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[REVIEW ARTICLE]

Prevalence of Hand Arm Vibration Syndrome and it's Association with Hand Grip Strength in Farmers Around Jalgaon District

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ABSTRACT :

Aim- To find the Prevalence of hand arm vibration syndrome (HAVS) and its association with hand grip strength in farmers around Jalgaon district.

Objectives- To find the prevalence of HAVS in farmers using the Stockholm workshop scale and assess hand grip strength in farmers with HAVS using a Hand dynamometer.

Methodology- A prevalence study was conducted among farmers. Farmers were selected according to inclusion criteria. The Stockholm workshop scale was used to check vascular and sensorineural symptoms in farmers. After diagnosing HAVS, the hand grip strength of the subjects was assessed by using a hand dynamometer.

Result- Data from 90 farmers was obtained and analyzed. Of the affected population of both vascular and sensorineural components, 18.88% had mild symptoms, and 13.33% had moderate symptoms. Among which mild (n=2) population and moderate (n=8) population had very poor grip strength (<40).

Conclusion- The total prevalence of the affected population having HAVS is 31%. There may be a risk of having more severe symptoms of HAVS in the future, which provides a better understanding of the impact and extent of HAVS on farmers.

Keywords- *Farming, Hand arm vibration syndrome, handgrip strength.*

INTRODUCTION

Hand arm vibration syndrome (HAVS) is an occupational disease that affects workers exposed to vibration. It is considered as a work-related disease.[1] This condition is associated with vibrating tools that occur mainly in men.[2] Hand arm vibration syndrome (HAVS) is a chronic and progressive disorder.[3]

Vibration is defined as oscillatory motion. Oscillatory displacement involves alternate velocity in the opposite direction. This velocity change means that the object constantly accelerates, first in one direction and then in the opposite direction. The oscillatory motion from a source, e.g., a vehicle or a tool, may be a simple harmonic sine wave, a multiple wave complex differing in frequency and acceleration, or a random, non-repeating series of complex waves.[4]

Hand-arm vibration syndrome likely causes local endothelial damage through mechanical trauma and oxidative stress and leads to peripheral vasoconstriction by activating the sympathetic nervous system. Vibration exposure might damage both large (myelinated) and small (unmyelinated and myelinated) nerve fibers of the finger. [5]

High-frequency vibration is first absorbed by the body's distalmost part, namely fingers and hands. This gives rise to the vascular and sensorineural symptoms of HAVS. The vibration of lower frequencies is likely transmitted to the arms and shoulders, which is associated with musculoskeletal abnormalities in the Hand and leads to pain, tingling, loss of function of hands, and reduced grip strength in farmers.[1]

Farming is an occupation that requires great effort as

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the world advances new machinery designed to decrease farmers' workload, which may affect their physical condition owing to its nature of performance and repetitive use. This occurs due to degeneration, excess physical efforts, and whole-body vibration.[1]

Long-term occupational exposure farmers are prone to various musculoskeletal and cumulative trauma disorders.[1] The farming equipment such as harvesters, tractors, cultivators, seed drills, and JCB, also farmers use appreciable force while working in the fields and carry out activities such as lifting, digging, and shoveling [1]

Pathophysiology:

The pathophysiology of the HAVS mechanism is not yet fully understood, and mechanical stimulus is thought to cause specific anatomical changes in the digital vessels (i.e., vessel wall hypertrophy and endothelial cell damage). In the initial stages, there is extrusion of fluid into the tissues. Combined with the subsequent spasmodic ischemia from cold-induced vasospasm, this edema damages the mechanoreceptor nerve endings and nonmedullated fibers. Subsequently, a demyelinating neuropathy of the peripheral nerve trunks develops.

Cold causes platelet aggregation. The subsequent release of serotonin (5-hydroxytryptamine [5-HT]) promotes 5-HT from the platelets, and the increased concentration stimulates smooth muscle to contract. Besides inhibiting platelet aggregation, the release of prostacyclin and endothelium-derived relaxing factor (EDRF) stimulates the production of cyclic adenosine monophosphate (Camp) and cyclic guanosine monophosphate (cGMP) in the smooth muscle cell. The simultaneous interaction of these mechanisms produces a delicate balance between smooth muscle contraction and relaxation.[6]

HAVS has three components[1][7]

1. Vascular.
2. Sensorineural.
3. Musculoskeletal.

The symptoms of vascular components include episodic finger blanching and cold intolerance, the type of secondary Raynaud's phenomenon, and the most established diagnosis of HAVS. It occurs because of local epithelial damage caused by repetitive mechanical trauma. This symptom may be seen less in tropical areas owing to temperature variation. The symptoms of sensorineural components include paresthesia or altered sensation, tingling, and numbness experienced in the hands of farmers. The symptoms of musculoskeletal components include pain and weakness in the upper extremities, leading to reduced grip strength of farmers. [1][6][7]

In advanced cases, peripheral circulation becomes sluggish, giving a cyanotic tinge to the skin of the digits. In contrast, in very severe cases, trophic skin changes (gangrene) will occur at the fingertips. The toes may be affected if directly subjected to vibration from a local source, such as vibrating platforms, or they may be affected by reflex spasms in subjects with severe hand symptoms. Reflex sympathetic vasoconstriction may also account for the increased severity of noise-induced hearing loss in HAVS farmers. [6]

The Hand is considered to be the most sophisticated and differential musculoskeletal tool. Hand grip strength is defined as a forcible activation of fingers and thumb acting against the palm for transmitting force to an object. Farmers need hand grip strength to do digging, lifting, and shoveling. HAVS damage soft tissues or may occur secondary to local nerve damage. This results in a loss of dexterity in Hand, which may impair daily activity. [1]

HAVS is a very painful and potentially disabling condition of the fingers, Hand, and arm due to vibration. There is initially a tingling sensation with numbness in the fingers. The fingers then become white and swollen when cold & then red and painful when warmed up.

Methodology

It is a prevalence study performed at hospital campuses and farming fields in and around Jalgaon district. The study lasted 6 months and was conducted among the local farmers in and around the Jalgaon district. Working farmers aged 35 to 55 years were selected by random sampling method. Male subjects working in the fields for more than 3 years and those using machinery in the field, such as tractors, harvesters, JCB, etc., were included in the study. Approximately 90 male farmers were selected based on inclusion and exclusion criteria and were requested to participate in the study, out of which around 90 farmers filled out the written consent form. Initially, the Stockholm workshop scale was

used to check vascular and sensorineural symptoms in farmers. After diagnosing HAVS, the hand grip strength of the subjects was assessed by using a hand dynamometer. Data was collected and analyzed, and a result was obtained.

Procedure

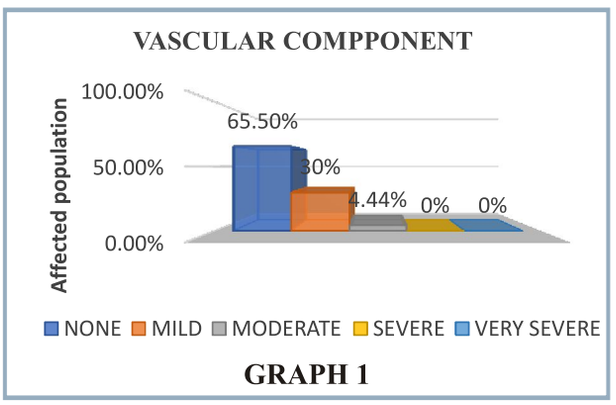
A prevalence study was conducted on 90 subjects aged 30 to 55 around Jalgaon. Approximately 90 male farmers were selected based on inclusion and exclusion criteria. They were clinically assessed for HAVS signs and symptoms of the vascular and sensorineural disorder using the "Stockholm workshop scale."

In addition, the handgrip strength was assessed using a handheld dynamometer. The participant sits comfortably on a chair with the elbow towards/against the body, flexed at 90 degrees, and the forearm and wrist in a neutral position. Place the hand dynamometer in the participant's Hand, and let the participant arrange the instrument to fit comfortably in the Hand. Asked the participant to squeeze with maximum strength. The needle will automatically record the highest force exerted. Grip force should be applied smoothly, without rapid wrenching or jerking motion. Then, the subjects were asked to record dominant Hand twice and the best effort rating.

Results

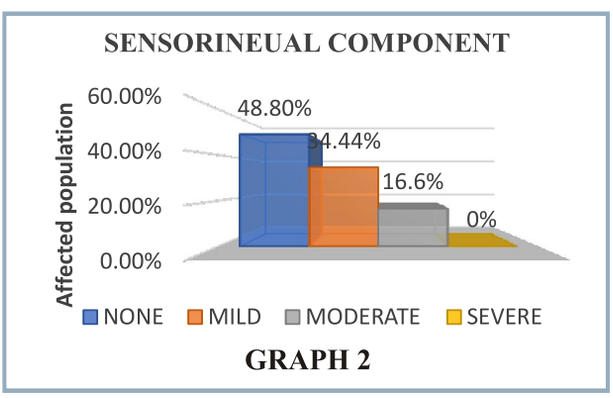
The present study was conducted on a population of 90 participants with a mean age of 40.2 using a vibrating tool.

Table 1 Represents the gradings of the vascular component of HAVS, which ranges from 0V to 4V, among which 65% of the population had no attacks of vibration white fingers (VWF) on exposure to tools, and 30% of the population had mild symptoms with occasional attacks affecting only tips of one or more fingers and 4.44% of the population had moderate symptoms with occasional attacks affecting the distal and middle phalanges of one or more fingers.



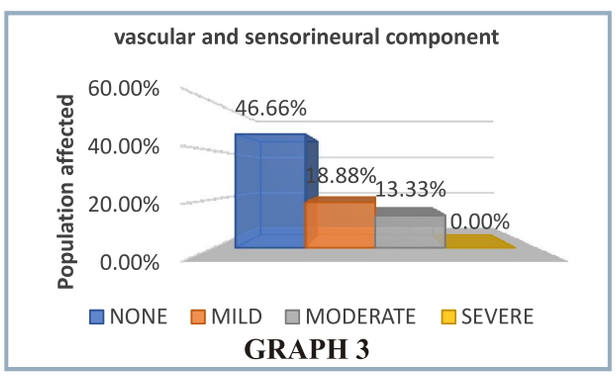
GRAPH 1

Table 2 Represents the grading of a sensorineural component of HAVS, which ranges from 0SN to 3SN, among which 48.8% of the population had vibration exposure. Still, there were no symptoms, and 34.44% of the population presented with intermittent numbness with or without tingling, and 16.6% of the population presented with intermittent or persistent numbness and reduced sensory perception.



GRAPH 2

Table 3 presents the Affected population of both vascular and sensorineural components, which ranges from mild to severe, among which 46.66% had no symptoms, 18.88% had mild symptoms, and 13.33% had moderate symptoms.



GRAPH 3

Table no.1- Population affected with Vascular Component.

Stage	Grades	Clinical Description	Population Affected	Percentage of affected population
0V		No attacks	59	65.5%
1V	Mild	Occasional attacks affecting only the tips of one or more fingers	27	30%
2V	Moderate	Occasional attacks affecting the distal and middle (rarely also proximal) phalanges of one or more fingers	4	4.44%
3V	Severe	Frequent attacks affecting all phalanges of most fingers	0	0%
4V	Very severe	As in stage 3V with tropic changes in the fingertips	0	0%

Table no.2: Population affected with Sensorineural component

Stage	Grades	Clinical Description	Population Affected	Percentage of affected populations
0SN	None	Vibration Exposure but no symptoms	44	48.8%
1SN	Mild	Intermittent numbness with or without tingling	31	34.44%
2SN	Moderate	Intermittent or persistent numbness reduces sensory perception	15	16.6%
3SN	Severe	Intermittent or persistent numbness, reduced tactile discrimination, and/or manipulative dexterity	0	0%

Table no.3: Population affected by both vascular and sensorineural components.

Vascular component		Sensorineural component		Population affected	Percent of affected population
0V	None	0SN	No attack	42	46.66%
1V	Mild	1SN	Mild	17	18.88%
2V	Moderate	2SN	Moderate	12	13.33%
3V	Severe	3SN	Severe	0	0%

Handgrip Strength

Table 4 shows that the mild population with both vascular and sensorineural symptoms with very poor grip strength is 2.

The moderately affected population with vascular and sensorineural symptoms and poor grip strength is 8.

GRAPH 4

Table 4: For grip strength

Vascular And Sensorineural Component	Rating	Male/Kg	Population Affected
MILD	Average	48-52	3
	Below Average	44-48	8
	Poor	40-44	4
	Very Poor	<40	2
MODERATE	Average	48-52	0
	Below Average	44-48	0
	Poor	40-44	4
	Very Poor	<40	8

Discussion

This study was conducted among farmers to find the prevalence of Hand arm Vibration Syndrome (HAVS). HAVS is an occupational disease that may affect farmers exposed to vibrating tools.

A total of 90 participants were included in the study according to the selection criteria. The Stockholm workshop scale was used on 90 participants to determine the prevalence of hand arm vibration syndrome. Also, the hand dynamometer was used to check their hand grip strength. The results showed that the

HAVS symptoms in participants are in the mild to moderate range.

Javid Hussain Sagar and Soniya T. Lohana conducted a study on Hand-arm vibration syndrome in farmers and its correlation with degenerative triangular fibrocartilage complex injury in a population of 100 participants with a mean age of 53.54 using a vibrating tool.[1] 38% of the population had mild vascular and sensorineural symptoms, and 26% only had sensorineural symptoms, collectively comprising 64% of the prevalence rate, with 39% of farmers having TFCC injury and HAVS (P value= <0.0001).[1]

The present study was conducted on the population of 90 participants with a mean age of 40.2 using the vibrating tool. In the present study,, 30% of population had mild vascular symptoms and 4% had moderate vascular symptoms, whereas 34.4% had mild sensorineural symptoms and 16.6% had moderate sensorineural symptoms.

Walker-bone K, Palmer KT, conducted a study among UK farm workers. It was found that they are prone to HAVS, there was a moderately high risk of cold-induced finger blanching, and sensorineural symptoms and prevalence ratio were found out to be 1.2-2.6 in comparison with unexposed occupations.[11]

Present study shows that 17 population had mild symptoms with 18.88% of vascular component and sensorineural component, whereas 12 population had moderate symptoms with 13.33% of vascular component and sensorineural component.

In the initial stages, there is extrusion of fluid into the tissues. Combined with the subsequent spasmodic ischemia from cold-induced vasospasm, this edema damages the mechanoreceptor nerve endings and nonmedullated fibers. Cold, causes platelet aggregation and subsequent release of serotonin (5-hydroxytryptamine) promotes platelets, and the increased concentration stimulates smooth muscle to contract. A delicate balance between smooth-muscle contraction and relaxation is produced by simultaneous interaction of vascular mechanism [6].

N. A Azmir, M.I. Ghazali conducted a study on grass cutter workers, study shows that before and after work indicates the strength of dominant Hand. The age group of 20-29 has higher grip strength since they are less exposed to Hand transmitted vibration while the group of 50-59 ages shows reduced hand grip strength.[9]

In the present study the average handgrip strength for male population is 48-50 kg of dominant Hand, it was found that those who are affected in both vascular and sensorineural component ranges from mild to moderate. Among the mildly affected population 2 of them had very poor grip strength which is <40 kg and moderately affected population 8 of them had very poor grip strength

The symptoms of musculoskeletal component, include pain and weakness in the upper extremities leading to reduced hand grip strength.[9] Hand is the most distal-most part of the body and thus absorbs high-frequency vibrations and transmits it to arms and shoulders leading to pain and impairment of the function of upper extremities.

Due to prolong exposer to hand arm vibrating tool in farmers in and around Jalgaon district shows that age group of 35-45 with mild symptoms has higher grip strength since they have less experience while age group of 45-55 with moderate symptoms has lesser grip strength as the experience and exposer to vibrating tool is high.

Conclusion

The present study concludes that there is prevalence of HAVS in farmers with mild and moderate symptoms is 18.88% and 13.33% respectively.

Hence, the total prevalence of affected population having HAVS is 31%.

Also, there is significant involvement of the reduced hand grip strength in farmers having HAVS. There may be a risk of having more severe symptoms of HAVS in future which provides a better

understanding of the impact and extend of HAVS in farmers.

Limitations

Only male population were included.

Only one outcome measure was used to assessed hand arm vibration syndromes.

Future Scope

Study can be done with larger sample size.

Intervention and treatment can be given for HAVS symptoms.

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