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# Correlation of *Griva Parinaah* (GP) in *Anguli Praman* and BMI in *Medovriddhi* (Obesity) w.s.r. to Cardiovascular Risk

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## ABSTRACT

The prevalence of overweight and obesity in India is increasing faster than the world average. *Medovriddhi* (obesity) shows the symptoms as increased size of buttocks, breast and abdomen, *Shwasa* (breathlessness) after slight movement also. *Acharya Bhavprakash* added one more symptom the oversize of the neck (*Griva*). *Acharya Sushruta* mentioned the *Griva* measurement should be 20 *Angul* for both males and females with their fingers (self-finger unit). In modern science, body mass index (BMI) is used to find out obesity. Obesity is the foremost cause of cardiovascular diseases. BMI is the generalized metric way but *Grivaparinaah* in *Swangulpramaan* is a personalized quantifying anthropometric measurement. Individuals of *Medovriddhi* having an age group of 20 to 70 years were selected. So, intending to the height the importance of *Grivaparinaah* described in *Medodhatu Vriddhi* correlation study having been carried out. A positive correlation was found in GP with BMI in both genders having r-value of 0.3533 ( $p < 0.05$ ) for males and 0.3137 ( $p < 0.05$ ) for females. Using ROC curve analysis GP is  $> 21.63$  *Angul* for males and females were determined to be the best cut-off level for identifying a subject with BMI as cardiovascular risk.

**Key words:** BMI, *Grivaparinaah*, *Swangulpramaan*, *Medovridhi*, *Anthropometric*.

## INTRODUCTION

Worldwide, at least 2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million (2.3 percent) of global days are caused by overweight or obesity.<sup>[1]</sup>

Ayurveda the ancient Indian System of Medicine is known for its multidimensional approach towards mankind. The utility of this science starts right from

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fertilization to death, personal and public hygiene, diet and regimen to medicine, and so on. Ayurveda and health are closely related and supplementary to each other. The aims and objectives of this science are to maintain the health of a healthy individual and cure of diseased person. Prevention and promotion of health are the first and the foremost aim of *Ayurveda*.<sup>[2][3]</sup> A person is not aware of his ideal health because he is busy to achieve physical pleasure as early as possible. A person will be completely healthy if he follows the dictums of a tripod of life (*Trayoupstambh*) i.e. *Aahar*, *Nidra*, and *Brahmacharya*. *Aahar* is important among the others because it maintains the equilibrium state of *Dosha*, *Dhatu*, and *Mala*. If a person indulges in improper *Aahar* he may suffer from various types of health hazards, overeating leads to obesity. Obesity is a serious disorder of *Medodhatu* metabolism.

*Vriddhi* of *Medodhatu* shows the symptoms as increased size of buttocks, breast, and abdomen. The

person shows the sign of *Shwas* (breathlessness) after a slight movement also.<sup>[4]</sup> Additional to the above symptoms of *Medovriddhi*, *Bhavprakasha* added thirst (*Trishna*), sweating (*Sweda*), goiter (*Granthi*), and oversize of the neck (*Griva*).<sup>[5]</sup> The BMI is defined as the body mass divided by the square of the body height and is universally expressed in units of kg/m<sup>2</sup> resulting from mass in kilograms and height in meters.<sup>[6]</sup> As per WHO, a BMI of less than 18.5 is considered underweight, greater than 25 is overweight while greater than 30 considered overweight.<sup>[7]</sup>

According to modern science female having NC 34cm and male having NC 37 cm is considered normal.<sup>[8][9]</sup> While *Acharya Sushruta* mentioned the *Griva* measurement i.e., *Grivaparinaah* (GP) should be 20 *Angul* for both males and females with their finger (self-finger unit).<sup>[10][11]</sup>

Obesity is described in *Ayurveda* by the name of *Sthoulya* and *Atisthoulya*. It has been classified under "Eight despicable personalities" (*Ashtanindita Purusha*) and defined as an excessive and abnormal increase of *Meda Dhatu* along with *Mamsa Dhatu* resulting in the pendulous appearance of buttocks, belly, and breasts.<sup>[12]</sup> According to *Acharya Charaka*, there is an excess of fat in over obese individuals, and further only fat is accumulated and not the other *Dhatus* so, thus the life span is shortened.<sup>[13]</sup> According to *Ayurveda* in the case of *Sthoulyayoga*, *Vayu* and *Agni* are the main culprits for producing the complications.<sup>[14]</sup> Symptoms of *Medovriddhi* are given in detail in compendia, there is a need to develop parameter which will help persons in the society to get aware of this disease. The *Ayurvedic* classical literature is available along with many hypothetical concepts. An *angul pramaana* is one of them *Sharir Pramana* is the only tool for determining the *Ayu* of an individual.<sup>[15]</sup> Thus with an objective to find the correlation between GP and BMI study was carried out.

## OBJECTIVE

To study the correlation between *Grivaparinaah* (GP) and BMI in *Medovriddhi* w.s.r. to cardiovascular risk.

## MATERIALS AND METHODS

This study was an observational cross-sectional study carried out at Shri Ayurved Hospital, Nagpur. A total of 185 patients from OPD and IPD were enrolled for the study, after getting ethical clearance and written informed consent patients underwent detailed history recording, clinical examination, and relevant anthropometric and laboratory investigations. After screening eligible respondents of *Medovriddhi* were selected. Individuals of the age group 20 to 70 years were selected. Individuals of both sexes irrespective of social-economic conditions were selected. ANC female was excluded from the study. People who deny participating in the study were excluded. A person having endocrine dysfunction were excluded.

### Diagnostic criteria for *Medovriddhi*

Valid questionnaire used for assessment of *Medovriddhi* in individuals based on *Medovriddhi* symptoms in *Ayurvedic* compendia.

### Anthropometric measurement

*Swangulpramaan* (self-finger unit) means the female body should measure with her finger, the male body by his finger, and the child's body by his/her self-finger.<sup>[16]</sup> *Acharya Dalhan* mentioned middle finger's middle interphalangeal joint is one *Angul*. Recently research shows that the mediolateral proximal interphalangeal joint of the middle finger gives one's self-finger unit.<sup>[17]</sup> Participants were asked to, avoid food, all drinks, and strenuous exercise for 2 hours before anthropometric measurement.

### Method used to take *Angulpramaan*

Measurement of four fingers from little to index finger at the joint of metacarpal and lower phalanges considered as four *Angul*.<sup>[18]</sup>

**Procedure** - *Swangulpramaan* taken for each examinee with the help of Vernier calliper. For measuring one *Angulpramaan* ask the examinee to remove his/her finger ornaments firstly and to keep both hands on flat surface (e.g. table) in such a way that index, middle, ring and little fingers were closely related to each other and thumb remains slightly

away from the index finger. Then Vernier calliper kept at a place of *Parvasandhi* and *Panital* joint (breadth of a joint between the lower phalanges and metacarpals of both hands) of right hand neither tight nor loose, perpendicular to the flat surface, in such way that both ends of Vernier calliper must touch the flat surface. Now Vernier calliper removed and reading of right hand noted on paper in centimeters. A left reading hand was taken in the same way. For calculation of one *Angulpramaan* following formula was taken, as *Dalhan Acharya* mentioned one's own folded palm (*Swapanitala*) is 4 *Angul* in measurement.<sup>[19],[20]</sup> Self-finger measurement means sum of the breadth of the joint between the lower phalanges and metacarpals of both right and left hands divided by eight. Both the right hand and the left hand will be measured only to minimize error which may occur due to different sizes of the right and left hands. In this way, we will get the one *Angulpramaan* in centimeters.

#### Measurement of Grivaparinaah (Neck circumference)

Round measurement of body objects is *Parinaah*. For measuring *Parinaah* measurement was taken at mid-point of that organ.<sup>[21][22][23]</sup> According to modern anthropometry, the boundary line encompassing an area or object is called the circumference. According to *Sushruta* GP should be 20 *Angul* in *Parinaah*.<sup>[24]</sup> According to modern science, NC will measure using nonstretchable measuring tape at the middle of the neck between the mid-cervical spine and mid anterior neck and horizontally at just inferior the Adam's apple.<sup>[25]</sup> Participants were asked to stand on a horizontal plane. GP was measured at the mid-point of *Griva* (neck). Just below the laryngeal prominence superior border of a tape measure was placed and applied perpendicular with the long axis of the neck using a tape measure neck circumference was measured to the nearest 0.1 cm.<sup>[26]</sup>

#### Body mass index (BMI)

BMI was calculated by using the formula (Quetelet index) weight in kilograms divided by height in meter

square.

#### Measurement of weight

The person's weight taken on the weighting machine in kilograms. The weight machine clear and adjusted at zero levels after each reading. Asked the examinee to remove shoes and all accessories such as mobile, Bag, hand purse, etc. Examinee Instructed to stand in the center, looking straight ahead, with an equal balance on both the legs. When the examinee is properly positioned and blinking of weight arrow is stopped totally, then recorded the weight exactly above zero lines.

#### Measurement of height

Standing height is an assessment of maximum vertical size. Examinee stand on the floor with heels of both feet together and the toes pointed slightly outwards at approximately 60° angle make sure the bodyweight is evenly distributed and both feet are flat on the floor. Checked the position of the back of the head, shoulder blades, buttocks, and heels back of the head for contact with vertical measuring scale was there. Depending on the overall body of the individual all points may not touch, in such case make assured that the examinee's trunk was vertical above the waist and the arms and shoulder were relaxed. Aligned the head in Frankfort horizontal plane. Once correctly positioned, instructed the examinee to take a deep breath, and stand as tall as possible. (Deep breaths allowed the spine to straighten, yielding a more consistent and reproducible stature measurement). Allow sufficient pressure to compress hair, record the height in centimeter. Convert it into the meter and put the values in the formula, precautions were taken like remove hair ornaments, jewellery, buns, braids, and roll from the top of the head was removed to measure stature properly.

According to *Sushruta* GP should be 20 *Angul*.<sup>[27]</sup> As per the classification of BMI, persons having BMI less than 18.50 categorized as underweight, BMI of 18.50 – 24.90 considered as normal, BMI between 25.0 - 29.9 is defined as overweight and obesity is defined as BMI having 30 or higher.<sup>[28]</sup>



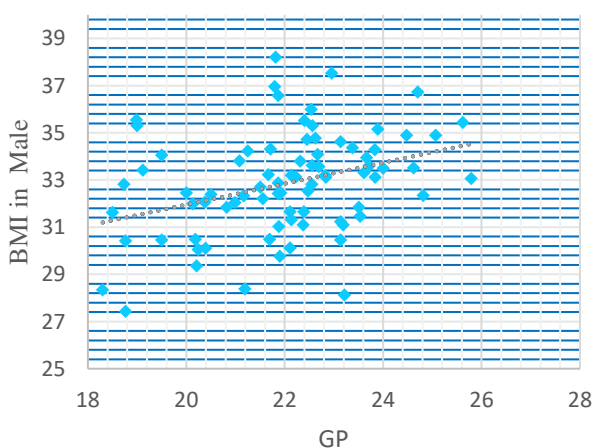
**OBSERVATIONS AND RESULTS**

**Statistical analysis:** Collected Data were entered into a Microsoft spreadsheet. Tables and charts were prepared using Microsoft word and excel spreadsheets. Continuous variables (demographic, fitness parameters, biochemical, hemodynamic, and lipid parameters) were presented as Mean SD. Categorical variables were expressed in frequency and percentages. All study parameters were compared between male and female and also to compare greater than & less than 20 Angul of GP. The correlation coefficient (r) was used to assess the magnitude and direction of correlation between BMI with GP by using the Pearson correlation statistical method. The risk of cardiovascular factors associated with the >20 Angul of GP was carried out by calculating Odds Ratio, 95% confidence interval and statistical significance were assessed by performing a chi-square test. The receiver'soperative characteristic Curve was used to determine the best cut-off value of GP to differentiate between the presence and absence of risk of cardiovascular factors.

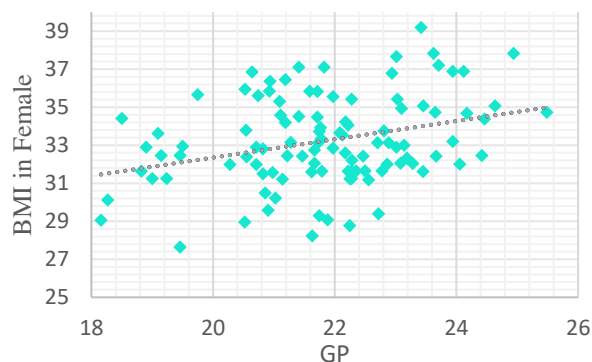
**Table 1: Correlation of GP with BMI.**

Parameter	Total		Male		Female	
	r-value	p-value	r-value	p-value	r-value	p-value
BMI	0.3231	<0.0001, HS	0.3533	0.0013, S	0.3137	0.0011, S

**Graph 1 - Correlation of GP with BMI in males.**



**Graph 2 - Correlation of GP with BMI in females.**

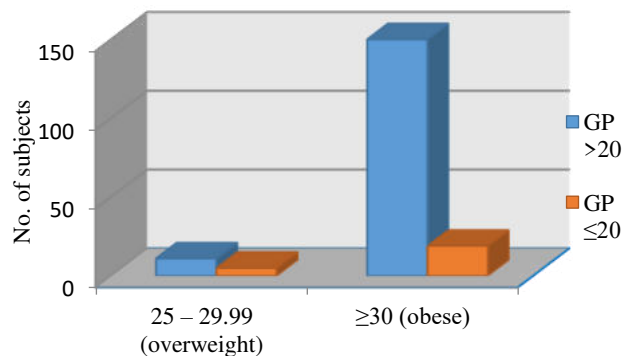


Pearson’s correlation coefficient between GP and BMI. (Table 1) Positive correlation found in GP with BMI in both genders having r-value 0.3533 (p<0.05) for male and r-value 0.3137 (p<0.05) for female. (graph no. 1 & 2)

**Table 2: Risk of cardiovascular factors associated with the presence of GP.**

Parameter	Cut value	GP		Chi2-value	OR (95% C.I.)
		>20	≤20		
BMI	25 – 29.99 (overweight)	11	5	Chi2=5.154 P=0.0231,S	0.27 (0.08-0.88)
	≥30 (obese)	150	19		

**Graph 3: Association of BMI with GP >20 & <20 Anguli.**

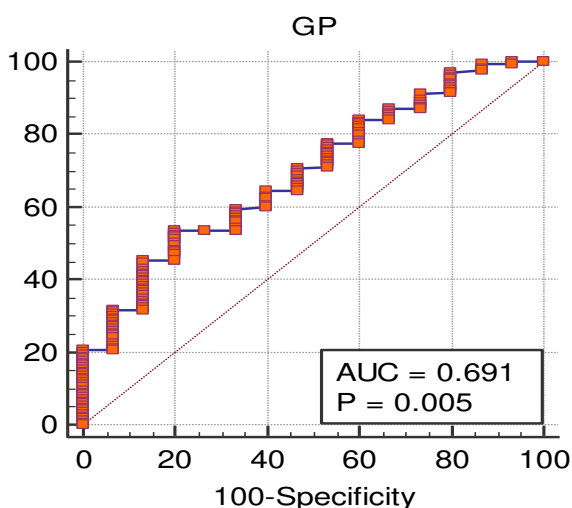


The odds ratio is 0.27 suggests that persons having GP > 20 angulpraman positively associated with the BMI as a risk factor for cardiovascular diseases follows

under the category of overweight and obese. (Table 2, Graph 3)

**Table 3: Receiver Operative characteristic curve for data on GP to differentiate between the presence and absence of risk of cardiovascular factor BMI.**

Parameter	Best cut off	Area under curve	95 % C.I.	Sensitivity	Specificity	Z-value	p-value
BMI	>21.63	0.691	0.62-0.76	64.71	60.0	2.822	0.0048, HS



**Graph 4: ROC curve analysis GP and BMI.**

Using ROC curve analysis GP is >21.63 Angul for males and females were determined to be the best cut-off level for identifying a subject with CV risk factor BMI. (Graph no. 4)

**DISCUSSION**

The result of the study shows *Grivaparinaah* correlated significantly with BMI in males and females taken together, and significant when taken individually. BMI is widely used as a measurement of obesity to identify risk for metabolic disorder. Measuring GP can be used as an easy, simple, and personalized screening test to evaluate body fat that means *Medovriddhi*. BMI is a wider used GP for

predicting the level of obesity. It is reasonable to consider GP as a tool to screen individuals with obesity in combination with BMI. When it is not possible to use BMI, such as for individuals with amputee's legs. It is impractical to measure the height and weight of a person, then GP would be a logical method to assess obesity. As BMI increases neck fat also increases with central body fat. That's why correlation may become positive.

**LIMITATIONS**

It is difficult to make a causal inference as it was a cross-sectional study. Our study was small-scale hospital-based study results may over or underestimate the true correlation between other anthropometric and laboratory parameters in metabolic syndrome so a larger study needs to be conducted to conclude.

**CONCLUSION**

The study shows a positive correlation between GP and BMI to assess one of the risk factors for cardiovascular diseases. As BMI increases, GP increases in obesity. Thus, it is reasonable to consider anthropometric measurement *Angulpramaan* for the prediction of *Medovriddhi*.

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