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ASSESSMENT ANAEMIA AND HYPERTENSION IN RELATION TO DIFFERENT BMI CATEGORIES AMONG PADDY THRESHING WORKERS

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ABSTRACT ■ As Agriculture workers do the paddy threshing work by manual means as well as using a paddy machine with foot pedal. Threshing activity was very strenuous and physiologically demanding. The main aim of the present investigation was to evaluate the occurrence anaemia and blood pressure in relation to nutritional status of the paddy threshing workers. For the study 352 workers engaged in paddy threshing were selected at random from villages of different districts of West Bengal state. The Socioeconomic Status (SES) was evaluated by modified Kuppuswami Scale. The nutritional status of the workers was determined by cut-off values of Body Mass Index (BMI) as prescribed by WHO. The general health condition of paddy threshing workers was evaluated by the measurement of blood pressure and blood haemoglobin concentration level. The results revealed that most of the paddy threshing workers was belonging to upper lower socioeconomic class (male: 81.33%; female: 84.72 %). The chronic energy deficiency (CED) was prevalent (male: 26.11%; female: 40.71%) among the workers engaged in paddy threshing. In the study population, the prevalence of anaemia was 46.11% in males and 69.19% in females, which was more than the global value. The results indicated that the energy deficiency in paddy workers (BMI <18.5 kg/m^2) of both sexes were more likely to be anemic compared to of normal and overweight individuals. The occurrence of hypertension was more in males compared to that of females. The incidence of hypotension in females was higher than that of males. It was concluded that the occurrence of anaemia and abnormalities of blood pressure among paddy threshing workers was linked to their BMI values.

Key Words: Paddy Threshing, Agriculture, BMI, Anaemia, Hypertension, Hypotension and Socioeconomic *Status.*

INTRODUCTION :

India is an agriculturally oriented country and agriculture plays a significant part in the country's economic growth. According to the 2011 census, 57.05 percent of men and 42.95 percent of women in India work in agriculture (Census of India, 2011). Cereal production (rice, wheat, etc.) is the most popular agriculture in India. Agriculture workers are involved in different phases of paddy cultivation, such as, scattering of seeds, uprooting, transplantation, weeding, reaping, binding of straw bundles, carrying of straw bundles, and threshing etc. Threshing is a post harvesting activity and both male and female workers actively

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participate in this agricultural task. Traditional threshing of paddy is generally done by the hand: bunches of panicles are beaten against a hard element (e.g., a stiff wooden bar, stone or bamboo table or drum) or with a flail. Manual pedal operated threshing machines are also used to thresh the paddy in the field or farm. One or two person operates the machine with foot pedal and feed the bales from the behind for threshing the crops. In addition to that the operator keeps on spreading the paddy bundle on the threshing drum so that panicles get detached. This requires a suitable hand orientation to keep the paddy spreading. Pedal threshing requires synchronization of both hand and leg (Mahata *et. al.,* 2015). However, little hindrance cannot be avoided, as the pedal movement is continuous and very fast. Working in the same situation for prolonged periods was the work factor recognized as most challenging. Threshing activity is very strenuous and physiologically demanding.

A large number of people of West Bengal state, especially of Midnapore (East and West), Purulia, Bankura, Howrah district etc. are engaged in agriculture throughout the year. The majority of these agricultural employees come from rural and economically depressed areas where job prospects are few (Pal *et al.,* 2014). Farmers are forced to perform the majority of agricultural duties using only their own efforts because of their poverty. Even now, Indian agriculture relies heavily on manual labour, despite the fact that modernization has reached some sections of the country. Agricultural work is performed by manual labour, and agricultural employees, possibly more than any other occupational group, are subjected to a wide range of physiological strains (Sabharwal and Kaushik, 2011). These manual procedures are often seen as a source of drudgery that is possibly destructive to their health and well-being because to their energy requirements and they are widely regarded as a source of drudgery that is potentially harmful to their health and well-being (Sabharwal and Kaushik, 2011).

Working condition can substantially affect the health and nutrition of agriculture labourers (Meinzen *et al*., 2012). Farm labourers have a difficult existence filled with heavy work, stress, and uncertainty about their jobs; they live in deplorable circumstances, and they barely receive the health treatment they need. Socioeconomic status (SES) of a population is an important aspect in community based studies because it is an important determinant of health and nutrition of an individual. Body mass index (BMI) is the most efficient epidemiological measure of general obesity, according to the World Health Organization (WHO, 2012). BMI, in addition to nutritional status, is regarded as a useful predictor of a population's socioeconomic state, particularly among adult population in developing nations (Venkatramana *et al.,* 2005). BMI is a most effective indicator tool for nutritional evaluation (Das and Bose, 2010).

The agricultural workers may have the common health problem like, anaemia. Hemoglobin measurement is one of the most routinely conducted clinical tests in determining an individual's primary health condition. The concentration of hemoglobin (Hb) is the most widely used test for anaemia diagnosis (Karakochuk *et al*., 2019). Anaemia is linked to a lower quality of life in terms of health (NKF, 2001). Anaemia is a worldwide public health issue that affects both developing and wealthy nations (Azeredo *et al.,* 2013). Anaemia is a serious public health issue that has a detrimental impact on

people's health and a population's economic potential (Garcia-Casal *et al.,* 2019). Blood pressure screening is an important part of general health. Blood pressure is considered as sensitive indicator to check the subject's physical soundness.

The main aim of the present study was to evaluate the prevalence of anaemia and status of blood pressure in relation to BMI of agricultural workers engaged in threshing of paddy.

METHODOLOGY:

i) Site and Subjects:

The present study was conducted on 180 male and 172 female paddy threshers (age group of 20-55 Years), randomly selected form different villages of different districts of West Bengal, India.

Prior permission and ethical approval was obtained from Institutional Ethics Committee before commencement of the study and the experiment was conducted in accordance with the ethical standards of the committee and with the Helsinki Declaration.

❒ ***Subject inclusion criteria***:
- Subjects having age 20 years to 55 years
- Apparently healthy subjects

❒ ***Subject exclusion criteria:***
- Subjects below 20 years
- Subjects above 55 years
- Subjects with physical deformities
- Subjects having acute cardiovascular, serious arrhythmias, chronic addiction and other diseases.

ii) Socioeconomic Status (SES):

Socioeconomic status of the subjects was evaluated by modified Kuppuswami Scale (Gururaj and Maheshwaran, 2014). From the response of the subjects each question quoted against their score and determined summated score is compared with the graded chart of social status.

iii) Measurement of Anthropometric Dimensions:

Anthropometric measures were taken from the subjects following standard techniques and appropriate landmarks (Ermakova *et al.,* 1985). Weight was measured to the nearest 0.1 kg using portable weighing machine (Libra) and height was measured to the nearest 0.1 cm using anthropometer (Hindustan Minerals).

iv) Body Mass Index (BMI):

From measures of height and weight of the subjects the body mass index (BMI) was computed using the following standard equation (Park and Park, 2005): BMI = weight (kg) / height^2 (m). The subject was classified into three classes, viz., underweight (BMI $<$18.5 kg/m^2), normal weight (BMI 18.50-24.99 kg/ m^2) and overweight (BMI = 25.00 kg/m^2) in accordance with the international classification system of the WHO (2004).

v) Measurement of Blood Pressure:

The systolic and diastolic blood pressure of the workers was measured during resting conditions. The blood pressure was measured by auscultatory method, with the help of a sphygmomanometer (mercury type) and a stethoscope (Weiner and Lourie, 1981). The subjects were classified as normotensive, hypotensive and hypertensive according to the US Seventh Joint National Committee on Detection, Evaluation, and Treatment of Hypertension (JNC VII) guidelines (Chobanian *et al.,* 2003).

Normotensive: SBP $<$120 mm Hg and DBP $<$80 mm Hg

Hypertensive: SBP $\geq$ 140 mmHg and DBP $\geq$ 90 mmHg

Hypotensive: SBP $\leq$ 90 mmHg and DBP $\leq$ 60 mmHg

vi) Determination of Hemoglobin Concentration:

The hemoglobin (Hb) level in the blood was measured with a finger prick sample of capillary blood and analyzed immediately using a hemoglobinometer (STAT-Site M Hemoglobin Analyzer, STANBIO Laboratory, USA) (Pal *et al.,*2014).

vii) Determination of Resting Heart Rate:

The resting heart rate of the subjects was measured by 30 beat times taken recording method following arrest period of 15 minutes under sitting in relax condition. An electronic stop watch was used for measuring the time.

RESULTS:

The educational status of the paddy threshers has been shown in Table 1. From the results, it was noted that both male and female paddy threshers had got very low level of education. Approximately 46.11% of the males and 54.07% of females were illiterate. Among the rest, only 7.22% of males male and 8.14% of females had secondary level and only 2.22% of males and 1.74% of females had above secondary level education.

The findings also showed that the females possessed lower level of education than that of the male paddy threshers. The explanation for low literacy level of the workers may be associated with the poor economic status of their family and lack of awareness about the advantage of education.

It was noted from the socioeconomic score (Table 2) that a bulk number of the paddy threshers were belonging to upper lower socioeconomic class (male: 81.33%; female: 84.72 %). A notable percentage of the workers

Table 1: Frequency (f) and percentage (%) of educational status of the paddy threshing workers

Sex	f & %	Illiterate	Literate			
			Primary level	Upper primary level	Secondary level	Above secondary level
Male (n=180)	f	83	58	22	13	4
	%	46.11	32.22	12.22	7.22	2.22
Female (n=172)	f	93	39	23	14	3
	%	54.07	22.67	13.37	8.14	1.74

Table 2: Socioeconomic status of paddy threshing workers according to the modified Kuppuswami Scale (values showing the % of total subjects)

Total Score	Socioeconomic Status Scale	Male (n=180)	Female (n=172)	All together (N=352)
26-29	Class I (Upper)	-	-	-
16-25	Class II (Upper middle)	-	-	-
11-15	Class III (Lower middle)	18.67%	11.74%	15.28%
5-10	Class IV (Upper lower)	81.33%	88.26%	84.72%
<5	Class V (Lower)	-	-	-

were within the lower middle class (male: 18.67%; female: 11.74%) also. The low socioeconomic status of the paddy cultivators could be associated with their lack of education and proper nutrition.

The stature and weight of the paddy threshing workers were measured and BMI was calculated from the data and the results have been presented in Table 3. It was observed that the mean values of BMI for both male and female were low and falling under the 'lower weight' category (Table 4). The results indicated that the stature, weight and BMI of male workers were significantly ($p<0.001$) higher than that of the female paddy threshers.

Several groups of researchers used WHO proposed BMI cutoff points for classifying subjects into underweight or overweight (WHO, 1995, 2004). On the other hand Ferro-Luzzi *et al.* (1992) proposed BMI cutoff points to classify subjects for different nutritional

Table 3: The physical characteristics of the paddy threshing workers

Variables	Male (n=180)	Female (n=172)
Age (years)	33.06±10.45	32.48±9.39
Body Weight (kg)	54.26±8.56	44.27±7.32***
Stature (cm)	162.77±5.52	152.02±5.98***
BMI (kg/m^2)	20.43±2.71	19.09±2.53***

w.r.t male *** $P<0.001$

Table 4: Frequency (f) and percentage (%) of Chronic Energy Deficiency (CED) according to BMI of the paddy threshing workers (n=352).

BMI Value	CED Classification[1]	BMI Classification[2]		Frequency and Percentage of the paddy threshers				Chi Square Value between two group ($\chi 2$)
		Classification	Sub class	Male (n=180)		Female (n=172)		
				f	%	f	%	
<16.00	CED Grade III (Severe)	Under weight	Severe thinness	2	1.11	18	10.47	14.36***
16.00 - 16.99	CED Grade II (Moderate)		Moderate thinness	4	2.22	18	10.47	10.19**
17.00 - 18.49	CED Grade I (Mild)		Mild thinness	41	22.78	34	19.77	0.47
18.50 - 20.00	Low weight normal	Normal range		46	25.56	46	26.74	0.06
20.01 - 24.99	Normal			72	40.00	54	31.40	2.83
25.00 - 29.99	Obese	Overweight		15	8.33	2	1.16	9.83 **
≥30.00		Obese		0	0.00	0	0.00	0.00

[1]Ferro-Luzzi Classification (Ferro-Luzzi et al. 1992); [2]WHO Classification (WHO, 1995)
w.r.t male **$p<0.01$, *** $P<0.001$

grade. However, in both the cases, a cutoff point for BMI of 18.5 kg/m^2 was taken for chronic energy deficiency (CED) (Bailey and Ferro-Luzzi, 1995; Khongsdier, 2005) as well as underweight (WHO, 2000, 2004) category. Thereby, for screening of the CED grades of the cultivators, the value of 18.5 was taken as the cutoff point.

Table 4 represents the percentage distribution of paddy threshers of present study according to BMI. The CED was prevalent (male: 26.11%; female: 40.71%) among the paddy threshers. About 65.56% of males and 58.14% of females were normal while a very less percentage (male: 8.33%; female: 1.16%) of them were overweight/obese.

It was noted that the average blood hemoglobin values of both male and female paddy threshers were below the normal range (Table 5). Especially, its value in the female workers was very low and significantly ($P<0.001$) lower than that of the males.

Both male and female paddy workers had mild, moderate or severe anaemia based upon their hemoglobin status following international reference (WHO, 2011) and have been presented in Table 6.

In the study population, the prevalence of anaemia (Table 6) was 46.11% in males and 69.19% in females, which was more than the global prevalence (Worldwide prevalence of anaemia, 1993–2005; De-Mayer and Tegman,

Table 5: Mean± SD of hemoglobin content (g/dl) among male and female paddy threshers

Sex	Mean±SD
Male (n=180)	12.14±2.73
Female (n=172)	10.00±2.06***

w.r.t male ***p<0.001

Table 6: Prevalence Frequency (f) and percentage (%)) of different categories of anaemia among male and female paddy threshers

Haemoglobin levels to diagnose anaemia		Male (n=180)		Female (n=172)		Chi Square Value between two group (χ2)
		(f)	(%)	(f)	(%)	
Non-Anaemic (Male- Hb.<13g/dl; Female- Hb.<12g/dl)		97	53.89	53	30.81	19.15***
Grades of Anaemia	**Mild (Male- Hb.10-12.9 g/dl; Female- Hb.10 –11.9 g/dl)**	40	22.22	52	30.23	2.92
	Moderate (Hb.7-9.9 g/dl)	31	17.22	46	26.74	4.66*
	Severe (Hb.< 7 g/dl)	12	6.67	21	12.21	3.18
All anaemia category		83	46.11	119	69.19	19.15***

w.r.t male *p<0.05; ***p<0.001

1998). Among these, 22.22% of males and 30.23% of females had mild, 17.22% of males and 26.74% of females had moderate and 6.67% of males and 12.21% females had severe anaemia.

The participants were divided into anaemic and non-anaemic groups with the cutoff value of hemoglobin (anaemia < 13.0 g/dl for male and < 12.0 g/dl for female).

The mean values of BMI and resting heart rate were also compared between those anaemic and non-anaemic groups (Table 7).

Table 7: Comparison of heart rate and BMI between anaemia and non anaemia subjects

Parameters	Male (n=180)		Female (n=172)	
	Non-Anaemia (n=97)	Anaemia (n=83)	Non-Anaemia (n=53)	Anaemia (n=119)
Heart rate (beats/min)	74.61±6.60	84.37±7.24***	72.91±4.52	82.10±6.75***
BMI (kg/m^2)	22.29±2.30	18.24±0.90***	21.14±2.66	18.18±1.85***

w.r.t. Non anaemia ***$p<0.001$

Table 8: Percentage (%) of normal (non anemic) and different groups anemic subjects according to BMI categories.

Sex		BMI		
		Underweight	Normal	Overweight/Obese
MALE		(n=47)	(n=118)	(n=15)
Normal		38.30	52.54	80.00
Anaemia	Mild	21.28	37.29	20.00
	Moderate	25.53	10.17	0
	Severe	14.89	0	0
	Total	61.70	47.46	20.00
OR		6.44	3.61	1
(95% CI)		(1.59-26.01)	(0.96-13.47)	-
Significant Level		0.0089	0.0557	-
FEMALE		(n=70)	(n=100)	(n=02)
Normal		20.00	38.00	50.00
Anaemia	Mild	38.57	39.00	50.00
	Moderate	24.29	14.00	0
	Severe	17.14	9.00	0
	Total	80.00	62.00	50.00
OR		4.00	1.63	1
(95% CI)		(0.23-67.10)	(0.10-26.86)	-
Significant Level		0.3375	0.7319	-

[OR= Odd Ratio, CI= Class Interval]

The findings revealed that the mean BMI of anaemic persons was substantially lower than that of non-anaemic adults in both sexes (Table 8). However, in anaemic group, the mean resting heart rate was significantly greater than that of the non-anemic group.

The Odd Ratio (OR) became higher in underweight group compared to the normal and overweight /obese groups of both sexes (Table 8). In case of male, it was about six times higher in underweight group and three times higher in normal group compared to the overweight /obese group. In case of female the odd ratio was four times higher in underweight group and approximately two times higher in normal group compared to that of the overweight/obese group. The results indicated that the thin paddy threshing workers (BMI <18.5 kg/m^2) of both sexes were more likely to be anemic compared to of normal and overweight individuals.

The systolic, diastolic and mean arterial blood pressures of the paddy threshing workers have been shown in Table 9 according to the sex.

It was noted (Table 9) that the average blood pressure values (SBP and DBP) of both male and female workers were within the normal range. However, those values were significantly lower ($P<0.001$) in female than that of their male counterpart.

In the study population, the participants were categorized into normotensive, hypotensive and hypertensive according to the blood pressure cut-off values as described by Chobanian *et al.,* 2003 and it was found (Table 10) that most of the participants were within the normotensive range (male: 60 %; female: 59.88%). However, a notable percentage of the participants had hypertension (male: 28.33%; female: 16.27%), although the prevalence of hypotension was low (male: 11.66%; female: 23.83%). The results also indicated that the prevalence of hypertension

Table 9: Mean±SD of blood pressure of paddy threshing workers.

Blood Pressure	Male (n=180) (Mean ± SD)	Female (n=172) (Mean ± SD)
SBP (mm Hg)	124.09±14.04	114.76±14.85***
DBP (mm Hg)	81.03±9.52	75.49±9.70***
MAP (mm Hg)	95.39±10.44	88.58±10.76***

SBP- Systolic blood pressure; DBP- Diastolic blood pressure, MAP- Mean arterial pressure
w.r.t. male *** $p<0.001$

Table 10: Frequency and percentage of the workers of different blood pressure categories

Blood pressure categories[#$] (mm-Hg)	Male (n=180)		Female (n=172)		Chi Square Value between two group ($\chi 2$)
	(f)	(%)	(f)	(%)	
Hypotension	21	11.66	41	23.83	8.97**
Normotension	108	60.00	103	59.88	0.00
Hypertension	51	28.33	28	16.27	7.34**

[#]Chobanian et al. 2003; [$]Pickering et al. 2005 w.r.t. male ** $p<0.01$

was significantly ($p<0.01$) higher in males than that in females, but in case of females, hypotension was significantly ($p<0.01$) higher than that of the males. In the instance of normotensive subjects, however, there was no significant difference between males and females.

The prevalence of hypertension and hypotension among the paddy threshing workers having different BMI categories was studied (Table 11) and it was found that the prevalence of hypertension was low in underweight (male: 12.77%; female: 8.57%) and normal groups (male: 29.66%; female: 21%), whereas a considerably high prevalence of hypertension was noted in the overweight/obese group (male: 66.67%; female: 50%). The result indicated that there were significant differences in the occurrence of hypertension among the BMI categories except between underweight and normal groups of both sexes. In the occurrence of hypotension, however, opposing tendencies were seen. A higher prevalence of hypotension was found in the underweight group (male: 25.53%; female: 38.57%) compared to the normal (male: 6.78%; female: 14%) and overweight/obese groups (male: 6.67%). The result also indicated that there were significant differences in the percentage of hypotension among the BMI categories except between normal and overweight/obese groups. The odd ratio became significantly higher in the overweight/obese group, and it was approximately twelve times higher in the overweight/obese group compared to the underweight group in the hypertensive subjects of both sexes. In case of the hypotensive category, the odd ratio was significantly higher in the underweight group, and they were approximately five times higher in underweight group compared to the overweight/obese group of males and four times higher in the underweight group compared to the normal group in females.

DISCUSSION:

The socioeconomic status of an individual or a population is dependent on several factors. In the present study this status of paddy threshing workers was determined by terms of their literacy level, occupation, and financial condition. It was observed (Table 2) that a large number of workers of both sexes were belonging to the upper lower socioeconomic class (84.72%) which might be

Table 11: Prevalence (%) of hypertension and hypotension according to the nutritional categories

BMI Classification	Hypertension				Hypotension			
	Prevalence		OR (95% CI)		Prevalence		OR (95% CI)	
	M	F	M	F	M	F	M	F
Underweight	12.77	8.57	1	1	25.53	38.57	4.80 (0.57-40.47)	3.86## (1.83-8.10)
Normal	29.66	21	2.88# (1.12-7.40)	2.83# (1.08-7.44)	6.78	14	1.01 (0.12-8.76)	1
Overweight / Obese	66.67	50	13.67## (3.46-53.97)	10.66 (0.59-192.97)	6.67	-	1	-
χ^2	16.57***	6.35*	-	-	11.86***	14.33***	-	-

*p<0.05, ***p<0.001 # p<0.05, ##p<0.001

(M: Male; F: Female)

owing to low daily wage and also non-availability of work throughout the year. The same trends of results were also reported by Anshu and Varma (2017). Mahata *et. al.,* 2015, observed that a large number of workers were compelled to leave school before finishing primary education due to poor economic conditions. This might be due to economic pressures to support their family livelihood, which force them to overburden themselves with agricultural labor, particularly low-paying, low-skilled and repetitive occupations. They were compelled to engage themselves in the agriculture fields in order to support their families (Bala, 2010). Another explanation for this might be the low literacy rate (Table 1). Workers were unaware of the various occupational illnesses, their treatment, or remedial measures due to a lack of knowledge as well as low educational level (Kar and Dhara, 2007). Their poverty pushes them to labor in deplorable conditions. This further adds to the workers' physical pain, which is yet to be addressed (Manoharan *et al.,* 2012). Workers who make up a significant percentage of the unorganized labor sector in rural regions are frustrated and have a low quality of life due to poverty and a lack of other employment possibilities (Sain and Meena, 2018). In the present study, it has been pointed that the females were educationally poorer (Table 1) than the male workers. The paddy threshing workers' poor socioeconomic level might have an impact on their nutritional status and health as well. In addition to that the socioeconomic status of the workers might have an impact on work-related health issues. According to the study by Boyer *et al.,* (2009), it was observed that work-related musculoskeletal diseases (WMSDs) were influenced by the workers' socioeconomic status.

From the result (Table 4) it was observed that a major percentage of paddy threshing workers were underweight (male: 26.11%; female: 40.71%). Such health condition of the workers might be due to the deprived nourishment as a result of low consumption of nutritious food. This in turn might be related to lower socioeconomic condition (84.72%) of the workers. Low socioeconomic status (Table 2) of the workers might be one of the reasons of low BMI (Table 4). This low socioeconomic status may be related to their nutrition and health status also (Bose *et al.,* 2007). Thomas and Strauss (1997) found that the body-mass index is an important determinant of wages for males, particularly among the less educated ones (Croppenstedt & Muller, 2000). The study of Chakraborty *et al.,* (2007) and Bose *et al.,* (2007) revealed that the monthly family income was substantially and positively linked with BMI. According to them, the lowest income family group had the lowest mean BMI.

Based on the WHO (1995) classification, it was revealed (Table 4) that prevalence of CED was very high among both male and female paddy threshers and thus the situation was critical among them. This indicated that most of the workers were suffering from nutritional deficiencies. Low body mass index and notable undernutrition were important public health issues in emerging nations, particularly among poor rural adults (WHO, 1995). Different groups of researchers conducted various investigations, which unanimously indicated that the adult Indian rural population was suffering from some grade of CED (Bose *et al.*, 2007; Chakraborty *et al.*, 2007). According to the study by Ijaz *et al.*, (2020), majority of the workers were underweight. Poor-quality food rendered drug addicts and mentally unstable unorganized-sector employees affected their health and body weight which put them at

risk for ergonomic hazards. Strenuous physical activity might be one of the causes for their body's low fat content, which leads to a low body weight. Some well-known variables, including socioeconomic disparities and the lifestyle of industrial workers, have a significant impact on BMI (Wadden *et al.*, 2012; Eckel *et al.*, 2014)

The prevalence of anaemia was high among the workers, particularly in female workers. Many studies have reported some physiological differences present between anaemic and non-anaemic individuals. In the present study, the mean value of resting heart rate was significantly higher in anemic groups (Table 7) than that of non-anemic groups. Anaemia was previously thought to be linked to a low heart rate (Gehi *et al.*, 2005). According to the study of Weiskopf *et al.*, (2003), each gm/dl drop in haemoglobin concentration increased the heart rate by 4 bpm. Ickx *et al.*, (2000) evaluated a sample of 20 conscious individuals and found that their heart rate increased by 2.2 beats per minute per g haemoglobin decrease, when their haemoglobin content was dropped from 13.7 g/dl to 8.6 g/dl. Severe anaemia may impair the capacity to provide enough oxygen to satisfy the demands of increased myocardial oxygen consumption induced by a faster heart rate (Weiskopf *et al.*, 2003).

The current study (Table 7) indicated that the mean value of BMI was significantly lower among anemic individuals than the non-anemic individuals of both sexes. In the National Family Health Survey (NFHS-2) study (National Family Health Survey (NFHS-2), 1998–99), it was stated that individual with a low BMI had a somewhat higher prevalence of anaemia than another. Ramachandra and Kasthuri, (2008-2010) studied on anaemia in the elderly south Indian rural population and shown an association between the higher prevalence of anaemia and low BMI. Bentley and Griffiths (2003) also reported that the prevalence of anaemia was significantly increased with a decrease in the BMI. Gupta *et al.* (2011) reported a similar finding in their study. Kanani and Poojara (2000) observed that low BMI category had high prevalence of anaemia. Malhotra *et al.* (2004) also point out that the prevalence of anaemia was higher among people with a poor socioeconomic level, as well as those who were illiterate and had a low body mass index.

In the study population most of the participants were in the normotensive range in both male & female (Table 10). Alhawari *et al.* (2018); observed that there were substantial gender differences in both systolic and diastolic blood pressure, with males having greater systolic and diastolic blood pressure than that of females (Oparil and Miller, 2005).In the present investigation same trends of results was reflected (Table 9). The systolic blood pressure (SBP) was shown to be substantially lower in women but no significant difference in diastolic blood pressure (DBP) was identified (Anish *et al.*, 2013).

Pramanik *et al.* (2010), found in their study that a large percentage of the agricultural workers had blood pressure with high normotensive values. Regular physical exercise and a low-fat diet are two variables that may contribute to maintain healthy blood pressure levels. The findings (Demos *et al.*, 2013) of blood pressure records revealed that farmers had a greater percentage of normotension but less hypertension than non-farmers.

Human population observational researches demonstrate that work stress was a source of life stress that could impact on blood pressure levels (Radi *et al.*, 2005). The farmers were found to have a high incidence of arterial

hypertension (Tomei *et al.,* 2013). In the present study it was observed that a small percentage (males: 28.33% & females: 16.27%) of agriculture workers had hypertension (Table 10). According to a research work (Kuper *et al.*, 2002), low socioeconomic level and educational status were linked to an unhealthy lifestyle, psychological stress, and an increased incidence of high blood pressure. Zhang and Moran (2017) found that the prevalence of pre-hypertension was higher among men than that of the women. From the study of the Venkatramana and Reddy (2002), it has been revealed that the percentage of hypertention of the Indian rural male population was comparatively lower than that of the urban.

The occurrence of hypotension was high in females (Table 10 & 11). Hypotensive occurrences might be linked to a low-risk cardiovascular profile in these individuals (Owens *et al.*, 2000). According to current research, estrogen may modify vascular endothelial function, resulting in vasodilatation, which may contribute to reduced blood pressure in female (Mendelsohn & Karas, 1999).

Therefore, it appeared that the increase in BMI had a significant clinical effect on blood pressure variables. In the present study, prevalence of high blood pressure was greater in those with high BMI values (Table 11), which was also reported in other studies (Rohrer *et al.*, 2007; Kannel, 2000; Mungreiphy *et al.*, 2011). The prevalence of hypertension increased significantly from underweight to obese categories, according to Chakraborty et al. (2009). Mungreiphy *et al.* (2011), also observed that underweight subjects were less likely to have high blood pressure than those who were in normal BMI category. Overweight or obese subjects were more likely to have higher blood pressure than those with normal BMI. The significant trend of an increased risk of hypertension with an increased BMI was found to be similar to the results from cross-sectional studies conducted in Asian populations (Santhirani *et al*. 2003; Simony *et al.* 2007). Hu *et al.* (2007), also found higher prevalence of hypertension with higher BMI levels. Bernabe-Ortiz *et al.* (2021), reported that greater BMI was associated with higher blood pressure levels in population groups of Peru. Other studies also reported that hypertension was, 4.17 times higher among those who were obese, compared with those of normal weight (Shihab *et al.*, 2012, Wilson *et al.*, 2002). Faramawi (2015) found that, for every one-unit increase in BMI, short-term blood pressure variability (BPV) increased by 0.25. Obesity-related hypertension, according to Doll *et al.* (2002), was caused by insufficient vasodilatation in the presence of increased blood volume and cardiac output, both of which were normal outcomes of increased body mass. According to Chakraborty *et al.* (2009), a prevalence of hypotension lower than 15% was of no consequences to public health. Chandra Babu and Shantharajah (2019) observed that low BMI people had lower SBP and DBP value than the high BMI people.

CONCLUSION:

It appeared from the study of BMI that a large percentage of male and female paddy threshing workers were undernourished, which might be related to their low socioeconomic status. The prevalence of anaemia was high in underweight category as well as in the female agricultural workers. The blood pressure of most of the paddy threshing workers was within the normotensive range which might be due to their regular physical activities related to the

agricultural tasks. The incidence of hypotension was high in females than that of males which might be due to their lower BMI values. The prevalence of anaemia and abnormality in blood pressure (hypertension or hypotension) might be related to BMI values of the paddy threshing workers.

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