female kho kho players

Normal P-P Plot of Regression Standardized Residual

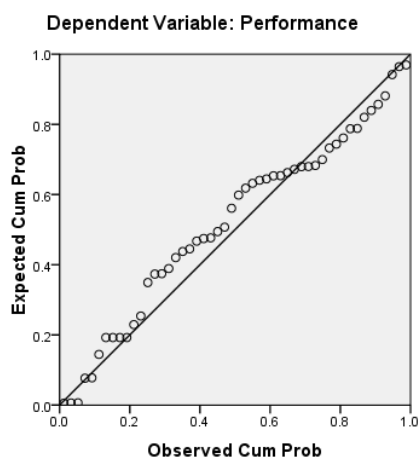


Figure 4.7: Q.Q. Plots related to the residuals of junior level female kho kho players

Figure 4.6 and 4.7 shows the histogram with normal curve and Q.Q. Plots related to junior level female kho kho players. This shows that distribution of residuals related to junior level females kho kho player is normal in nature.

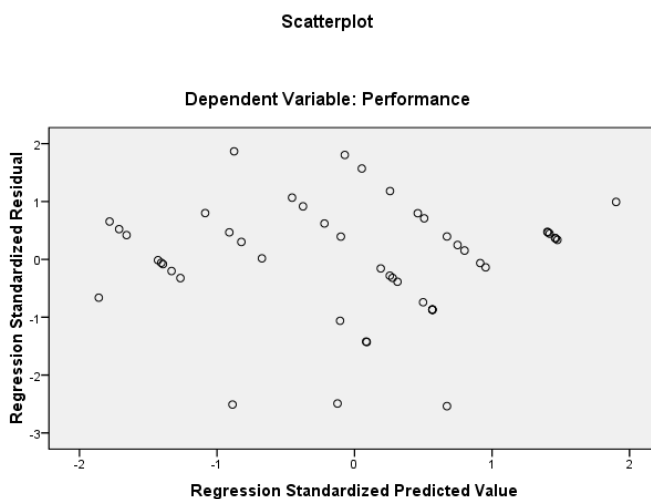


Figure 4.8: Scatter Plot showing constant variance related to the residuals of junior level female kho kho player

Figure- 4.8 of scatter plot shows that in junior level female kho kho players constant variance is found is relation to residuals. Last and fourth assumption of independent

of data point is tested by Durbin-Watson test (gives in table 4.9). The value of 1.948 shows that neither strong negative nor is strong positive correlation was found.

Since all the assumptions are fulfilled, results of the study may be generalized.

Table 4.14: Relationship between anthropometric characteristics, digit ratio, stress vulnerability and kho-kho performance of junior female kho- kho players.

		Height	Leg	Calf	Thigh	Waist	Digit	Body	Stress	Perform
Height	P. Corr	1	-.168	.260	.081	.194	.118	.564**	-.154	.092
	Sig. (2-t)		.243	.068	.577	.177	.413	.000	.287	.527
	N	50	50	50	50	50	50	50	50	50
Leg Length	P. Corr	-.168	1	-.093	-.107	.204	.205	-.798**	-.200	.103
	Sig. (2-t)	.243		.520	.458	.155	.153	.000	.163	.475
	N	50	50	50	50	50	50	50	50	50
Calf Girth	P. Corr	.260	-.093	1	.168	.049	-.003	.068	-.279*	.086
	Sig. (2-t)	.068	.520		.243	.737	.986	.639	.049	.555
	N	50	50	50	50	50	50	50	50	50
Thigh Girth	P. Corr	.081	-.107	.168	1	-.157	.102	.034	-.237	.109
	Sig. (2-t)	.577	.458	.243		.277	.482	.816	.097	.452
	N	50	50	50	50	50	50	50	50	50
Waist Circumference	P. Corr	.194	.204	.049	-.157	1	.011	-.006	-.111	.075
	Sig. (2-t)	.177	.155	.737	.277		.941	.969	.443	.606
	N	50	50	50	50	50	50	50	50	50
Digit Ratio	P. Corr	.118	.205	-.003	.102	.011	1	-.093	-.675**	.862**

	Sig. (2-t)	.413	.153	.986	.482	.941		.520	.000	.000
	N	50	50	50	50	50	50	50	50	50
Body Ratio	P. Corr	.564**	-.798**	.068	.034	-.006	-.093	1	.210	-.058
	Sig. (2-t)	.000	.000	.639	.816	.969	.520		.143	.691
	N	50	50	50	50	50	50	50	50	50
Stress Vulnerability	P. Corr	-.154	-.200	-.279*	-.237	-.111	-.675**	.210	1	-.741**
	Sig. (2-t)	.287	.163	.049	.097	.443	.000	.143		.000
	N	50	50	50	50	50	50	50	50	50
Performance	P. Corr	.092	.103	.086	.109	.075	.862**	-.058	-.741**	1
	Sig. (2-t)	.527	.475	.555	.452	.606	.000	.691	.000	
	N	50	50	50	50	50	50	50	50	50
**. Correlation is significant at the 0.01 level (2-tailed).										
*. Correlation is significant at the 0.05 level (2-tailed).										

Table- 4.14 shows the partial relationship of all the related variables and Kho-Kho performance of junior level female kho kho players.

The relationship between Height and body ratio ($R = .56$ $p = .00$), leg length and body ratio ($R = -.79$ $p = .00$) calf girth and stress vulnerability ($R = -.27$ $p = .05$) & digit ratio and stress vulnerability ($R = -.67$ $p = .00$) were found significant relationship.

On the other hand, insignificant relationships were found among height and leg length, height and calf girth, height and thigh girth, height and waist circumference, height and digit ratio, height and stress vulnerability, leg length and calf girth, leg length and thigh girth, leg length and waist circumference, leg length and digit ratio, leg length and stress vulnerability, calf girth and thigh girth, calf girth and waist

circumference, calf girth and digit ratio, calf girth and body ratio, thigh girth and waist circumference, thigh girth and digit ratio, thigh girth and body ratio, thigh girth and stress vulnerability, waist circumference and digit ratio, waist circumference and body ratio, waist circumference and stress vulnerability, digit ratio and body ratio & body ratio and stress vulnerability.

Table 4.15: Descriptive statistics of kho kho performance of senior level male kho kho players

	N	Mean		Std. Dev	Skewness		Kurtosis	
		Statistic	Std. Error		Statistic	Std. Error	Statistic	Std. Error
Height	50	167.3200	.84004	5.93997	-.183	.337	-.924	.662
Leg Length	50	88.4600	.72799	5.14766	.023	.337	.519	.662
Calf Girth	50	32.6600	.44042	3.11422	1.462	.337	1.893	.662
Thigh Girth	50	46.0400	.44900	3.17490	.747	.337	.836	.662
Waist Circum	50	81.3400	.40468	2.86150	.045	.337	-.786	.662
Digit Ratio	50	1.0054	.00562	.03975	-.040	.337	-1.386	.662
Body Ratio	50	1.8983	.01555	.10994	.360	.337	.532	.662
Stress Vulner	50	40.8600	1.29174	9.13395	-.518	.337	-.575	.662
Performance	50	5.8600	.20605	1.45700	-.036	.337	-.706	.662

Table- 4.15 revealed that the descriptive statistics of fifty subjects in Anthropometric, Digit Ratio, Stress Vulnerability and Kho-Kho Performance with respect to kho-kho players.

1. In Height, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard error of kurtosis are found 167.32, 5.93, -.18 and -.92 respectively.

2. In Leg Length, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 88.46, 5.14, .02 and .51 respectively.
3. In Calf Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 32.66, 3.11, 1.46 and 1.89 respectively.
4. In Thigh Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 46.04, 3.17, .74 and .83 respectively.
5. In Waist Circumference, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 81.34, 2.86, .04 and -.78 respectively.
6. In Digit Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 1.0054, .04, -.040 and -1.386 respectively.
7. In Body Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 1.8983, .10884, .360 and .532 respectively.
8. In Stress Vulnerability, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 40.860, 9.13, -.518 and -.575 respectively.
9. In Performance, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 5.8600, 1.46, -.036 and -.706 respectively.

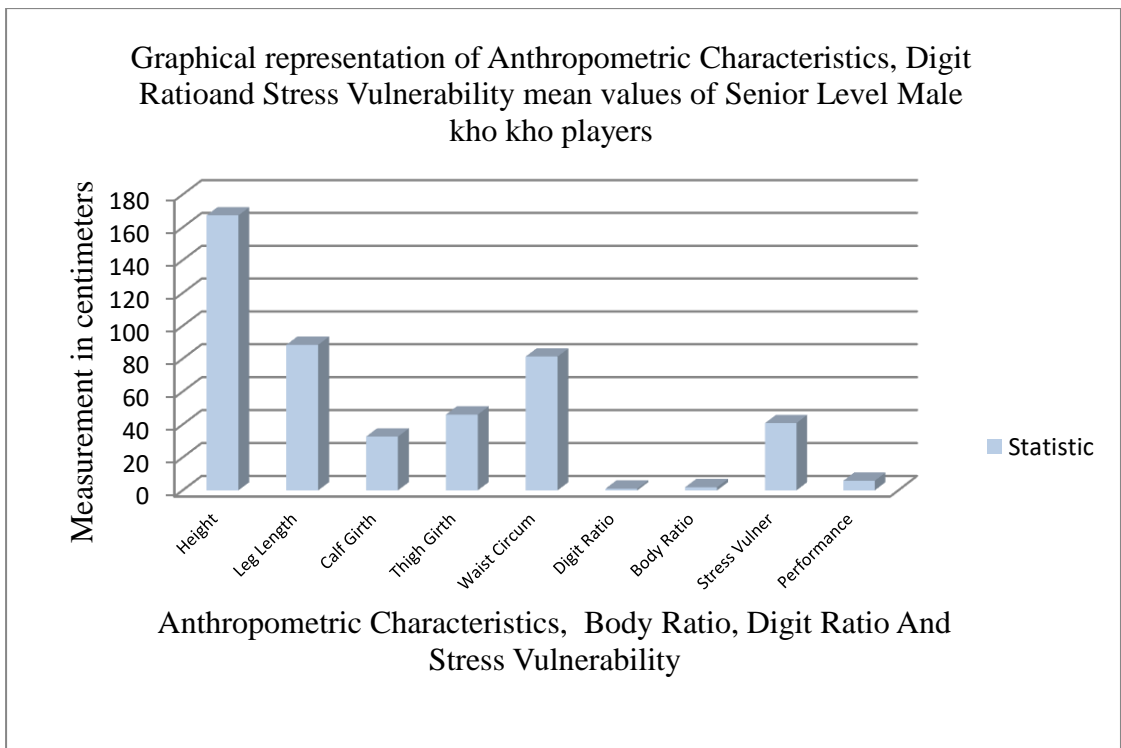


Figure 4.9: Graphical representation of anthropometric characteristics, digit ratio and stress vulnerability mean values of senior level male kho kho players.

Table 4.16: Model Summary related to estimating kho kho Performance of senior level male kho – kho players on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.960 ^a	.923	.921	.40974	1.319
2	.968 ^b	.936	.934	.37504	
3	.972 ^c	.945	.941	.35335	
a. Predictors: (Constant), Digit Ratio					
b. Predictors: (Constant), Digit Ratio, Calf Girth					
c. Predictors: (Constant), Digit Ratio, Calf Girth, Height					
d. Dependent Variable: Performance					

Table- 4.16 shows the model summary for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level male kho kho player. one model was established by multiple regression analysis.

- I. In model 1, R of .960 is the relationship between independent variables (Digit Ratio) and dependent variable (kho kho Performance). Adjusted R square of .92 justify that 92% of kho kho Performance in explained by Digit Ratio.
- II. In model 2, R of .968 is the relationship between independent variables (Digit Ratio and Calf Girth) and dependent variable (kho kho Performance). Adjusted R square of .93 justify that 93% of kho kho Performance in explained by Digit Ratio and calf Girth.
- III. In model 3, R of .972 is the relationship between independent variables (Digit Ratio, Calf Girth and Height) and dependent variable (kho kho Performance). Adjusted R square of .94 justify that 94% of kho kho Performance in explained by Digit Ratio, Calf Girth and Height.

Table 4.17: ANOVA table for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level male kho kho player

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	95.961	1	95.961	571.582	.000 ^a
	Residual	8.059	48	.168		
	Total	104.020	49			
2	Regression	97.409	2	48.705	346.260	.000 ^b
	Residual	6.611	47	.141		
	Total	104.020	49			
3	Regression	98.277	3	32.759	262.370	.000 ^c
	Residual	5.743	46	.125		

	Total	104.020	49			
a. Predictors: (Constant), Digit Ratio						
b. Predictors: (Constant), Digit Ratio, Calf Girth						
c. Predictors: (Constant), Digit Ratio, Calf Girth, Height						
d. Dependent Variable: Performance						

Table- 4.17 of ANOVA is related to the utility of one established model.

- I. In this model, F. Value of 571.582 is significant at .05 level, this model is found effective is estimating kho kho Performance on the basis of Digit Ratio.
- II. In this model, F. Value of 346.260 is significant at .05 level, this model is found effective is estimating kho kho Performance on the basis of Digit Ratio and Calf Girth.
- III. In this model, F. Value of 262.3700 is significant at .05 level, this model is found effective is estimating kho kho Performance on the basis of Digit Ratio, Calf Girth and Height.

Table 4.18: Coefficients of regression model for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level male kho- kho players

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-29.531	1.481		-19.934	.000
	Digit Ratio	35.202	1.472	.960	23.908	.000
2	(Constant)	-28.151	1.423		-19.789	.000
	Digit Ratio	31.458	1.783	.858	17.645	.000
	Calf Girth	.073	.023	.156	3.208	.002

3	(Constant)	-12.152	6.216		-1.955	.057
	Digit Ratio	24.828	3.025	.677	8.209	.000
	Calf Girth	.061	.022	.131	2.803	.007
	Height	-.054	.020	-.218	-2.636	.011
a. Dependent Variable: Performance						

Table- 4.18 shows the coefficients of regression model for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability senior level male kho kho players. on the basis of table 4.18 established models are:

Model 1: Performance = -29.531 + 35.202 * Digit Ratio
Model 1: Performance = -28.151 + 31.458 * Digit Ratio + .073 * Calf Girth
Model 1: Performance = -12.152 + 24.828 * Digit Ratio + .061 * Calf Girth + -.054 * Height

Table 4.19: Details of excluded variables for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level male kho kho players

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics	
					Tolerance	
1	Height	-.265 ^a	-3.054	.004	-.407	.183
	Leg Length	-.138 ^a	-2.593	.013	-.354	.506
	Calf Girth	.156 ^a	3.208	.002	.424	.571
	Thigh Girth	.092 ^a	1.657	.104	.235	.508
	Waist Circum	.073 ^a	1.853	.070	.261	.983

	Body Ratio	-.105 ^a	-1.967	.055	-.276	.534
	Stress Vulnerability	-.051 ^a	-1.116	.270	-.161	.762
2	Height	-.218 ^b	-2.636	.011	-.362	.175
	Leg Length	-.100 ^b	-1.901	.064	-.270	.466
	Thigh Girth	.059 ^b	1.117	.270	.162	.484
	Waist Circum	.046 ^b	1.210	.233	.176	.921
	Body Ratio	-.073 ^b	-1.437	.158	-.207	.509
	Stress Vulnerability	.034 ^b	.669	.507	.098	.528
3	Leg Length	-.073 ^c	-1.424	.161	-.208	.443
	Thigh Girth	.048 ^c	.966	.339	.142	.481
	Waist Circum	.039 ^c	1.081	.286	.159	.915
	Body Ratio	-.047 ^c	-.948	.348	-.140	.484
	Stress Vulnerability	.036 ^c	.751	.456	.111	.528
a. Predictors in the Model: (Constant), Digit Ratio						
b. Predictors in the Model: (Constant), Digit Ratio, Calf Girth						
c. Predictors in the Model: (Constant), Digit Ratio, Calf Girth, Height						
d. Dependent Variable: Performance						

Table- 4.19 shows the details of excluded variables for estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in senior level male kho kho players.

- I. In model 1, five Anthropometric variables (Height, Leg Length, Calf Girth, Thigh Girth, Waist Circumference.), Body Ratio and Stress Vulnerability were excluded.
- II. In model 2, four Anthropometric variables (Height, Leg Length, Thigh Girth, Waist Circumference), Body Ratio and Stress Vulnerability were excluded.
- III. In model 3, three Anthropometric variables (Leg Length, Thigh Girth, Waist Circumference), Body Ratio and Stress Vulnerability were excluded.

Table 4.20: Residual statistics for kho kho performance related to anthropometric variables, digit ratio and stress vulnerability in senior level male kho kho players

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.4301	8.7325	5.8600	1.41621	50
Residual	-.58987	.82749	.00000	.34236	50
Std. Predicted Value	-1.716	2.028	.000	1.000	50
Std. Residual	-1.669	2.342	.000	.969	50
a. Dependent Variable: Performance					

Table- 4.20 shows the residual statistics for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level male kho kho players.

In this standardised residual ranges from -1.669 to 2.342. This does not fall in the expected range, so there are outliers in this study. In table 4.16, Durbin Watson value of 1.319 justify that there is independence in data point to a great extent.

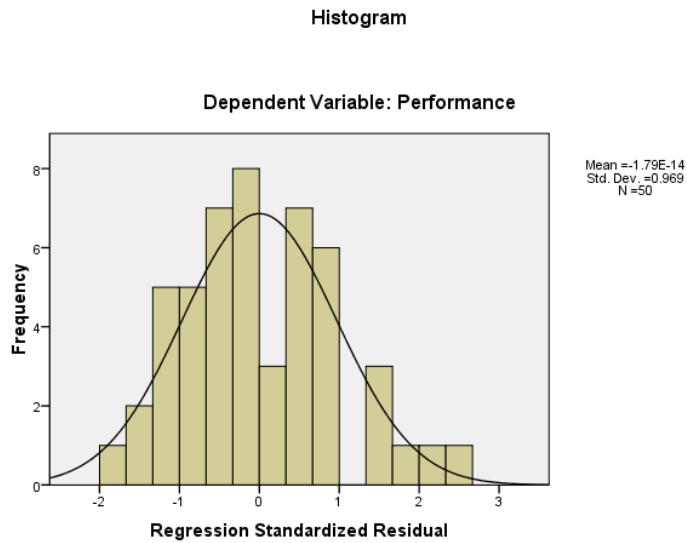


Figure 4.10: Histogram with normal curve related to the residuals of senior level male kho kho players

Normal P-P Plot of Regression Standardized Residual

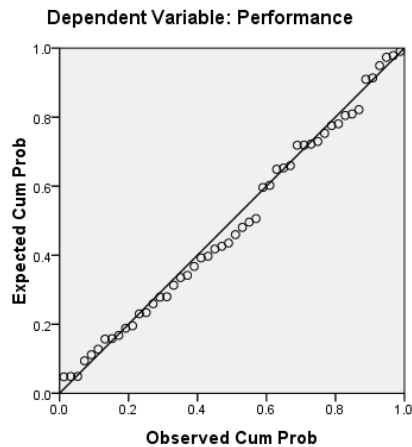


Figure 4.11: Q.Q. Plots related to the residuals of senior level male kho kho players

Figure 4.10 and 4.11 shows the histogram with normal curve and Q.Q. Plots related to senior level male kho kho players. This shows that distribution of residuals related to senior level male kho kho players is normal in nature.

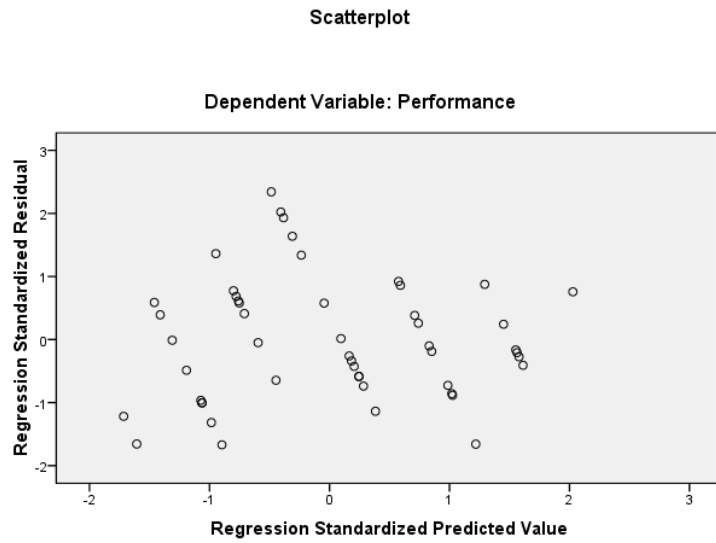


Figure- 4.12 of scatter plot shows that in senior level male kho kho players constant variance is found is relation to residuals. Last and fourth assumption of independent of data point is tested by Durbin-Watson test (gives in table 4.16). The value of 1.319 shows that neither strong negative nor is strong positive correlation was found. Since all the assumptions are fulfilled, results of the study may be generalized.

Table 4.21: Relationship between anthropometric characteristics, digit ratio, stress vulnerability and kho-kho performance of senior level male kho- kho players

		Height	Leg	Calf	Thigh	Waist	Digit	Body	Stress	Perform
Height	P. Corr	1	.717**	-.657**	-.672**	.064	-.904**	.697**	-.394**	-.917**
	Sig(2-t)		.000	.000	.000	.657	.000	.000	.005	.000
	N	50	50	50	50	50	50	50	50	50
Leg Length	P. Corr	.717**	1	-.611**	-.669**	.042	-.703**	.623**	-.135	-.745**
	Sig(2-t)	.000		.000	.000	.773	.000	.000	.349	.000
	N	50	50	50	50	50	50	50	50	50

Calf Girth	P. Corr	-.657**	-.611**	1	.575**	.105	.655**	-.567**	-.046	.718**
	Sig(2-t)	.000	.000		.000	.469	.000	.000	.750	.000
	N	50	50	50	50	50	50	50	50	50
Thigh Girth	P. Corr	-.672**	-.669**	.575**	1	-.013	.701**	-.698**	.228	.720**
	Sig(2-t)	.000	.000	.000		.930	.000	.000	.111	.000
	N	50	50	50	50	50	50	50	50	50
Waist Circumference	P. Corr	.064	.042	.105	-.013	1	-.129	-.140	.085	-.052
	Sig(2-t)	.657	.773	.469	.930		.372	.332	.555	.720
	N	50	50	50	50	50	50	50	50	50
Digit Ratio	P. Corr	-.904**	-.703**	.655**	.701**	-.129	1	-.682**	.488**	.960**
	Sig(2-t)	.000	.000	.000	.000	.372		.000	.000	.000
	N	50	50	50	50	50	50	50	50	50
Body Ratio	P. Corr	.697**	.623**	-.567**	-.698**	-.140	-.682**	1	-.344*	-.711**
	Sig(2-t)	.000	.000	.000	.000	.332	.000		.014	.000
	N	50	50	50	50	50	50	50	50	50
Stress Vulnerability	P. Corr	-.394**	-.135	-.046	.228	.085	.488**	-.344*	1	.429**
	Sig(2-t)	.005	.349	.750	.111	.555	.000	.014		.002
	N	50	50	50	50	50	50	50	50	50
Perfor manc	P. Corr	-.917**	-.745**	.718**	.720**	-.052	.960**	-.711**	.429**	1

	Sig(2-t)	.000	.000	.000	.000	.720	.000	.000	.002	
	N	50	50	50	50	50	50	50	50	50
**. Correlation is significant at the 0.01 level (2-tailed).										
*. Correlation is significant at the 0.05 level (2-tailed).										

Table- 4.21 shows the partial relationship of all the related variables and Kho-Kho performance of senior level male kho-kho players.

The relationship between Height and leg length ($R = .71$ $p = .00$), Height and calf girth ($R = -.65$ $p = .00$), Height and thigh girth ($R = -.67$ $p = .00$), Height and digit ratio ($R = -.90$ $p = .00$), Height and body ratio ($R = .69$ $p = .00$), Height and stress vulnerability ($R = -.39$ $p = .00$); leg length and calf girth ($R = -.61$ $p = .00$), leg length and thigh girth ($R = -.66$ $p = .00$), leg length and digit ratio ($R = -.70$ $p = .00$), leg length and body ratio ($R = .62$ $p = .00$); calf girth and thigh girth ($R = .57$ $p = .00$), calf girth and digit ratio ($R = .65$ $p = .00$), calf girth and body ratio ($R = -.56$ $p = .00$); thigh girth and digit ratio ($R = .70$ $p = .00$), thigh girth and body ratio ($R = -.69$ $p = .00$); digit ratio and body ratio ($R = -.68$ $p = .00$), digit ratio and stress vulnerability ($R = .48$ $p = .00$); & body ratio and stress vulnerability ($R = -.34$ $p = .01$) were found positive correlation at .05 level of significance.

On the other hand, height and waist circumference, leg length and waist circumference, leg length and stress vulnerability, calf girth and waist circumference, calf girth and stress vulnerability, thigh girth and waist circumference, thigh girth and stress vulnerability, waist circumference and digit ratio, waist circumference and body ratio & waist circumference and stress vulnerability were found no relationship among the variables.

Table 4.22: Descriptive statistics of kho kho performance of Senior level female kho kho players

	N	Mean		Std. Dev	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
Height	50	160.5400	.68046	4.81159	-.294	.337	-.537	.662
Leg Length	50	83.4600	.72799	5.14766	.023	.337	.519	.662
Calf Girth	50	29.6600	.44042	3.11422	1.462	.337	1.893	.662
Thigh Girth	50	42.0400	.44900	3.17490	.747	.337	.836	.662
Waist Circum	50	77.3400	.40468	2.86150	.045	.337	-.786	.662
Digit Ratio	50	.9758	.00582	.04115	-.050	.337	-1.379	.662
Body Ratio	50	2.0547	.01650	.11666	.298	.337	-.291	.662
Stress Vulnerability	50	43.4400	2.09317	14.80094	.748	.337	.099	.662
Performance	50	5.9600	.20396	1.44222	-.055	.337	-.549	.662

Table- 4.22 revealed that the descriptive statistics of fifty subjects in anthropometric, digit ratio, stress vulnerability and kho-kho performance with respect to kho-kho players.

1. In Height, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 160.54, 4.81, -.29 and -.54 respectively.
2. In Leg Length, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 83.46, 5.15, .02 and -.52 respectively.

3. In Calf Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 29.66, 3.11, 1.46 and 1.89 respectively.
4. In Thigh Girth, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 42.04, 3.17, .75 and -.84 respectively.
5. In Waist Circumference, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 77.34, 2.86, .045 and .78 respectively.
6. In Digit Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found .976, .04, -.50 and -1.379 respectively.
7. In Body Ratio, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 2.0547, .117, .298 and -.291 respectively.
8. In Stress Vulnerability, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 43.44, 14.80, .748 and .099 respectively.
9. In Performance, observed mean (statistics), standard deviation, Skewness (statistics), standard error of Skewness, kurtosis (statistics), standard of kurtosis are found 5.96, 1.44, -.055 and -.55 respectively.

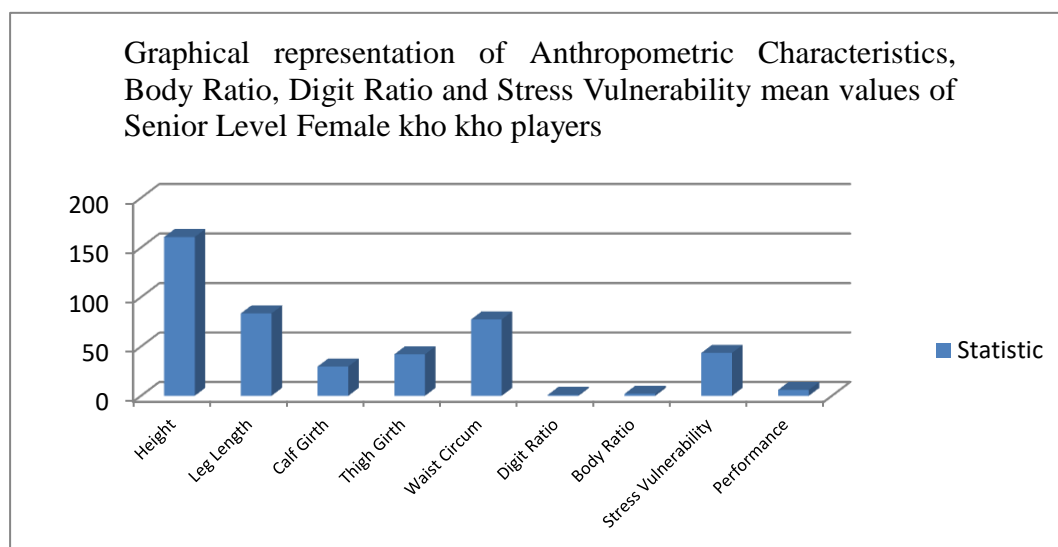


Figure 4.13: Graphical representation of anthropometric characteristics, digit ratio and stress vulnerability mean values of senior level female kho kho players.

Table 4.23: Model summary related to estimating kho kho performance of senior level females kho- kho players on the basis of anthropometric variables, digit ratio and stress vulnerability

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.914 ^a	.835	.832	.59172	1.406
2	.925 ^b	.856	.849	.55957	
a. Predictors: (Constant), Digit Ratio					
b. Predictors: (Constant), Digit Ratio, Height					
c. Dependent Variable: Performance					

Table- 4.23 shows the model summary for estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in senior level female kho kho player. One model was established by multiple regression analysis.

- I. In this model, R of .91 is the relationship between independent variables (Stress Vulnerability) and dependent variable (kho kho Performance).

Adjusted R square of .83 justify that 83% of kho kho Performance in explained by Digit Ratio.

- II. In this model, R of .92 is the relationship between independent variables (Stress Vulnerability) and dependent variable (kho kho Performance). Adjusted R square of .84 justify that 84% of kho kho Performance in explained by Digit Ratio and Height.

Table 4.24: ANOVA table for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level female kho kho players

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	85.114	1	85.114	243.091	.000 ^a
	Residual	16.806	48	.350		
	Total	101.920	49			
2	Regression	87.203	2	43.602	139.250	.000 ^b
	Residual	14.717	47	.313		
	Total	101.920	49			
a. Predictors: (Constant), Digit Ratio						
b. Predictors: (Constant), Digit Ratio, Height						
c. Dependent Variable: Performance						

Table-4.24 of ANOVA is related to the utility of one established model.

- I. In model 1, F. Value of 243.091 is significant at .05 level, this model is found effective is estimating kho kho Performance on the basis of Digit Ratio.
- II. In model 2, F. Value of 139.250 is significant at .05 level, this model is found effective is estimating kho kho Performance on the basis of Digit Ratio, Height.

Table 4.25: Coefficients of regression model for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level female kho kho players

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-25.296	2.006		-12.607	.000
	DigitRatio	32.032	2.054	.914	15.591	.000
2	(Constant)	-13.801	4.837		-2.853	.006
	DigitRatio	28.716	2.329	.819	12.332	.000
	Height	-.051	.020	-.172	-2.583	.013

a. Dependent Variable: Performance

Table-4.25 shows the coefficients of regression model for estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in senior level female kho kho players. On The basis of table 4.25 established models are:

$$\text{Model 1: Performance} = -25.29 + 32.03 * \text{Digit Ratio}$$

$$\text{Model 2: Performance} = -13.801 + 28.716 * \text{Digit Ratio} + -.051 * \text{Height}$$

Table 4.26: Details of excluded variables for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level female kho kho players

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics	
					Tolerance	
1	Height	-.172 ^a	-2.583	.013	-.353	.696
	Leg Length	-.121 ^a	-1.484	.144	-.212	.505
	Calf Girth	.160 ^a	2.149	.037	.299	.575
	Thigh Girth	.060 ^a	.731	.468	.106	.512
	Waist Circumference	.093 ^a	1.600	.116	.227	.982
	Body Ratio	-.056 ^a	-.862	.393	-.125	.809
	Stress Vulnerability	-.103 ^a	-1.680	.100	-.238	.876
2	Leg Length	-.136 ^b	-1.781	.081	-.254	.502
	Calf Girth	.132 ^b	1.821	.075	.259	.559
	Thigh Girth	.099 ^b	1.261	.214	.183	.496
	Waist Circumference	.060 ^b	1.033	.307	.151	.916
	Body Ratio	.014 ^b	.204	.839	.030	.663
	Stress Vulnerability	-.108 ^b	-1.878	.067	-.267	.875
a. Predictors in the Model: (Constant), DigitRatio						
b. Predictors in the Model: (Constant), DigitRatio, Height						
c. Dependent Variable: Performance						

Table- 4.26 shows the details of excluded variables for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level female kho kho players.

- I. In this model, five Anthropometric variables (Height, Leg Length, Calf Girth, Thigh Girth, and Waist Circumference), Body Ratio and Stress vulnerability were excluded.
- II. In this model, four Anthropometric variables (Leg Length, Calf Girth, Thigh Girth, and Waist Circumference) Digit Ratio and stress vulnerability were excluded.

Table 4.27: Residual statistics for kho kho performance related to anthropometric variables, digit ratio and stress vulnerability of senior level female kho-kho players

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	3.6614	8.2265	5.9600	1.33404	50
Residual	-1.73836	1.05930	.00000	.54803	50
Std. Predicted Value	-1.723	1.699	.000	1.000	50
Std. Residual	-3.107	1.893	.000	.979	50
a. Dependent Variable: Performance					

Table- 4.27 shows the residual statistics for estimating kho kho performance on the basis of anthropometric variables, digit ratio and stress vulnerability in senior level female kho kho players.

In this standardised residual range from -3.107 to 2.469 this does not fall in the expected range, so there are outliers in this study. In table 4.23, Durbin Watson value of 1.406 justify that there is independence in data point to a great extent.

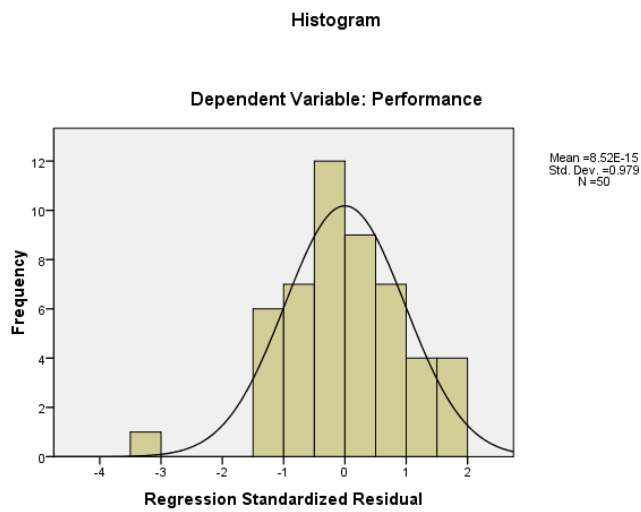


Figure: 4.14: Histogram with normal curve related to the residuals of senior level female kho kho players

Normal P-P Plot of Regression Standardized Residual

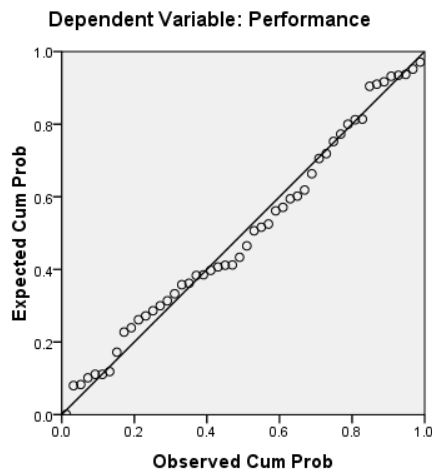


Figure 4.15: Q.Q. Plots related to the residuals of senior level female kho kho players

Figure 4.14 and 4.15 shows the histogram with normal curve and Q.Q. Plots related to senior level females kho kho player. This shows that distribution of residuals related to senior level female kho kho players is normal in nature.

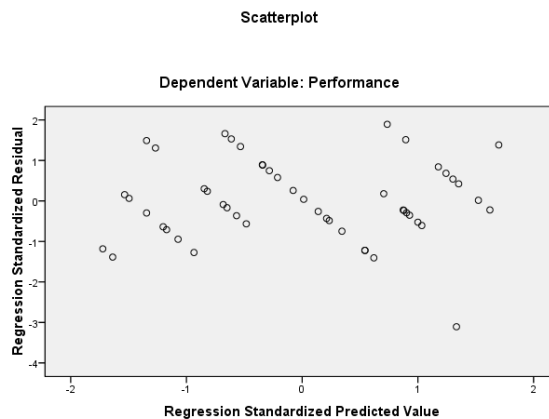


Figure- 4.16 of scatter plot shows that in senior level female kho kho players constant variance is found is relation to residuals. Last and fourth assumption of independent of data point is tested by Durbin-Watson test (gives in table 4.23). The value of 1.406 shows that neither strong negative nor is strong positive correlation was found.

Table 4.28: Relationship between anthropometric characteristics, digit ratio, stress vulnerability and kho-kho performance of senior level female kho- kho players

		Height	Leg	Calf	Thigh	Waist	Digit	Body	Stress	Perform
Height	P. Corr	1	.345*	-.467**	-.279*	-.140	-.551**	.560**	.168	-.623**
	Sig. (2-t)		.014	.001	.049	.334	.000	.000	.243	.000
	N	50	50	50	50	50	50	50	50	50
Leg Length	P. Corr	.345*	1	-.611**	-.669**	.042	-.703**	.395**	.288*	-.704**
	Sig. (2-t)	.014		.000	.000	.773	.000	.005	.042	.000
	N	50	50	50	50	50	50	50	50	50
Calf Girth	P. Corr	-.467**	-.611**	1	.575**	.105	.652**	-.438**	-.382**	.688**
	Sig. (2-t)	.001	.000		.000	.469	.000	.001	.006	.000

	N	50	50	50	50	50	50	50	50	50
Thigh Girth	P. Corr	-.279*	-.669**	.575**	1	-.013	.698**	-.476**	-.332*	.669**
	Sig. (2-t)	.049	.000	.000		.930	.000	.000	.018	.000
	N	50	50	50	50	50	50	50	50	50
Waist Circum	P. Corr	-.140	.042	.105	-.013	1	-.134	-.279*	.070	-.031
	Sig. (2-t)	.334	.773	.469	.930		.353	.050	.628	.829
	N	50	50	50	50	50	50	50	50	50
Digit Ratio	P. Corr	-.551**	-.703**	.652**	.698**	-.134	1	-.437**	-.352*	.914**
	Sig. (2-t)	.000	.000	.000	.000	.353		.002	.012	.000
	N	50	50	50	50	50	50	50	50	50
Body Ratio	P. Corr	.560**	.395**	-.438**	-.476**	-.279*	-.437**	1	-.054	-.445**
	Sig. (2-t)	.000	.005	.001	.000	.050	.002		.708	.001
	N	50	50	50	50	50	50	50	50	50
Stress Vulnerabil	P. Corr	.168	.288*	-.382**	-.332*	.070	-.352*	-.054	1	-.412**
	Sig. (2-t)	.243	.042	.006	.018	.628	.012	.708		.003
	N	50	50	50	50	50	50	50	50	50
Performance	P. Corr	-.623**	-.704**	.688**	.669**	-.031	.914**	-.445**	-.412**	1
	Sig. (2-t)	.000	.000	.000	.000	.829	.000	.001	.003	
	N	50	50	50	50	50	50	50	50	50

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table- 4.28 shows the partial relationship of all the related variables and Kho-Kho performance of senior level female kho-kho players. The relationship between height and leg length ($R = .34$ $p = .01$), height and calf girth ($R = -.46$ $p = .00$), height and thigh girth ($R = -.27$ $p = .05$), height and digit ratio ($R = -.55$ $p = .00$), height and body ratio ($R = .56$ $p = .00$); leg length and calf girth ($R = -.61$ $p = .00$), leg length and thigh girth ($R = -.66$ $p = .00$), leg length and digit ratio ($R = -.70$ $p = .00$), leg length and body ratio ($R = .39$ $p = .00$), leg length and stress vulnerability ($R = .28$ $p = .05$); calf girth and thigh girth ($R = .57$ $p = .00$), calf girth and digit ratio ($R = .65$ $p = .00$), calf girth and body ratio ($R = -.43$ $p = .00$), calf girth and stress vulnerability ($R = -.38$ $p = .00$); thigh girth and digit ratio ($R = .69$ $p = .00$), thigh girth and body ratio ($R = -.47$ $p = .00$), thigh girth and stress vulnerability ($R = -.33$ $p = .01$); waist circumference and body ratio ($R = -.27$ $p = .05$), digit ratio and body ratio ($R = -.43$ $p = .00$) & digit ratio and stress vulnerability ($R = -.35$ $p = .01$) were found significant relationships.

On the other hand, no relationships were found between height and waist circumference, height and stress vulnerability, leg length and waist circumference, calf girth and waist circumference, thigh girth and waist circumference, waist circumference and digit ratio, waist circumference and stress vulnerability & body ratio and stress vulnerability.

Discussion of Findings

Bailey AA, and Hurd PL(2005) conducted an investigation on the topic “Finger length ratio (2D:4D) correlates with physical aggression in men but not in women”. Researchers were scrutinized the association among trait hostility, examined by a questionnaire, and digit dividend ratio in both the genders (male and female). Men with characteristics of inferior, additional masculine, ratio of the finger lengths had advanced attribute to physical violence totals ($r(\text{partial}) = -0.21$, $N = 134$, $P = 0.028$). Scientists have attained in conclusion where there is no correlation in parameters like the length ratio in the fingers to female aggression traits. These observations are goes in agreement with the postulate that testosterone has an

administrative influence on mature level of aggression in males. On the basis of the results, it may be concluded that digit ratio are not effected by aggression in men.

Voracek M, Reimer B, Dressler SG (2010) conducted a study on the topic “Digit ratio (2D:4D) predicts sporting success among female fencers independent from physical, experience, and personality factors”. In particular to females and not to the male fencers, inferior 2D:4D has result to a better ranking in national fencing. 2D:4D still believed to be responsible for additional alteration (in percentage = 12%) in fencing accomplishments, where ever there is a better controlling of prominent performance aspects (example age group, BMI, years of fencing, training concentration, and the characteristics parameter attainments, regulator, harm evasion, and social effectiveness). Contestants energetic in the prominent aggressive forms (the sabre) had inferior finger digit ratio as compared with those participants involved in other forms of activity (épée and foil fencing). The success in any sporting event in the adult age partially prenatally automated via extra genital properties of testosterone. On the basis of above results, it may be concluded that sporting success are effected by digit ratio.

Bennett M, Manning JT, Cook CJ, & Kilduff LP (2010) conducted a study on the topic “Digit ratio (2D:4D) and performance in elite rugby players”. The comparative digit length ratio of the lengths of the finger tips is a recognized indicator for the prenatal testosterone hormonal effects. High performance index in sports can be directly correlates to a lower 2D:4D ratio in general. This affiliation between the length digit ratio and the performance in elite rugby sportspersons has been examined. The procedures of performance encompassed adjusted number of age of worldwide performances (caps) for Wales, a assessment of trainers first-choice League team in comparison with others, performance in club matches in terms of number of tries. Paralleled with subjects, gamers had inferior 2D:4D for both the hands. Some useful information can be expressed in terms of the number of caps, low 2D:4D in right hand and little right 2D:4D associated with their left (right - left 2D:4D difference) has been observed with high numbers of caps. The difference is less significant in between First-choice players and second-choice players for the 2D:4D, however, they do have a inferior right-left digit ratio as compared to the second choice players. Low right and low right - left 2D:4D differences were considerably accompanying with a

higher amount of tries. Thus it can be concluded that low right and right - left variances are indicators of augmented level of performance among the players. On the basis of results, it was concluded that digit ratio are affected to elite rugby players' performance.

Tariq Qudsia (2013) conducted a study on the topic "Impact of stress vulnerability on anxiety and depression". The prediction scale of vulnerability to stress has been governed to attain conclusive remarks on the dissimilarity in stress vulnerability among persons experiencing a higher degree of nervousness dejection. The values have been estimated so as to observe the mean scores in patients suffering from the state of anxiety and depression and the same test has been conducted to conclude the same effect between the different genders. The present study was clearly indicated that stress vulnerability was showed on anxiety and depression. Since there is a close association of digit ratio, vulnerability to stress and anxiety and designated anthropometric parameters with the kho-kho performance, the regression equation established in this study may be generalized to estimate kho-kho performance on the basis of selected anthropometric variables, digit ratio and stress vulnerability.

CHAPTER- V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

1. For the purpose of the study six objectives were formulated. To determine the finger ratio, anthropometric profile and stress vulnerability of Kho-Kho players. To find out the partial correlation of finger ratio with performance of Kho-Kho players. To find out the partial correlation of anthropometry with performance of Kho-Kho players. To find out the partial correlation of stress vulnerability with performance of Kho-Kho players. To find out the joint contribution of finger ratio, anthropometry and stress vulnerability in performance of Kho-Kho players. To predict the performance of Kho-Kho players based on finger ratio, anthropometry and stress vulnerability.
2. For the purpose of the study, total two hundred (200) students are selected. Out of total 200 students, we have selected hundred (100) senior level (male and female) and hundred (100) junior level (male and female) Kho-kho players randomly as the subjects for the study. The subjects are selected from different states of India. The age level of the subjects is of two different age groups i.e.15-18 years' junior groups, and above eighteen years senior groups'.
3. Based on the consultation with the experts and, gleaning through the literature available, considering the feasibility criteria in mind, finger ratio, anthropometric (height, weight, body ratio, total leg length, upper leg length, lower leg length, calf girth, thigh girth, waist circumference) and stress vulnerability will be selected as variable for the study.
4. Height was measured in meter, leg length, calf girth, thigh girth, waist circumference and sitting height were measured in centimetres. The digit ratio was recorded in centimetres and millimetres. Body ratio was measured in centimetres and millimeters and stress vulnerability questionnaire was developed by two psychologists at Boston University

Medical Center, L.H. Miller and A.D. Smith, and is reproduced by the SCI Noble Counseling Center of Caldwell, Ohio.

5.2 Conclusions

1. For estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio, Body Ratio and Stress Vulnerability in junior level male kho-kho players and established model 1 is : **Performance = 9.198 + .064 * Stress Vulnerability** and model 2 is **Performance = -6.233 + .58* Stress Vulnerability + 15.12 * Digit Ratio**. The relationship between Height and Digit Ratio (R= -.30 p= .03), Height and Body Ratio (R= .75 p= .00), Height and Stress Vulnerability (R= .30 p= .03), Calf Girth and Thigh Girth (R=.33 p=.01), Thigh Girth and Digit Ratio (R= -.33 p=.01), & Body Ratio and Stress Vulnerability (R= .45 p=.00) were found positive correlation at .05 level of significance.
2. On the other hand, height and leg length, height and calf girth, height and thigh girth & height and waist circumference; leg length and calf girth, leg length and thigh girth, leg length and waist circumference, leg length and digit ratio, leg length and body ratio & leg length and stress vulnerability; calf girth and waist circumference, calf girth and digit ratio, calf girth and body ratio & calf girth and stress vulnerability; thigh girth and waist circumference, thigh girth and body ratio, & thigh girth and stress vulnerability; waist circumference and digit ratio, waist circumference and body ratio & waist circumference and stress vulnerability; digit ratio and body ratio & digit ratio and stress vulnerability no relationship were found.
3. For estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio, Body Ratio and Stress Vulnerability in junior level female kho-kho players and established model III is: **Performance = -27.071 + 33.544 * Digit Ratio** and model IV is: **Performance = -18.196 + 25.842 * Digit Ratio + -.023 * Stress Vulnerability**. The relationship between Height and body ratio (R= .56 p= .00), leg length and body ratio (R= -.79 p= .00) calf girth and stress vulnerability (R= -.27 p= .05) & digit ratio and stress vulnerability (R= -.67 p= .00) were found significant relationship.

4. On the other hand, insignificant relationships were found among height and leg length, height and calf girth, height and thigh girth, height and waist circumference, height and digit ratio, height and stress vulnerability, leg length and calf girth, leg length and thigh girth, leg length and waist circumference, leg length and digit ratio, leg length and stress vulnerability, calf girth and thigh girth, calf girth and waist circumference, calf girth and digit ratio, calf girth and body ratio, thigh girth and waist circumference, thigh girth and digit ratio, thigh girth and body ratio, thigh girth and stress vulnerability, waist circumference and digit ratio, waist circumference and body ratio, waist circumference and stress vulnerability, digit ratio and body ratio & body ratio and stress vulnerability.
5. For estimating kho kho Performance on the basis of Anthropometric variables, Digit Ratio, Body Ratio and Stress Vulnerability senior level male kho kho players and established model V is **Performance = -29.531 + 35.202 * Digit Ratio**, model VI is **Performance = -28.151 + 31.458 * Digit Ratio + .073 * Calf Girth** and model VII is **Performance = -12.152 + 24.828 * Digit Ratio + .061 * Calf Girth + -.054 * Height**. The relationship between Height and leg length (R= .71 p= .00), Height and calf girth (R= -.65 p= .00), Height and thigh girth (R= -.67 p= .00), Height and digit ratio (R= -.90 p= .00), Height and body ratio (R= .69 p= .00), Height and stress vulnerability (R= -.39 p= .00); leg length and calf girth (R= -.61 p= .00), leg length and thigh girth (R= -.66 p= .00), leg length and digit ratio (R= -.70 p= .00), leg length and body ratio (R= .62 p= .00); calf girth and thigh girth (R= .57 p= .00), calf girth and digit ratio (R= .65 p= .00), calf girth and body ratio (R= -.56 p= .00); thigh girth and digit ratio (R= .70 p= .00), thigh girth and body ratio (R= -.69 p= .00); digit ratio and body ratio (R= -.68 p= .00), digit ratio and stress vulnerability (R= .48 p= .00); & body ratio and stress vulnerability (R= -.34 p= .01) were found positive correlation at .05 level of significance.
6. On the other hand, height and waist circumference, leg length and waist circumference, leg length and stress vulnerability, calf girth and waist circumference, calf girth and stress vulnerability, thigh girth and waist circumference, thigh girth and stress vulnerability, waist circumference and

digit ratio, waist circumference and body ratio & waist circumference and stress vulnerability were found no relationship among the variables.

7. For estimating Kho kho Performance on the basis of Anthropometric variables, Digit Ratio and Stress Vulnerability in senior level female Kho kho players and established model VIII is: **Performance = -25.29 + 32.03 * Digit Ratio** and model IX is: **Performance = -13.801 + 28.716 * Digit Ratio + -.051 * Height**. The relationship between height and leg length (R= .34 p= .01), height and calf girth (R= -.46 p= .00), height and thigh girth (R= -.27 p= .05), height and digit ratio (R= -.55 p= .00), height and body ratio (R= .56 p= .00); leg length and calf girth (R= -.61 p= 00), leg length and thigh girth (R= -.66 p= 00), leg length and digit ratio (R= -.70 p= 00), leg length and body ratio (R= .39 p= 00), leg length and stress vulnerability (R= .28 p= 05); calf girth and thigh girth (R= .57 p= 00), calf girth and digit ratio (R= .65 p= 00), calf girth and body ratio (R= -.43 p= 00), calf girth and stress vulnerability (R= -.38 p= 00); thigh girth and digit ratio (R= .69 p= 00), thigh girth and body ratio (R= -.47 p= 00), thigh girth and stress vulnerability (R= -.33 p= 01); waist circumference and body ratio (R= -.27 p= .05), digit ratio and body ratio (R= -.43 p= .00) & digit ratio and stress vulnerability (R= -.35 p= .01) were found significant relationships.
8. On the other hand, no relationships were found between height and waist circumference, height and stress vulnerability, leg length and waist circumference, calf girth and waist circumference, thigh girth and waist circumference, waist circumference and digit ratio, waist circumference and stress vulnerability & body ratio and stress vulnerability.

5.3 Recommendations

1. Same type of study may be conducted on other variables.
2. Same type of study may be repeated on other players of different games.
3. Similar type of study may be conducted on the kho-kho players of other age groups.
4. Same type of study may be conducted on other players of different games.

5. Established regression equations are recommended for estimating kho-kho performance of different levels on the basis of anthropometric profile, digit ratio, body ratio and stress vulnerability.

BIBLIOGRAPHY

- Amaral, A. P., and Serra, A. V. (2009). FC02-02 Vulnerability to stress and physical and mental illness. *European Psychiatry*, 24, S219.
- Arngrímsson, S. Á., Evans, E. M., Saunders, M. J., Ogburn III, C. L., Lewis, R. D., & Cureton, K. J. (2000). Validation of body composition estimates in male and female distance runners using estimates from a four-component model. *American Journal of Human Biology: The Official Journal of the Human Biology Association*, 12(3), 301-314.
- Baker, F. (1888). Anthropological notes on the human hand. *American Anthropologist*, 1(1), 51-76.
- Bale, P. (1986). A review of the physique and performance qualities characteristic of games players in specific positions on the field of play. *The Journal of sports medicine and physical fitness*, 26(2), 109-22.
- Bauld, R., & Brown, R. F. (2009). Stress, psychological distress, psychosocial factors, menopause symptoms and physical health in women. *Maturitas*, 62(2), 160-165.
- Bennett, M., Manning, J. T., Cook, C. J., & Kilduff, L. P. (2010). Digit ratio (2D: 4D) and performance in elite rugby players. *Journal of sports sciences*, 28(13), 1415-1421.
- Bescós, R., Esteve, M., Porta, J., Mateu, M., Iruiria, A., & Voracek, M. (2009). Prenatal programming of sporting success: Associations of digit ratio (2D: 4D), a putative marker for prenatal androgen action, with world rankings in female fencers. *Journal of sports sciences*, 27(6), 625-632.

- Biswas, M., & Halder, S. (2015). A Comparative Study on Selected Anthropometric Variables and Motor Abilities between Women Kho-Kho and Kabaddi Players, *International Journal of Physical Education, Sports and Health*, 2(1), 66-68.
- Carter, J. L., Carter, J. L., & Heath, B. H. (1990). *Somatotyping: Development and applications (Vol. 5)*. Cambridge university press.
- Caredda, M., Roscioli, C., Mistretta, M., & Pacitti, F. (2009). Stress vulnerability and night eating syndrome in the general population. *Rivista di psichiatria*, 44(1), 45-54.
- Chauhan, S. N., & Sabir, M. G. Stress Vulnerability among the Different Games of State Level Male Players. *Int. J. Phy. Edu. Spo*, 3(03), 12-16.
- Claessens, A. L., Lefevre, J., Beunen, G., & Malina, R. M. (1999). The contribution of anthropometric characteristics to performance scores in elite female gymnasts. *Journal of Sports Medicine and Physical Fitness*, 39(4), 355-60.
- Gabbett, T. J. (2000). Physiological and anthropometric characteristics of amateur rugby league players. *British journal of sports medicine*, 34(4), 303-307.
- George, R. (1930). Human finger types. *The Anatomical Record*, 46(2), 199-204.
- Ghosh, M., & Kundu, B. (2014). Physical, physiological and anthropometric measures as determinants of performance in kho-kho skills-a correlational study. *International Journal of Humanities and Social Science Invention*, 3(8), 04-12.
- Gómez, J. E. (2004). ATHENA (Athletes Targeting Healthy Exercise and Nutrition Alternatives): A Promising Program Up Against Stiff Competition. *Archives of pediatrics & adolescent medicine*, 158(11), 1084-1086.

- Ivarsson, A., Johnson, U., & Podlog, L. (2013). Psychological predictors of injury occurrence: a prospective investigation of professional Swedish soccer players. *Journal of sport rehabilitation*, 22(1), 19-26.
- Jaiswal, A. (2014). Anthropometric and somatotyping study among the female Kho-Kho players of Pondicherry: a comparative analysis. *J. Glob. Econ.*, 2, 1-3.
- Jürimäe, T., Voracek, M., Jürimäe, J., Lätt, E., Haljaste, K., Saar, M., & Purge, P. (2008). Relationships between finger-length ratios, ghrelin, leptin, IGF axis, and sex steroids in young male and female swimmers. *European journal of applied physiology*, 104(3), 523-9.
- Kasperson, J. X., & Kasperson, R. E. (2001). *International Workshop on Vulnerability and Global Environmental Change: A Workshop Summary*. Stockholm Environment Institute, Stockholm, Sweden.
- Keogh, J. (1999). The use of physical fitness scores and anthropometric data to predict selection in an elite under 18 Australian rules football team. *Journal of Science and Medicine in Sport*, 2(2), 125-133.
- Kumar, R. (2014). Kinanthropometric and fitness variables as predictors of Kho_Kho playing ability, *International Journal of Multidisciplinary & Allied Studies* , Vol.03, Issue 08,142-147.
- Malina, R. M. (2007). Body composition in athletes: assessment and estimated fatness. *Clinics in sports medicine*, 26(1), 37-68.

- Manning, J. T., & Taylor, R. P. (2001). Second to fourth digit ratio and male ability in sport: implications for sexual selection in humans. *Evolution and Human Behavior*, 22(1), 61-69.
- Martens, R., Vealey, R. S., & Burton, D. (1990). Competitive anxiety in sport. *Human kinetics*.
- Mathur, D. N., & Salokun, S. O. (1985). Body composition of successful Nigerian female athletes. *The Journal of sports medicine and physical fitness*, 25(1-2), 27-31.
- Paul, S., & Das, S. S. (2016). Physiological performance structure of male kho-kho players. *International Journal of Physical Education, Sports and Health*, 3(3), 98-100
- Prior, B. M., Modlesky, C. M., Evans, E. M., Sloniger, M. A., Saunders, M. J., Lewis, R. D., & Cureton, K. J. (2001). Muscularity and the density of the fat-free mass in athletes. *Journal of Applied Physiology*, 90(4), 1523-1531.
- Reilly, T., Bangsbo, J., & Franks, A. (2000). Anthropometric and physiological predispositions for elite soccer. *Journal of sports sciences*, 18(9), 669-683.
- Singh, B. (2018). Comparative study of anthropometric variables of male kabaddi and kho-kho players. *International Journal of Physiology, Nutrition and Physical Education*, 3(1), 177-178.
- Slater, G. J., Rice, A. J., Mujika, I., Hahn, A. G., Sharpe, K., & Jenkins, D. G. (2005). Physique traits of lightweight rowers and their relationship to competitive success. *British journal of sports medicine*, 39(10), 736-741.

- Sudhakar, H. H., Majumdar, P., Umesh, V., & Panda, K. (2014). Second to fourth digit ratio is a predictor of sporting ability in elite Indian male kabaddi players. *Asian journal of sports medicine*, 5(3), e23073.
- Turner, B. L., Kasperson, R. E., Matson, P. A., McCarthy, J. J., Corell, R. W., Christensen, L., ... & Polsky, C. (2003). A framework for vulnerability analysis in sustainability science. *Proceedings of the national academy of sciences*, 100(14), 8074-8079.
- Voracek, M., Reimer, B., & Dressler, S. G. (2010). Digit ratio (2D: 4D) predicts sporting success among female fencers independent from physical, experience, and personality factors. *Scandinavian journal of medicine & science in sports*, 20(6), 853-860.
- Zubin, J., & Spring, B. (1977). Vulnerability: a new view of schizophrenia. *Journal of abnormal psychology*, 86(2), 103-126.

APPENDICES

Junior Boys									
S. No.	Height	Leg Length	Calf Girth	Thigh Girth	Waist Circumference	Digit Ratio	Body Ratio	Stress Vulnerability	Performance
1	160	84	34	42	70	1.033333	1.777778	24	8
2	170	80	30	44	69	1	1.976744	55	5
3	162	76	30	39	72	1.009412	1.862069	45	6
4	157	83	29	40	66	1.091538	1.764045	23	9
5	169	85	32	44	71	0.995294	1.920455	30	5
6	169	79	32	42	71	0.989459	1.898876	29	8
7	167	86	30	45	68	1.027397	1.855556	65	4
8	170	84	28	40	69	0.942029	2	59	5
9	160	79	33	42	66	0.922029	1.818182	27	9
10	168	78	30	42	71	1.017397	2.1	70	6
11	166	76	31	43	73	0.998904	1.908046	53	7
12	157	79	32	39	65	1.035974	1.847059	46	5
13	160	80	33	35	65	1.046875	1.777778	32	8
14	168	85	31	43	60	0.985294	1.826087	33	5
15	166	82	33	45	64	1.015625	1.886364	45	6
16	163	84	29	45	70	0.994848	1.811111	27	8
17	158	77	33	44	72	0.958333	1.837209	36	4
18	155	79	31	36	72	1.025925	1.845238	59	6
19	160	84	28	36	67	1.044776	1.860465	28	9
20	168	77	30	41	69	0.955882	1.88764	36	5
21	170	80	35	45	70	1.014706	1.910112	30	7

22	158	82	32	40	66	1.014 493	1.736 264	30	9
23	161	75	31	43	66	1	1.916 667	56	4
24	166	79	27	37	69	1.044 118	1.824 176	29	7
25	159	81	33	40	69	1.042 857	1.786 517	31	8
26	158	80	29	38	71	1.060 606	1.837 209	28	6
27	170	84	30	42	73	0.983 333	2	38	6
28	161	80	33	44	70	1.059 701	1.788 889	23	9
29	159	85	31	40	66	1.058 824	1.728 261	50	7
30	156	76	34	43	66	1.041 429	1.772 727	34	8
31	168	79	32	46	69	0.955 882	1.931 034	69	4
32	159	78	32	45	71	0.955 882	1.766 667	39	5
33	169	84	30	39	65	1	1.920 455	35	6
34	164	82	34	45	65	1.042 254	1.842 697	67	7
35	171	80	35	42	68	0.945 205	2.011 765	59	5
36	165	78	29	43	70	1.032 254	1.918 605	63	9
37	169	77	34	45	66	1	1.942 529	26	8
38	161	85	30	42	69	1.040 541	1.894 118	39	6
39	159	79	31	45	72	0.972 603	1.806 818	54	6
40	155	83	30	43	72	0.945 205	1.802 326	27	9
41	166	75	32	40	69	0.986 486	1.824 176	56	4
42	165	77	34	45	67	0.925 205	1.853 933	33	4
43	169	79	33	35	65	0.986 301	1.965 116	43	6
44	169	80	30	43	72	0.982 222	1.857 143	49	7
45	160	81	28	39	72	1.029 851	1.839 08	31	9

46	159	83	30	37	69	0.985 714	1.766 667	49	6
47	156	84	32	44	71	0.961 429	1.695 652	30	7
48	165	85	34	41	69	1	1.875	48	5
49	161	83	34	43	66	1.036 338	1.872 093	28	9
50	168	84	30	43	65	0.990 149	1.887 64	49	6

Junior Girls										
S. No.	Height	Leg Length	Calf Girth	Thigh Girth	Waist Circumference	Digit Ratio	Sitting Height	Body Ratio	Stress Vulnerability	Performance
1	155	71	27	34	60	1	75	2.066 667	40	7
2	159	65	26	32	56	0.933 333	67	2.373 134	78	4
3	152	70	25	31	58	1	70	2.171 429	46	6
4	157	69	22	35	60	1.032 258	69	2.275 362	31	8
5	148	63	24	33	57	0.993 846	60	2.466 667	77	5
6	159	64	28	35	61	0.929 577	64	2.484 375	78	4
7	154	72	27	31	62	1	72	2.138 889	46	6
8	157	68	23	34	55	0.959 091	68	2.308 824	82	3
9	160	67	25	33	59	1.032 258	67	2.388 06	32	8
10	157	60	26	35	56	1	62	2.532 258	46	6
11	159	72	25	32	60	0.928 571	72	2.208 333	69	4
12	149	69	24	30	58	1	69	2.159 42	46	6
13	160	71	25	31	62	1.006 393	71	2.253 521	40	7
14	150	70	25	30	59	0.953 846	70	2.142 857	64	5
15	156	66	26	35	57	0.983 607	66	2.363 636	45	6
16	159	66	28	33	60	1	66	2.409 091	73	5

17	158	68	26	34	61	0.927 536	68	2.323 529	75	4
18	160	80	26	31	62	0.984 375	69	2.318 841	66	6
19	160	71	28	32	56	1.015 625	71	2.253 521	67	7
20	156	71	23	33	58	1	66	2.363 636	85	4
21	155	69	26	34	60	0.984 615	69	2.246 377	45	6
22	160	71	27	34	60	0.994 848	71	2.253 521	44	6
23	148	65	26	31	57	0.923 077	65	2.276 923	88	4
24	147	68	27	32	56	1.015 385	68	2.161 765	53	7
25	159	60	26	30	59	1	60	2.65	52	7
26	158	67	25	35	61	1.021 746	64	2.468 75	23	8
27	160	70	27	31	62	1	70	2.285 714	40	5
28	159	66	28	34	55	1.031 25	67	2.373 134	34	8
29	159	71	28	35	56	1.030 769	71	2.239 437	30	8
30	155	72	26	35	59	1.044 776	72	2.152 778	21	9
31	160	64	28	33	60	0.985 507	69	2.318 841	44	6
32	154	60	25	33	58	0.923 077	60	2.566 667	72	4
33	157	61	26	32	57	0.970 588	61	2.573 77	66	6
34	150	70	24	30	61	1.014 706	65	2.307 692	80	7
35	151	69	25	30	60	0.914 286	69	2.188 406	82	4
36	162	65	28	34	59	0.907 692	65	2.492 308	79	3
37	145	67	27	35	56	0.958 904	67	2.164 179	44	6
38	148	70	27	31	60	1.014 085	70	2.114 286	40	7
39	158	69	25	32	55	0.942 857	69	2.289 855	65	5
40	147	71	26	34	58	0.914 286	71	2.070 423	75	4
41	149	69	28	33	60	0.957	69	2.159	56	6

						746		42		
42	160	65	28	35	61	1.013889	66	2.424242	42	7
43	154	71	25	32	58	0.997143	71	2.169014	64	6
44	153	70	22	30	60	0.942029	70	2.185714	74	5
45	160	59	24	31	57	1	59	2.711864	82	7
46	159	57	26	33	59	0.955224	59	2.694915	77	6
47	145	71	26	33	55	0.980299	71	2.042254	51	5
48	145	68	23	35	61	1	68	2.132353	75	7
49	161	69	27	30	59	1.029412	69	2.333333	31	8
50	159	60	28	31	62	0.9375	60	2.65	54	5

Senior Boys									
Sr. No	Height	Leg Length	Calf Girth	Thigh Girth	Waist Circumference	Digit Ratio	Body Ratio	Stress Vulnerability	Performance
1	160	88	35	50	85	1.053333	1.702128	53	7
2	170	92	30	44	80	0.961538	1.884701	37	4
3	170	80	30	48	82	1.029412	1.888889	46	6
4	157	80	37	50	80	1.061538	1.764045	32	8
5	173	92	32	44	85	0.985294	1.965909	43	5
6	169	87	32	42	80	0.959459	1.898876	37	4
7	167	86	30	48	78	1.027397	1.855556	46	6
8	178	101	28	40	76	0.942029	2.094118	24	3
9	160	79	40	49	79	1.061538	1.818182	35	8
10	168	90	30	42	79	1.027397	2.1	46	6
11	172	90	31	43	83	0.958904	1.977011	36	4
12	166	93	32	46	76	1.025974	1.952941	46	6

13	160	87	33	46	82	1.04687 5	1.95122	53	7
14	176	90	31	43	82	0.98529 4	1.83333 3	42	5
15	166	91	33	45	78	1.01562 5	1.76595 7	45	6
16	170	92	33	45	86	0.98484 8	1.88888 9	41	5
17	174	93	33	44	80	0.95833 3	2.02325 6	36	4
18	165	89	31	48	77	1.01492 5	1.96428 6	45	6
19	160	84	34	48	83	1.04477 6	1.86046 5	53	7
20	176	87	30	45	84	0.95588 2	1.97752 8	33	4
21	170	90	35	53	85	1.01470 6	1.78947 4	45	6
22	172	94	32	47	80	1.01449 3	1.89011	44	6
23	174	99	31	43	83	0.95588 2	2.07142 9	31	4
24	162	86	32	49	80	1.04411 8	1.74193 5	53	7
25	159	86	33	48	83	1.04285 7	1.78651 7	52	7
26	158	80	38	52	80	1.06060 6	1.64583 3	21	8
27	170	92	30	42	85	0.97333 3	1.82795 7	40	5
28	161	80	35	50	80	1.05970 1	1.78888 9	54	8
29	159	85	41	48	87	1.05882 4	1.76666 7	54	8
30	155	76	42	56	80	1.07142 9	1.76136 4	24	9
31	168	87	32	49	82	1.01388 9	1.93103 4	44	6
32	172	90	32	45	80	0.95588 2	1.91111 1	28	4
33	168	88	30	47	76	1	1.90909 1	44	6
34	164	88	34	46	78	1.04225 4	1.84269 7	51	7
35	176	88	32	42	83	0.94520 5	2.07058 8	27	4
36	177	99	30	43	79	0.94117 6	2.2125	23	3

37	171	90	34	45	80	0.98684 2	1.96551 7	44	6
38	161	85	30	47	78	1.04054 1	1.89411 8	51	7
39	169	94	31	45	86	0.97260 3	1.92045 5	40	5
40	175	87	30	43	80	0.94520 5	2.03488 4	25	4
41	166	86	32	47	82	0.98648 6	1.82417 6	43	6
42	165	88	33	45	79	1.04	1.85393 3	50	7
43	169	93	33	44	80	0.98630 1	1.96511 6	43	6
44	169	89	30	43	84	0.97222 2	2.01190 5	38	5
45	160	89	30	45	83	1.02985 1	1.90476 2	49	7
46	168	87	30	49	84	0.98571 4	1.86666 7	43	6
47	172	90	32	46	85	0.97142 9	1.86956 5	38	5
48	165	86	34	47	81	1.02985 1	1.875	48	7
49	161	83	40	43	83	1.05633 8	1.87209 3	29	8
50	173	97	30	43	86	0.97014 9	1.94382	38	5

Senior Girls									
Sr. No	Height	Leg Length	Calf Girth	Thigh Girth	Waist Circumference	Digit Ratio	Body Ratio	Stress Vulnerability	Performance
1	155	83	32	46	81	1.027778	1.845238	51	6
2	168	87	27	40	76	0.933333	2.094763	68	4
3	168	75	27	44	78	1	2.1	44	6
4	157	75	34	46	76	1.032258	1.987342	30	8
5	163	87	29	40	81	0.953846	2.089744	41	5
6	159	82	29	38	76	0.929577	2.012658	69	4
7	160	81	27	44	74	1	2	44	6
8	168	96	25	36	72	0.909091	2.24	22	3
9	150	74	37	45	75	1.032258	1.923077	31	8
10	158	85	27	38	75	1	2.257143	44	6
11	162	85	28	39	79	0.928571	2.103896	81	4
12	160	88	29	42	72	1	2.133333	44	6
13	160	82	30	42	78	1.016393	2.222222	29	8

14	166	85	28	39	78	0.953846	1.930233	70	5
15	156	86	30	41	74	0.983607	1.857143	43	6
16	160	87	30	41	82	0.952381	2	39	5
17	164	88	30	40	76	0.927536	2.157895	78	4
18	165	84	28	44	73	0.984375	2.22973	43	6
19	160	79	31	44	79	1.015625	2.105263	38	7
20	166	82	27	41	80	0.923077	2.101266	31	4
21	160	85	32	49	81	0.984615	1.882353	43	6
22	162	89	29	43	76	0.984848	2	42	6
23	164	94	28	39	79	0.923077	2.216216	65	5
24	160	81	29	45	76	1.015385	1.927711	51	7
25	159	81	30	44	79	1.014925	2.012658	35	7
26	158	75	35	48	76	1.031746	1.837209	30	8
27	165	87	27	38	81	0.944444	1.987952	59	5
28	161	75	32	46	76	1.03125	2.0125	26	8
29	159	80	38	44	83	1.030769	1.9875	28	8
30	155	71	39	52	76	1.044776	1.987179	23	9
31	168	82	29	45	78	0.985507	2.181818	42	6
32	166	85	29	41	76	0.923077	2.075	26	5
33	165	83	27	43	72	0.970588	2.115385	42	6
34	164	83	31	42	74	1.014706	2.075949	49	7
35	166	83	29	38	79	0.914286	2.213333	25	4
36	165	94	27	39	75	0.907692	2.357143	21	3
37	167	85	31	41	76	0.958904	2.168831	42	6
38	156	80	27	43	74	1.014085	2.08	49	7
39	159	89	28	41	82	0.942857	2.038462	38	5
40	165	82	27	39	76	0.914286	2.171053	70	4
41	156	81	29	43	78	0.957746	1.925926	41	6
42	155	83	30	41	75	1.013889	1.962025	48	7
43	159	88	30	40	76	0.957143	2.092105	41	6
44	159	84	27	39	80	0.942029	2.148649	36	6
45	150	84	27	41	79	1	2.027027	47	7
46	158	82	27	45	80	0.955224	1.975	41	6
47	162	85	29	42	81	0.940299	1.97561	55	5
48	155	81	31	43	77	1	1.987179	30	8
49	151	78	37	39	79	1.029412	1.986842	27	8
50	153	92	27	39	82	0.9375	1.936709	60	6

Vulnerability to Stress Scale

The following are some factors which have been found to influence your ability to deal with stress. A common aspect of each item is “Be good to yourself.” Circle a number from 1 (almost always) to 5 (never) according to how much of the time an item is true of you.

	<u>Almost Always (1)-----Never (5)</u>				
1. I eat at least one hot, balanced meal per day.	1	2	3	4	5
2. I get 7 to 8 hours of sleep at least 4 nights per week.	1	2	3	4	5
3. I give and receive affection regularly.	1	2	3	4	5
4. I have at least one relative within 50 miles on whom I can rely.	1	2	3	4	5
5. I exercise to the point of perspiration at least twice per week.	1	2	3	4	5
6. I smoke less than half a pack of cigarettes per day.	1	2	3	4	5
7. I take fewer than 3 alcoholic drinks per week.	1	2	3	4	5
8. I am the appropriate weight for my height.	1	2	3	4	5
9. I have income adequate to meet basic expenses.	1	2	3	4	5
10. I get strength from my spiritual beliefs.	1	2	3	4	5
11. I regularly attend club or social activities.	1	2	3	4	5
12. I have a network of friends and acquaintances.	1	2	3	4	5
13. I have one or more friends to confide in about personal matters.	1	2	3	4	5
14. I am in good health (including eyesight, hearing, teeth).	1	2	3	4	5
15. I am able to speak openly about my feelings when angry or worried.	1	2	3	4	5
16. I have regular conversations with the people I live with.	1	2	3	4	5
17. I do something for fun at least once per week.	1	2	3	4	5
18. I am able to organize my time effectively.	1	2	3	4	5
19. I drink less than 3 cups of coffee (or tea or cola drinks) per day.	1	2	3	4	5
20. I take quiet time for myself during the day.	1	2	3	4	5

Vulnerability to Stress Score (total score for items 1-20) = _____

Scoring Key:

- Less than 30 = You are in a very good position to weather stressful experiences
- 30 to 50 = You are about average, with room for improvement
- 51 to 79 = You are vulnerable to stress-related problem and would highly benefit from using stress management techniques
- More than 80 = You are a highly vulnerable to stress and should seriously consider making some changes in your daily life to more effectively manage stress