Chapter 3

VALIDITY OF THE JDC AND JDCS MODEL FOR INDIAN MIDDLE-LEVEL MANAGERS

Organisational factors are the major reasons for occupational stress. High work demands, deadlines, lack of control over work, and lack of support at the workplace are some of these factors that lead to workplace stress in employees. The Job Demand-Control (JDC) model (Karasek 1979) and its expanded version of the Job Demand-Control-Support (JDCS) model (Johnson and Hall, 1988) are among the most used and cited theoretical models that focus on occupational stress and organisational factors (Singh et al., 2022). The JDC model (Karasek, 1979) suggests that job stress results from the interaction between job demand and job control. It states that workers experiencing high job demands with low control at the workplace are more prone to experience work-related stress and have more chances of having poor physical and mental health in the long term (Singh et al., 2022). Karasek (1979) also gave a buffer hypothesis highlighting that a high level of job control reduces the negative effect of job demand. The model was further extended to add a new dimension of social support at the workplace and was named the Job Demand-Control-Support (JDCS) model by Johnson and Hall (1988). In addition to the previously made hypothesis, they suggested that the negative effect of job stress on workers' physical and mental health could be moderated by social support in the JDCS model. This model offers that the workers suffering or having more chances to have poor physical and mental health are in high demand and low control jobs paired with low workplace support. Buffer hypothesis of the JDCS model states that support at the workplace can moderate the negative effect of high demand and low control jobs, i.e., high strain jobs. It also suggests an interaction between job demand, job control, and support at the workplace (Singh et al., 2022).

The objective of the present work is to find the validity of the JDC and JDCS model on whether occupational stress and job satisfaction are affected by workload, job control, and support at the workplace for employees working in middle management of an Indian public sector telecom organisation. To validate the JDC and JDCS models following hypotheses were verified.

H1: There is a significant difference in psychological stress of the employees working in different job categories.

H2: There is a significant difference in the employees' job satisfaction working in different job categories.

H3: There is a significant effect of interaction between workload and job control, workload and "support at work", job control and "support at work" on psychological stress.

H4: There is a significant effect of interaction between workload and job control, workload and "support at work", and job control and "support at work" on job satisfaction.

H5: There is a significant effect of workload on psychological stress.

H6: There is a significant effect of job control on psychological stress.

H7: There is a significant effect of "support at work" on psychological stress.

H8: There is a significant effect of workload on job satisfaction.

H9: There is a significant effect of job control on job satisfaction.

H10: There is a significant effect of "support at work" on job satisfaction.

Figure 3.1 shows a flow chart that summarises the research methodology adopted in the present work. Analysis of Variance (ANOVA) was used to validate JDC and JDCS models.

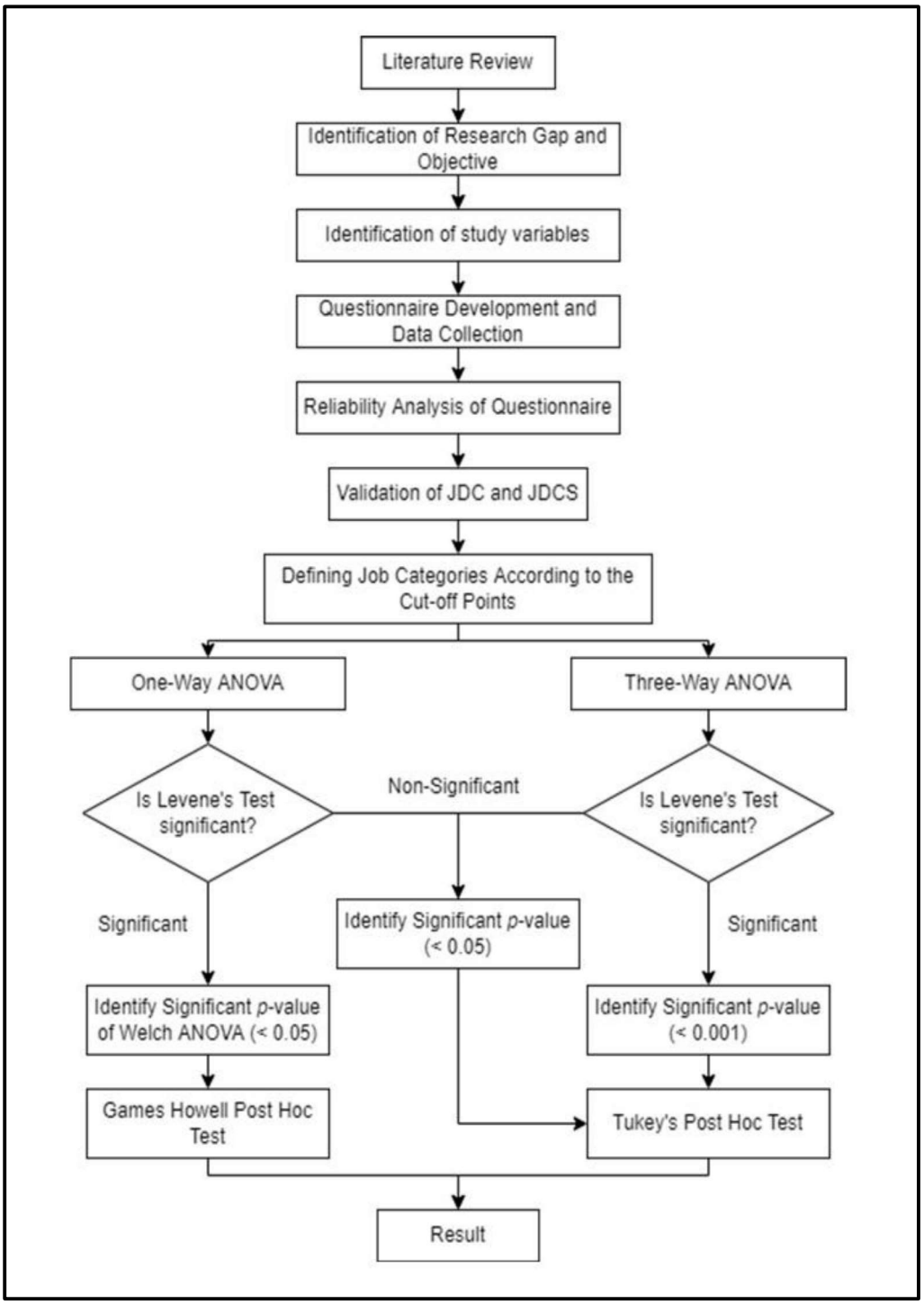

Figure 3.1: Flow chart depicting the research methodology

3.1. DATA ANALYSIS

For the analyses of the collected data, IBM SPSS, version 21.0, was used. JDC model categorises work into four job categories visualised as 1) high workload high control

(HWHC), 2) high workload low control (HWLC), 3) low workload high control (LWHC), and 4) low workload low control (LWLC) as shown in Figure 3.2.

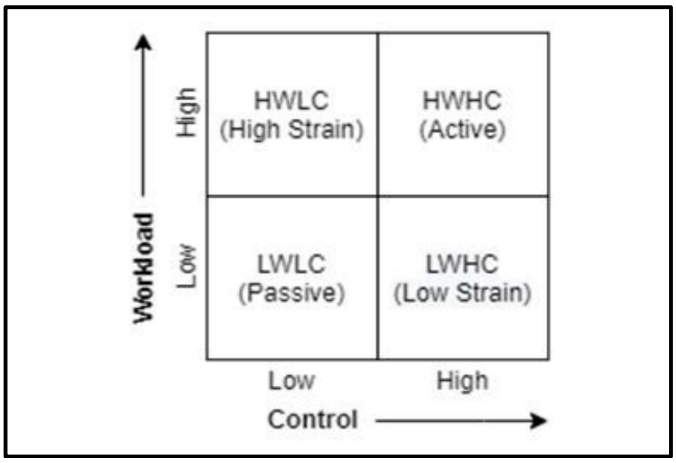

Figure 3.2: Quadrants in the JDC model

Cut-off points are used to define JDC's quadrants for the classification of individual employees' jobs as high-strain (HWLC), passive (LWLC), active (HWHC), and low-strain (LWHC).

A review of the trends and diversity in the empirical use of the JDCS model reported that 37% of studies used median as a cut-off point while 36% used tertile, 16% quartile, 5% mean, and 6% other different cut-off points (Alves et al., 2013). So, for the present work, ANOVA analysis was performed six times using six different cut-off points for workload, control, and “support at work” for the JDCS model, and the results were compared.

NASA TLX gives workload scores ranging from 0 to 100, 100 is the maximum workload, and 0 is no workload. The job control category consisted of 5 questions, each having scored from a minimum of 0 to a maximum of 4 (Table 2.8). So, the minimum and maximum scores for job control that can be obtained from the questionnaire used in the study are 0 and 20, respectively. Similarly, the maximum score of “support at work” is 12, and the minimum is 0. Cut-off values for all six approaches are given in Table 3.1.

Table 3.1: Cut-off value for six approaches

Cut off point	Demand	Control	Support
Median	> 50 high	> 10 high	> 6 high
	≤ 50 low	≤ 10 low	≤ 6 low
Tertile	> 66 high	> 14 high	> 8 high
	≤ 66, > 33 medium	≤ 14, > 7 medium	≤ 8, > 4 medium
	≤ 33 low	≤ 7 low	≤ 4 low
Quartile	> 75 very high	> 15 very high	> 9 very high
	≤ 75, > 50 high	≤ 15, > 10 high	≤ 9, > 6 high
	≤ 50, > 25 low	≤ 10, > 5 low	≤ 6, > 3 low
	≤ 25 very low	≤ 5 very low	≤ 3 very low
Mean	> 60 high	> 14 high	> 9 high
	≤ 60 low	≤ 14 low	≤ 9 low
60%	> 60 high	> 12 high	> 7 high
	≤ 60 low	≤ 12 low	≤ 7 low
40%	> 40 high	> 8 high	> 5 high
	≤ 40 low	≤ 8 low	≤ 5 low

According to these workload and job control scores, different job categories were created for each approach.

After defining job categories, one-way ANOVA was performed to check whether there is a difference in the stress and job satisfaction of employees working in different job categories. Three-way ANOVA was also performed to study the interaction effect of workload, job control, and "support at work" on stress and job satisfaction.

3.2. ONE-WAY ANOVA

Tables 3.2, 3.3, 3.4, 3.5, 3.6, and 3.7 show the mean and standard deviation for behavioural stress, cognitive stress, somatic stress and job satisfaction for all job categories for all six approaches.

Table 3.2: Descriptive statistics for the cut-off point as Median (one-way ANOVA)

		Behavioural Stress		Somatic Stress		Cognitive Stress		Job Satisfaction	
	N	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.
HWHC	**148**	3.88	4.05	3.50	4.22	3.78	2.87	7.11	1.51
HWLC	**26**	4.07	4.78	3.88	4.20	5.42	4.10	6.21	1.51
LWHC	**27**	3.85	3.67	3.93	4.04	4.67	3.93	7.02	1.78
LWLC	**9**	6.44	3.71	6.78	5.59	5.22	3.07	6.78	1.72
Total	**210**	4.01	4.09	3.74	4.28	4.16	3.23	6.97	1.57

HWHC: High Workload High Control, HWLC: High Workload Low Control,
LWHC: Low Workload High Control, LWLC: Low Workload Low Control

Table 3.3: Descriptive statistics for the cut-off point as tertile (one-way ANOVA)

		Behavioural Stress		Somatic Stress		Cognitive Stress		Job Satisfaction	
	N	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.
HWHC	**40**	3.00	3.52	3.03	3.71	3.05	2.63	7.39	1.38
HWMC	**34**	4.09	4.74	4.79	4.78	4.15	3.05	6.49	1.57
HWLC	**5**	4.40	6.69	3.00	3.39	7.80	6.34	5.00	1.87
MWHC	**61**	3.43	3.61	3.34	3.67	3.95	3.13	7.31	1.53
MWMC	**62**	5.13	4.19	4.06	4.78	4.55	3.15	6.90	1.44
MWLC	**5**	5.60	4.28	5.00	6.40	6.60	3.51	5.40	1.34
LWHC	**2**	1.00	1.41	0.00	0.00	3.50	4.95	9.00	1.41
LWMC	**1**	5.00	.	6.00	.	9.00	.	4.00	.
Total	**210**	4.01	4.09	3.74	4.28	4.16	3.23	6.97	1.57

HWHC: High Workload High Control, HWMC: High Workload Medium Control, HWLC: High Workload Low Control, MWHC: Medium Workload High Control, MWMC: Medium Workload Medium Control, MWLC: Medium Workload Low Control, LWHC: Low Workload High Control, LWMC: Low Workload Medium Control, LWLC: Low Workload Low Control

Table 3.4: Descriptive statistics for the cut-off point as Quartile (one-way ANOVA)

		Behavioural Stress		Somatic Stress		Cognitive Stress		Job Satisfaction	
	N	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.
VHWVHC	**16**	2.63	3.79	2.81	4.10	3.25	2.96	7.63	1.42
VHWHC	**14**	3.93	3.67	5.14	5.08	3.71	2.23	6.14	1.66
VHWLC	**5**	7.00	7.62	4.60	4.16	7.60	5.13	6.00	1.58
VHWVLC	**1**	0.00	.	0.00	.	0.00	.	7.00	.
HWVHC	**56**	3.63	3.67	3.21	3.74	3.55	2.82	7.29	1.68
HWHC	**61**	4.51	4.50	3.62	4.47	4.21	3.01	7.02	1.26
HWLC	**18**	2.94	3.87	3.17	3.97	4.44	3.88	6.36	1.63
HWVLC	**3**	6.00	2.00	7.00	5.57	7.67	1.15	5.67	0.58
LWVHC	**8**	1.38	1.30	3.63	2.97	4.88	4.36	7.56	1.40
LWHC	**18**	4.89	3.98	3.94	4.58	4.33	3.82	6.94	1.83
LWLC	**9**	6.44	3.71	6.78	5.59	5.22	3.07	6.78	1.72
VLWHC	**1**	5.00	.	6.00	.	9.00	.	4.00	.
Total	**210**	4.01	4.09	3.74	4.28	4.16	3.23	6.97	1.57

VHWVHC: Very High Workload Very High Control, VHWHC: Very High Workload High Control, VHWLC: Very High Workload Low Control, VHWVHC: Very High Workload Very Low Control, HWVHC: High Workload Very High Control, HWHC: High Workload High Control, HWLC: High Workload Low Control, HWVLC: High Workload Very Low Control, LWVHC: Low Workload Very High Control, LWHC: Low Workload High Control, LWLC: Low Workload Low Control, LWVLC: Low Workload Very Low Control, VLWVHC: Very Low Workload Very High Control, VLWHC: Very Low Workload High Control, VLWLC: Very Low Workload Low Control, VLWVLC: Very Low Workload Very Low Control

Table 3.5: Descriptive statistics for the cut-off point as Mean (one-way ANOVA)

		Behavioural Stress		Somatic Stress		Cognitive Stress		Job Satisfaction	
	N	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.
HWHC	**60**	2.97	3.28	3.07	3.65	3.35	2.84	7.33	1.48
HWLC	**58**	4.76	4.84	4.28	4.75	4.67	3.48	6.42	1.55
LWHC	**41**	3.68	3.95	3.44	3.74	3.95	3.14	7.40	1.53
LWLC	**51**	4.67	3.97	4.18	4.76	4.71	3.33	6.82	1.57
Total	**210**	4.01	4.09	3.74	4.28	4.16	3.23	6.97	1.57

HWHC: High Workload High Control, HWLC: High Workload Low Control,
LWHC: Low Workload High Control, LWLC: Low Workload Low Control

Table 3.6: Descriptive statistics for the cut-off point as 60% (one-way ANOVA)

		Behavioural Stress		Somatic Stress		Cognitive Stress		Job Satisfaction	
	N	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.
HWHC	**86**	3.56	4.11	3.31	4.07	3.62	2.99	7.16	1.55
HWLC	**32**	4.63	4.39	4.59	4.65	5.03	3.63	6.16	1.43
LWHC	**61**	3.66	3.69	3.79	4.01	3.98	3.20	7.37	1.48
LWLC	**31**	5.35	4.31	3.97	4.96	5.13	3.27	6.52	1.61
Total	**210**	4.01	4.09	3.74	4.28	4.16	3.23	6.97	1.57

HWHC: High Workload High Control, HWLC: High Workload Low Control,
LWHC: Low Workload High Control, LWLC: Low Workload Low Control

Table 3.7: Descriptive statistics for the cut-off point as 40% (one-way ANOVA)

		Behavioural Stress		Somatic Stress		Cognitive Stress		Job Satisfaction	
	N	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.	Mean	Std. Devi.
HWHC	**185**	3.90	3.98	3.64	4.16	3.97	3.04	7.07	1.53
HWLC	**19**	5.37	4.89	5.05	5.19	6.26	4.16	5.74	1.52
LWHC	**6**	3.33	4.84	2.83	4.67	3.33	3.98	7.83	1.33
Total	**210**	4.01	4.09	3.74	4.28	4.16	3.23	6.97	1.57

HWHC: High Workload High Control, HWLC: High Workload Low Control,
LWHC: Low Workload High Control, LWLC: Low Workload Low Control

Using the second column of Tables from 3.2 to 3.7, the distributions of employees among various job categories for all different cut-offs are shown in Figure 3.3. These distributions were compared with the ANOVA approach after performing Levene's test.

Levene's test was used to check the homogeneity of the variances across the groups for ANOVA analysis. In the case of a significant Levene test, the significant value of Welch ANOVA was used. Levene's test for behavioural stress is significant (p = 0.009) when the quartile was used as a cut-off. Similarly, in the case of somatic stress, Levene's test is significant when tertile (p = 0.012) and mean (p = 0.029) were used and for cognitive stress when median (p = 0.005), tertile (p = 0.044) and quartile (p = 0.015) was used. Table 3.8 shows the illustrative results of one-way ANOVA for the median cut-off approach. Similarly, the results of one-way ANOVA were obtained for each cut-

off approach, and significant values were obtained. Table 3.9 shows the significant value for one-way ANOVA for all approaches of cut-off for the JDC Model.

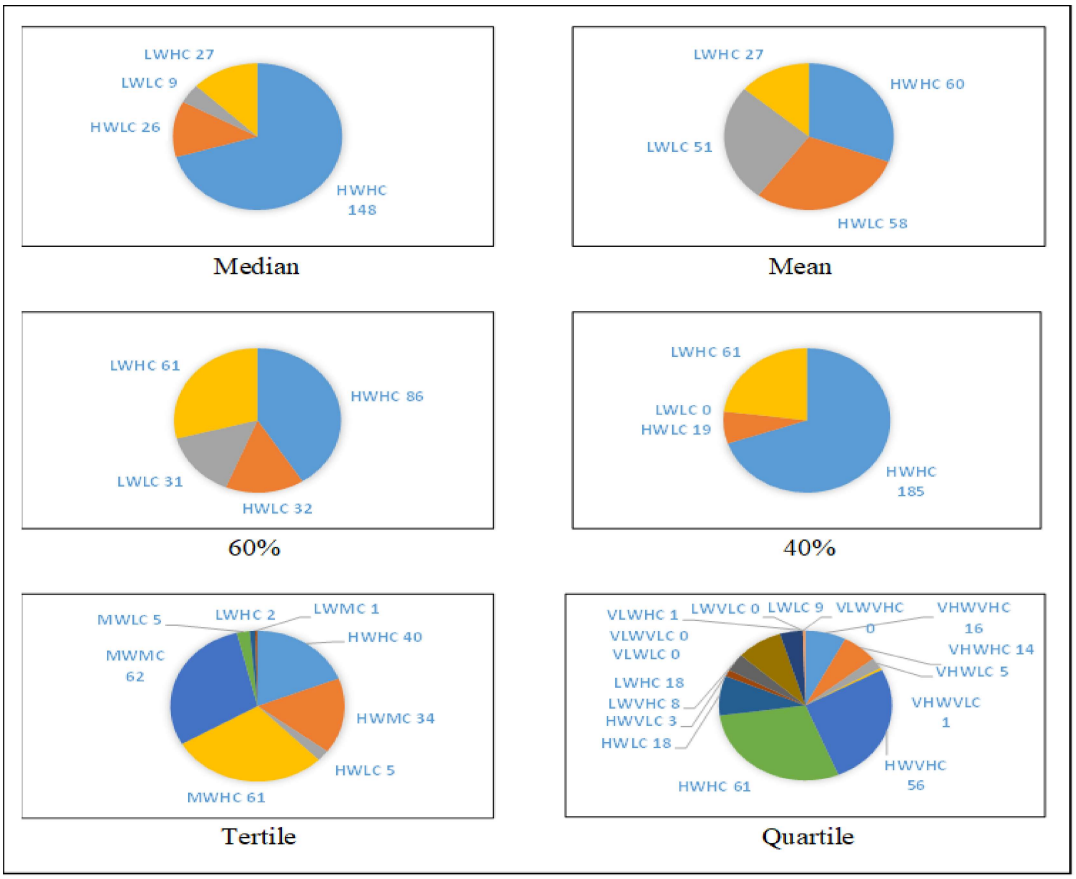

Figure 3.3: Distribution of employees in various job categories

Table 3.8: Results of one-way ANOVA for median cut-off

		Sum of Squares	Df	Mean Square	F	Sig.
BEHAVIOURAL_STRESS	Between Groups	56.434	3	18.811	1.124	.340
	Within Groups	3446.523	206	16.731		
	Total	3502.957	209			
SOMATIC_STRESS	Between Groups	93.053	3	31.018	1.713	.165
	Within Groups	3729.061	206	18.102		
	Total	3822.114	209			
COGNITIVE_STRESS	Between Groups	79.512	3	26.504	2.591	.054
	Within Groups	2106.983	206	10.228		
	Total	2186.495	209			
JS	Between Groups	18.175	3	6.058	2.500	.061
	Within Groups	499.153	206	2.423		
	Total	517.329	209			

Table 3.9: *p*-value of ANOVA

	Median	Tertile	Quartile	Mean	60%	40%
Behavioural Stress	0.340	0.173	0.130	0.059	0.134	0.303
Somatic Stress	0.165	0.492	0.443	0.361	0.530	0.340
Cognitive Stress	0.144	0.013	0.073	0.076	0.051	**0.010**
Job Satisfaction	0.061	**0.000**	**0.033**	**0.003**	**0.001**	**0.001**

Note: Significant value for cognitive Stress for tertile was not considered significant as Leven's test is significant in this case, and Welch ANOVA could not be performed.

3.2.1. H1: Significance for psychological stress of the employees working in different job categories

It can be seen from Table 3.9 that *p*-values for behavioural stress and somatic stress for all six approaches were greater than 0.05. *p*-value greater than 0.05. It shows that there was no significant difference in behavioural stress and somatic stress for different job categories.

p-values for cognitive stress for the first five approaches > 0.05, suggesting that there was no significant difference in cognitive stress for the employees working in different job categories. *p*-value for cognitive stress was 0.010 < 0.05 when 40% values were used as cut-off points. It suggests that for this approach, there was a significant difference among the defined job categories.

In the case of significant *p*-values, a post hoc Tukey's test was performed to determine the pair of job categories with significant differences (Table 3.10).

Table 3.10: Tukey's Test cognitive stress (40%)

(I) 40 %	(J) 40 %	Mean Difference (I-J)	Std. Error	Sig.
HWHC	**HWLC**	-2.29*	0.76	**0.009**

HWHC: High Workload High Control, HWLC: High Workload Low Control

Post hoc test revealed a significant difference in cognitive stress of employees working in HWHC and HWLC job categories. This shows that employees with similar workloads but different levels of job control had a difference in cognitive stress.

There was no significant difference in the results when using different cut-off points. All six approaches used to define job categories yield similar results for behavioural and cognitive stress. Only cognitive stress was different among active and passive jobs when 40% was used as the cut-off. Thus, the null hypothesis that there is a significant difference in psychological stress of the employees working in different job categories was rejected in this case.

3.2.2. H2: Significance for job satisfaction of the employees working in different job categories

The *p*-value for job satisfaction was greater than 0.05 when the median was used as the cut-off point, indicating no significant difference in job satisfaction in different job categories. However, the *p*-value for job satisfaction for all other approaches was less than 0.05, indicating a significant difference in job satisfaction (Table 3.9). In the case of median as the cut-off point, 148 cases in the HWHC category led to an insignificant difference in job satisfaction compared to other approaches.

A post hoc Tukey's test was performed to determine the pair of job categories with significant differences. The excerpts of the result of the significant Tukey test are shown in Table 3.11.

Table 3.11: Tukey's Test for job satisfaction (Mean)

		Mean	60%	40%
(I) MEAN	**(J) MEAN**	**Sig.**	**Sig**	**Sig**
HWHC	**HWLC**	0.008	0.009	0.001
LWHC	**HWLC**	0.011	0.002	0.010

HWHC: High Workload High Control, HWLC: High Workload Low Control,
LWHC: Low Workload High Control, LWLC: Low Workload Low Control

Post hoc tests for Tertile and Quartile approaches cannot be performed as a job category was identified with a case of one employee only.

There was a significant difference in employees' job satisfaction working in HWHC and HWLC categories for the remaining three approaches mean, 60% and 40%

(Table 3.11). It can be seen that, in comparing HWLC and HWHC, it is the control that creates a significant difference in job categories with a high workload. Similarly, HWLC and LWHC categories also have a significant difference in the job satisfaction of the employees. A comparison of LWHC and HWLC depicts that the difference in job satisfaction between these two job categories was due to the combined effect of workload and job control.

For the study of the interaction effect of workload, control and support to validate the buffer hypothesis of JDC and JDCS models, three-way ANOVA was used.

3.3. THREE-WAY ANOVA

Three-way ANOVA was performed for all six approaches of cut-off point to study the direct effects of workload, job control and "support at work" and the interaction effect of workload, control, and "support at work". Levene's test was performed for all six approaches. If Levene's test is significant, the results of ANOVA are less reliable. It is acceptable to use the *p*-value from the ANOVA as 0.001 instead of 0.05 as there is no equivalent test in the case of two-way or three-way ANOVA (Marshall and Boggis, 2016). In the cases of significant Levene's test, the significant value of ANOVA was compared with 0.001, and for the rest of the cases, it was compared with 0.05.

The value of Levene's test and *p*-value of ANOVA for behavioural stress, somatic stress, cognitive stress, and job satisfaction are given in Table 3.12, 3.13, 3.14 and 3.15, respectively, for all six approaches.

Table 3.12: Three-way ANOVA for behavioural stress

	Median	Tertile	Quartile	Mean	60%	40%
Levene's test	**0.047**	**0.035**	**0.004**	**0.104**	**0.434**	**0.582**
JD	0.825	0.605	0.353	0.393	0.924	0.894
JC	0.644	0.134	0.052	0.055	0.099	0.681
SW	0.704	0.209	0.305	0.32	0.334	0.738
JD * JC	0.806	0.800	0.056	0.333	0.797	.
JD * SW	0.060	0.739	0.116	0.508	0.124	.
JC * SW	0.842	0.127	0.195	0.95	0.957	0.089

JD- Job demand, JC – Job control, SW- support at work

Table 3.13: Three-way ANOVA for somatic stress

	Median	Tertile	Quartile	Mean	60%	40%
Levene's test	**0.174**	**0.002**	**0.253**	**0.018**	**0.330**	**0.207**
JD	0.451	0.657	0.601	0.972	0.923	0.854
JC	0.949	0.522	**0.020**	0.063	0.984	0.813
SW	0.239	0.352	0.331	0.413	0.931	0.983
JD * JC	0.496	0.567	0.231	0.959	0.063	.
JD * SW	**0.017**	0.986	**0.020**	0.323	0.826	.
JC * SW	0.148	0.074	0.103	0.718	0.107	0.438

JD- Job demand, JC – Job control, SW- support at work

Table 3.14: Three-way ANOVA for cognitive stress

	Median	Tertile	Quartile	Mean	60%	40%
Levene's test	**0.027**	**0.003**	**0.001**	**0.103**	**0.337**	**0.099**
JD	0.513	0.997	0.163	0.452	0.295	0.879
JC	0.196	0.057	0.059	0.033	0.067	0.259
SW	0.337	0.900	0.733	0.843	0.619	0.596
JD * JC	0.738	0.930	0.507	0.626	0.069	.
JD * SW	0.760	0.242	0.893	0.525	0.738	.
JC * SW	0.610	0.147	0.493	0.770	0.646	0.353

JD- Job demand, JC – Job control, SW- support at work

Table 3.15: Three-way ANOVA for job satisfaction

	Median	Tertile	Quartile	Mean	60%	40%
Levene's test	**0.112**	**0.373**	**0.005**	**0.352**	**0.462**	**0.933**
JD	0.579	0.318	0.120	0.193	0.319	0.766
JC	0.411	**0.013**	0.754	**0.005**	**0.004**	0.149
SW	0.052	0.142	**0.002**	**0.008**	**0.015**	0.278
JD * JC	**0.039**	0.693	0.113	0.390	0.997	.
JD * SW	0.742	0.771	0.097	0.877	0.929	.
JC * SW	**0.035**	0.959	0.364	0.256	0.703	0.462

JD - Job demand, JC - Job control, SW- support at work

With the help of the results shown in Tables 3.12 to 3.15, the remaining hypotheses were analysed and are discussed in the following sub-sections.

3.3.1. H3: Significance of interaction between "workload and job control", "workload and support at work", and "job control and support at work" on psychological stress

The *p*-values for all interaction effects for all the approaches were greater than 0.05 for behavioural and cognitive stress (Table 3.12 and 3.14). This indicates no interaction effect of workload, control, and support on behavioural and cognitive stress.

For Somatic stress, *p*-values for the interaction of workload and "support at work" were significant when Median and Quartile were used as cut-offs (p = 0.017 and 0.020). For the remaining approaches, *p*-values were greater than 0.05, suggesting no significant effect (Table 3.13). Thus, the null hypothesis that there is a significant effect of interaction between "workload and job control", "workload and support at work", and "job control and support at work" on psychological stress was rejected in this case.

3.3.2. H4: Significance of interaction between "workload and job control", "workload and support at work", and "job control and support at work" on job satisfaction

There was a significant effect of "workload and job control" interaction and "job control and support at work" interaction on job satisfaction when the median was used as the cut-off point (Table 3.15). There was no such significant interaction effect found with

the remaining approaches. Thus, the null hypothesis was partially accepted in the case of median cut-off but rejected in all other cases.

3.3.3. H5: Significance of workload on psychological stress

The result of the three-way ANOVA shows that workload had no significant effect on behavioural stress, cognitive stress and somatic stress for all six approaches of the cut-off point (Table 3.12, 3.13 and 3.14). Thus, the null hypothesis is rejected.

3.3.4. H6: Significance of job control on psychological stress

Job control had no significant effect on behavioural and cognitive stress for all six approaches of the cut-off point (Tables 3.12 and 3.14). When quartile was used as the cut-off point, job control had a significant effect on somatic stress. However, for all other cases, there was no significant effect (Table 3.13). Thus, the null hypothesis was accepted in the case of quartile cut-off but rejected in all other cases.

3.3.5. H7: Significance of "support at work" on psychological stress

"Support at work" had no significant effect on psychological stress when three-way ANOVA was used (Table 3.12, 3.13 and 3.14). Thus, the null hypothesis was rejected.

3.3.6. H8, H9 and H10: Significance of workload, job control and "support at work" on job satisfaction

Three-way ANOVA did not show any significant effect of workload on job satisfaction for any cut-offs (Table 3.15). Thus, the null hypothesis is rejected.

Job control had a significant effect on job satisfaction when tertile, mean and 60% were used as cut-off points (Table 3.15). In the remaining three approaches of the cut-off point, job control did not affect job satisfaction. Thus, the null hypothesis is accepted in half of the cases of cut-off and rejected in the remaining half.

"Support at work" significantly affected job satisfaction when quartile, mean and 60% cut-offs were used (Table 3.15). In the remaining three approaches of the cut-off point, "support at work" did not affect job satisfaction. Thus, similar to the case of job control and job satisfaction, the null hypothesis is accepted in half of the cases of cut-off and rejected in the remaining half.

3.4. DISCUSSION OF RESULTS OF ANOVA

In most cases, all six approaches have similar results. Table 3.16 shows a comparison of results for all six approaches of one-way ANOVA for hypotheses 1 and 2, i.e., the direct hypothesis of the JDC model.

Table 3.16: Comparison of all six cut-off approaches of ANOVA for the direct hypothesis of the JDC model

		Median	Tertile	Quartile	Mean	60%	40%
H1	Behavioural Stress	-	-	-	-	-	-
	Somatic Stress	-	-	-	-	-	-
	Cognitive Stress	-	-	-	-	-	+
H2	Job Satisfaction	-	+	+	+	+	+

+ supported, - not supported

It can be seen from Table 3.16 that cut-off points did not have any significant effect on the results of the JDC model. The results did not support the Job Demand-Control (JDC) model theory, which states a difference in employees' stress levels working in different job categories. Griffin et al. (2007), in their study on civil servants and Mausner-Dorscah and Eaton (2000) on multi-occupational employees, reported similar results stating that depression was unrelated to workload and control. A study on Australian public and private sector employees by Macklin et al. (2006) supported the JDC model theory for private-sector employees. However, the same study found no difference in public sector employees' psychological stress in different workload categories. These results are similar to the present study as the current work focuses on

Indian public sector employees. A survey of managers and public sector employees by Noblet et al. (2001, 2006) did not support the JDC model theory. The outcome of their study of "mental health" is very similar to the outcome of the present study.

In the case of job satisfaction as an outcome variable, the results were similar for five approaches suggesting a difference in job satisfaction among job categories. Noblet et al. (2006) and Rydstedt et al. (2006) also reported differences in job satisfaction in different job categories for Australian public sector employees and UK civil servants, respectively. Similar to psychological stress, the JDC model theory considering job satisfaction or dissatisfaction as an outcome has varied results in different occupations and study populations. Beeher et al. (2001), De Jonge et al. (2000), Fillion et al. (2007), Pisanti et al. (2006), Tummers et al. (2002), Verhoeven et al. (2003), and Rodriguez et al. (2001) in their study on US manufacturing employees, healthcare professionals from the Netherlands, Canadian nurses, teachers, nurses from the Netherlands, teachers from different countries and administrative workers respectively reported the results in favour of JDC model where job satisfaction was considered as an outcome of workload and control at the workplace.

The validity of the remaining hypotheses of the JDC and JDCS model, i.e., buffer hypotheses, was checked using three-way ANOVA. Table 3.17 shows a comparison of the results of all approaches.

Table 3.17: Comparison of all six cut-off approaches of ANOVA for the buffer hypothesis of the JDC model

		Median	Tertile	Quartile	Mean	60%	40%
H3	Behavioural Stress	-	-	-	-	-	-
	Somatic Stress	-	-	-	-	-	-
	Cognitive Stress	-	-	-	-	-	-
H4	Job Satisfaction	±	-	-	-	-	-

+ supported, - not supported, ± partially supported

The results partly support the buffer hypothesis of the JDCS model for job satisfaction when the median is used as a cut-off, but no support was found for the buffer theory in other cases. Akerboom and Maes (2006), Dollard et al. (2000), Griva and Joekes (2003), and Noblet et al. (2006) also reported no significant interaction effect of workload and job control; workload and "support at work"; and job control and "support at work".

As the results of the cut-off approaches are not similar, the validity of the JDC and JDCS models cannot be concluded considering all the approaches. So, for this purpose, the results of the approach with the cut-off of 60% are considered further. This particular approach was used as this approach gives a better distribution of the employees among four job categories of the JDC model (Figure 3.3).

Three-way ANOVA shows the direct effect and interaction effect. ANOVA using different cut-off points does not provide a clear conclusion, as seen from the results shown in section 3.3. Moreover, the indirect effect cannot be studied using ANOVA. For this purpose, SEM was used to study the direct/indirect effect of workload, job control and "support at work" on stress and job satisfaction. The results of SEM are then compared with three-way ANOVA which is also reported in the subsequent sections.

3.5. STRUCTURAL EQUATION MODELLING (SEM)

SEM was used to study the direct and indirect effect of independent variables on dependent variables. For this purpose, AMOS (Trial version 21.0 from IBM Corp., Armonk, NY, USA) was used. Figure 3.4 shows the flow diagram of SEM implementation.

A hypothetical path analysis SEM model was made based on hypotheses 5, 6, 7, 8, 9, and 10 (Figure 3.5). JC1, JC2, JC3, JC4, and JC5 were the indicators of job control, i.e., questions related to job control. Similarly, behavioural stress has B1, B2, B3, B4,

B5, somatic stress has S1, S2, S3, S4, S5, S6, S7, cognitive stress has CS1, CS2, CS3, CS4, and “support at work” has SS1, SS2, SS3 as their indicators.

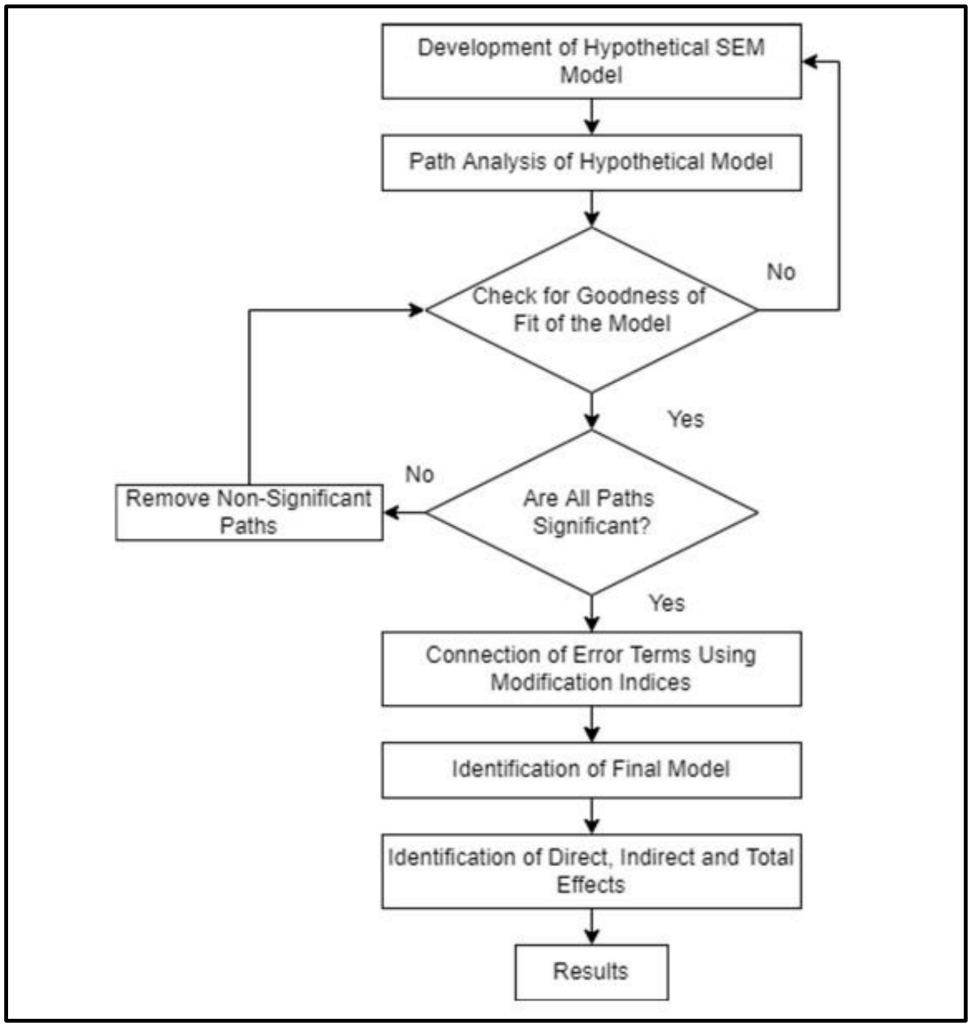

Figure 3.4: Flow chart depicting the Structure Equation Modelling

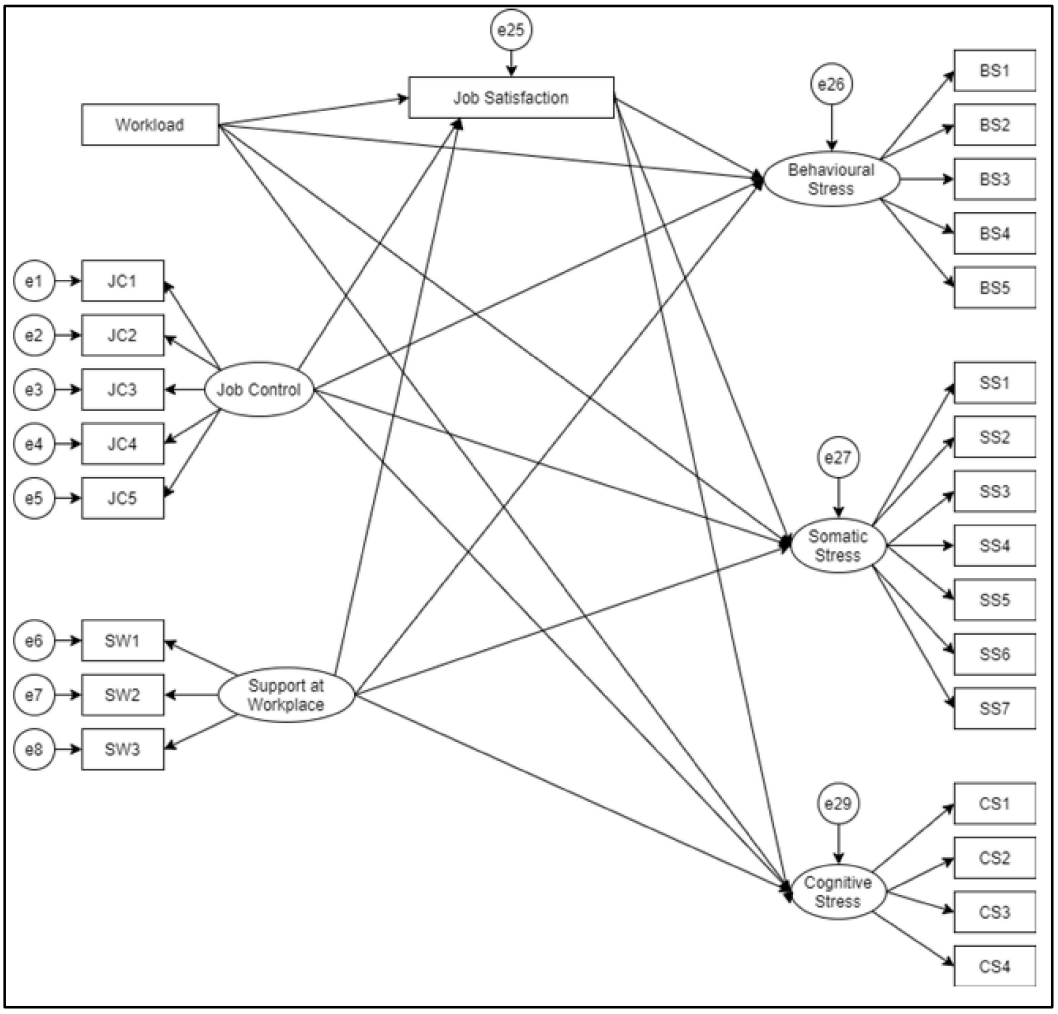

Figure 3.5: Hypothetical Path Analysis Model

The assumption in the model shown in Figure 3.5 is that workload, job control, and "support at work" were exogenous variables. At the same time, behavioural stress, somatic stress, and cognitive stress were endogenous variables, and job satisfaction was mediating variable. In the SEM approach, an endogenous variable is one which is either determined or influenced by one or more exogenous variables taken to be independent. Thus, an exogenous variable is one that is not affected by other variables in the model. The chosen mediating variable (job satisfaction) is the one that relates to exogenous and endogenous variables. The significance of direct, indirect, and the total effect of exogenous variables on endogenous variables were determined using the SEM model. The direct effect is the effect that an exogeneous variable directly has on an endogenous

variable. An indirect effect is an effect of an exogenous variable on an endogenous variable through some mediating variables (Singh et al., 2022).

The hypothetical model was tested for goodness-of-fit to check if the data fits the proposed path analysis model. The proposed model had CMIN/DF($\chi 2$/df) = 1.673, RMSEA = .057, TLI = 0.901, and CFI = 0.905 (as shown in Table 3.19), which suggested that the model has the appropriate fit.

The path analysis model of Figure 3.5 may have weak linkages between various causes and effects. Since weak linkages do not play any significant role in judging the impact of an exogenous variable on an endogenous variable, they can be removed to simplify the path analysis model. To check this, significance value (*p*), critical ratio (*t*) and the direct effect of exogenous variables on endogenous variables (*B*) were calculated for all the paths (Figure 3.5). Paths with a value of *p* greater than 0.05 and a critical ratio *(t)* between -1.96 and +1.96 were considered non-significant paths. Accordingly, 7 paths out of 15 paths were found to be non-significant. Table 3.18 shows the significance value (*p*), critical ratio (*t*) for the non-significant paths. Based on this result, the model shown in Figure 3.5 was modified by showing all the non-significant paths by the dotted lines in Figure 3.6 (Singh et al., 2022).

Table 3.18: Non-significant paths

		Path	***t***	***P***
JS	<---	SW	-.586	.558
BS	<---	WORKLOAD	.220	.826
SS	<---	WORKLOAD	.905	.365
CS	<---	WORKLOAD	.129	.897
BS	<---	JS	.071	.943
CS	<---	JS	.072	.943
BS	<---	SW	1.855	.064

After removing the non-significant paths, a modified path analysis model was obtained. The goodness-of-fit of the modified model was tested. The value of goodness-

of-fit coefficients is shown in Table 3.19. It can be seen from Table 3.19 that the modified model has improved goodness-of-fit over the initial model. Figure 3.7 shows the final model.

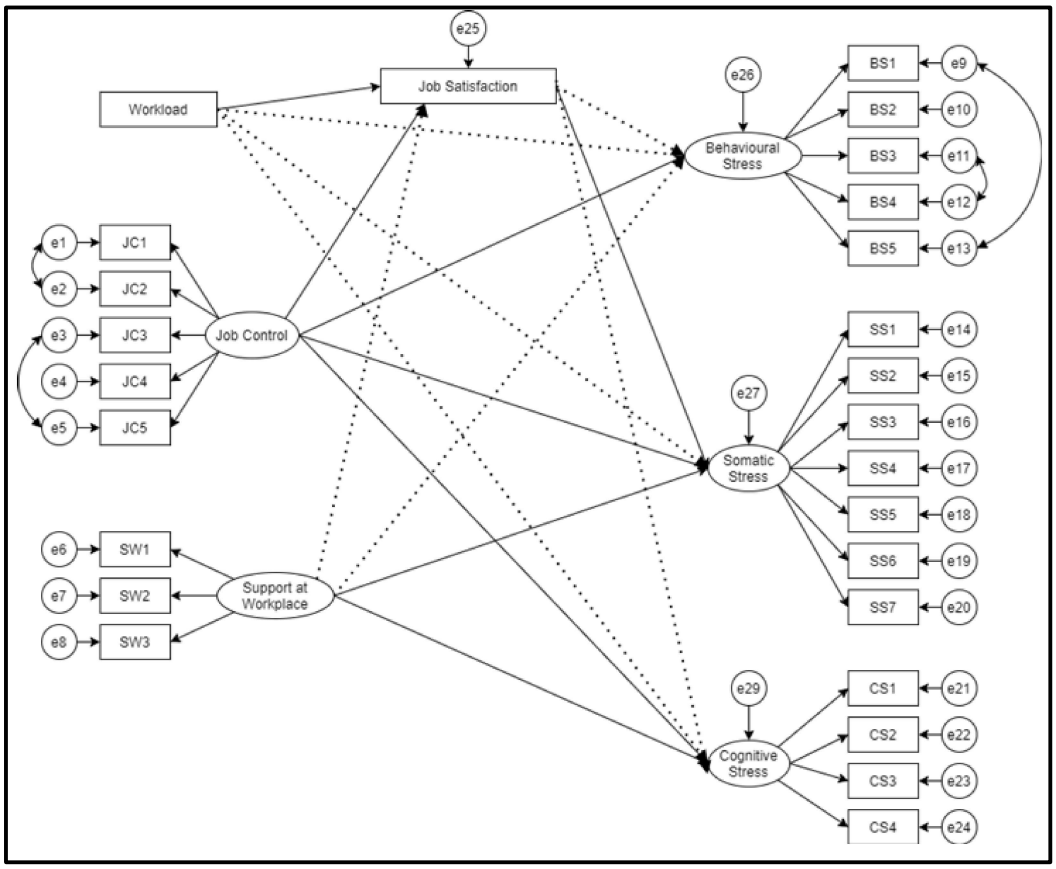

Figure 3.6: Non-significant paths in Path Analysis Model

Table 3.19: Model fit Indices

	CMIN/DF(χ2/df)	RMSEA	TLI	CFI
significance value (Hu and Bentler, 1999)	< 3.000	< 0.070	> 0.900	> 0.900
Initial Model	1.673	0.057	0.901	0.905
Modified model	1.523	0.050	0.915	0.925

CMIN- Chi-square, DF – Degree of freedom, RMSEA – Root mean square error of approximation, TLI- Tucker Lewis Index, CFI- Comparative fit index

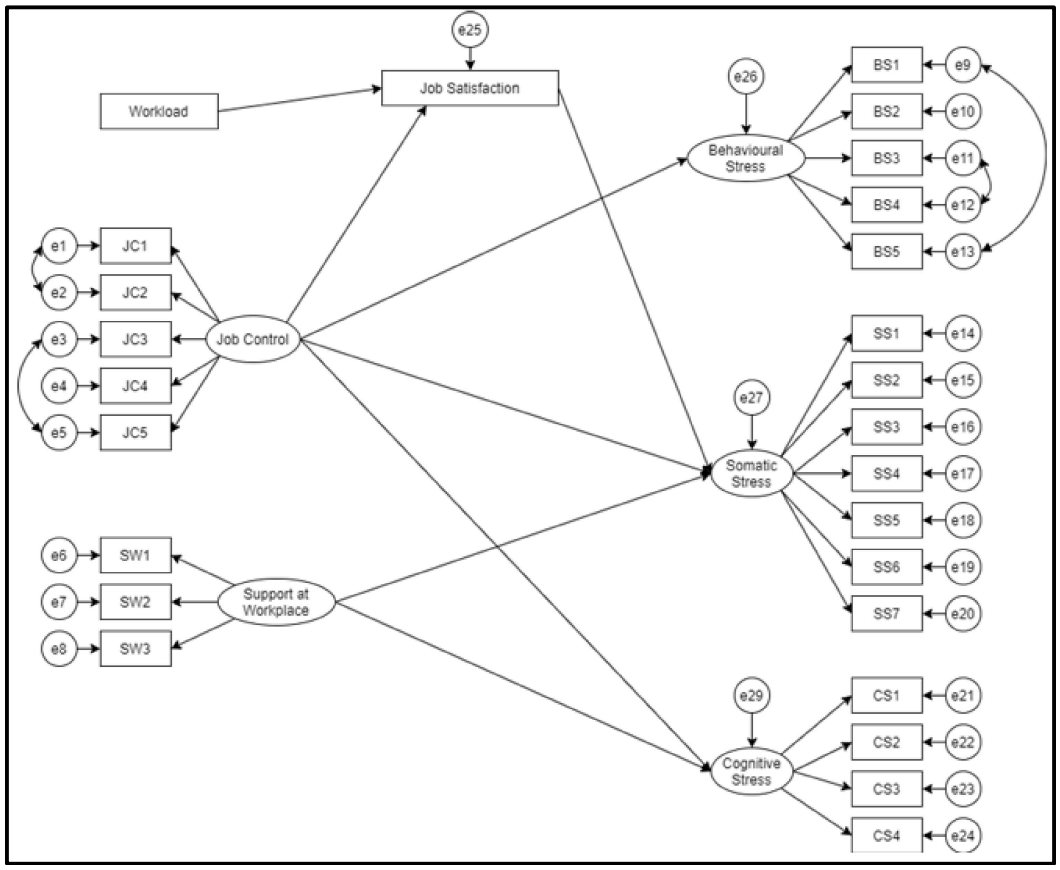

Figure 3.7: Final Path Analysis Model

After the identification of the final model, the effect of exogenous variables on endogenous variables was determined. The following sub-section shows inference obtained from these results.

3.6. RESULTS AND DISCUSSIONS OF SEM

Table 3.20 shows direct, indirect, and total effects in the final model.

3.6.1. H5: Significance of workload on psychological stress

The final path analysis model showed that workload had no significant direct effect on psychological stress. However, the workload had a very small significant indirect effect on somatic stress (0.03). Workload has no significant indirect effect on behavioural and cognitive stress (Table 3.20). So, it can be concluded that workload has no significant effect on psychological stress, and thus the null hypothesis is rejected.

Kawakami et al. (1992), Dollard et al. (2000), Beehr et al. (2001), Ramados (2012), and O'Donnell et al. (2015) also reported similar results where the workload was not significantly related to emotional stress, mental health and psychological stress (Singh et al., 2022).

Table 3.20: Standardized Direct, Indirect, and Total Effects

Exogenous variables	Endogenous variables	Direct effect (significance value)	Indirect effect	Total effect
Workload	Somatic Stress	Insignificant	0.03	0.03
	Job Satisfaction	-0.17 (= 0.009)	-	-0.17
Job Control	Behavioural Stress	-0.47 (< 0.001)	-	-0.47
	Somatic Stress	-0.68 (< 0.001)	-0.11	-0.79
	Cognitive Stress	-0.74 (< 0.001)	-	-0.74
	Job Satisfaction	0.52 (< 0.001)	-	0.52
Support at Workplace	Somatic Stress	-0.25 (= 0.039)	-	-0.25
	Cognitive Stress	-0.29 (= 0.022)	-	-0.29
Job Satisfaction	Somatic Stress	-0.20 (= 0.031)	-	-0.20

3.6.2. H6: Significance of job control on psychological stress

The final path analysis model of SEM shows that job control had a significant effect on behavioural (-0.47), somatic (-0.57) and cognitive (-0.74) stress (Table 3.20). Also, job control had an indirect effect on somatic stress. A negative correlation between job control and psychological stress implies that the higher the job control lesser the stress. This is very similar to the theory of the JDC model that an increase in job control results in better psychological well-being and less occupational stress. Thus, the null hypothesis is accepted in this case.

3.6.3. H7: Significance of "support at work" on psychological stress

"Support at work" was significantly related to somatic (-0.25) and cognitive (-0.29) stress in the final path analysis model. However, it did not affect behavioural stress. The negative correlation between somatic and cognitive stress implies that the higher the "support at work", the lesser the stress. Thus, the null hypothesis is partially accepted. Amick and Celentano (1991), Blanch (2016), and Leitao et al. (2018) reported a significant effect of "support at work" on stress.

3.6.4. H8, H9 and H10 Significance of workload, job control and "support at work" on job satisfaction

The path analysis model of SEM shows that workload had a direct significant negative effect (-0.17) on job satisfaction. It shows that a high workload will reduce job satisfaction. The null hypothesis is accepted in this case but rejected when ANOVA is used. Tyler and Cushway (1998), Pugliesi (1999), and Schmidt and Diestel (2011) also reported a significant effect of workload on job satisfaction.

The final model of SEM showed that job control had a significant direct association with job satisfaction (0.52). The null hypothesis is accepted in this case. Similar results were also reported by De Jonge et al. (1999), van der Doef et al. (2000), and Schmidt and Diestel (2011).

The "support at work" had no direct or significant indirect effect on job satisfaction in the path analysis model of SEM. Thus, the null hypothesis was rejected in this case. Similar to the results of SEM were the findings of De Jonge et al. (2000), De Lange et al. (2003), Fillion et al. (2007), Griva and Joekes (2003) and Nobelt et al. (2001). They reported no significant impact of "support at work" on job satisfaction.

The results of three-way ANOVA and SEM approaches were compared in the next section.

3.7. COMPARISON OF ANOVA AN SEM APPROACH FOR JDCS MODEL

ANOVA and SEM can both be used to study the JDCS Model. ANOVA categorises the employees in different groups and focuses on identifying a significant difference among the groups for dependent variables. SEM focuses on the direct and indirect relationship between dependent and independent variables. Both the approaches work differently and may have different outcomes for the same study. Both approaches were used to study the effect of workload, job control, and "support at work" on behavioural stress, cognitive stress, somatic stress, and job satisfaction. A comparison of the results of ANOVA (cut-off as 60%) and SEM is shown in Table 3.21.

From Table 3.21, it can be seen that workload had no significant effect on behavioural stress and cognitive stress using both approaches. With SEM, the workload had a significant indirect effect on somatic stress (Figure 3.7). SEM showed a significant direct effect of workload on job satisfaction but ANOVA.

Table 3.21: Comparison of ANOVA and SEM

Ind. Variable	**Dep. Variable**	**ANOVA** (60 % cut-off)	**SEM**
Workload	Behavioural Stress	-	-
	Somatic Stress	-	+
	Cognitive Stress	-	-
	Job Satisfaction	-	+
Job Control	Behavioural Stress	-	+
	Somatic Stress	-	+
	Cognitive Stress	-	+
	Job Satisfaction	+	+
Support at Workplace	Behavioural Stress	-	-
	Somatic Stress	-	+
	Cognitive Stress	-	+
	Job Satisfaction	+	-

The result of ANOVA concludes that job control had no significant effect on psychological stress. In SEM, job control had a significant direct effect on all three

stresses. Also, job control had a significant effect on job satisfaction when either of the methods was used.

When using ANOVA, there was no significant effect of "support at work" on stress, but SEM modelling shows a significant effect on somatic and cognitive stress. In SEM, "support at work" had no significant effect on job satisfaction, but ANOVA showed a significant effect. The effect of job control on job satisfaction was similar for both methods; however, for all other cases, the results were different.

ANOVA compares different groups, and SEM works on multiple linear regression. Also, ANOVA assumes that there is no measurement error in the data. However, accounting for the measurement error is a critical factor in data analysis (Borsboom et al., 2003; Borsboom, 2006). If the measurement error is missing in the analysis, results get biased (Culpepper and Aguinis, 2011; Hancock, 2003). The modelling of measurement error removes unsystematic variance from effect estimates and gives SEM advantages over ANOVA (Phillips and Jiang, 2016; Ree and Carretta, 2006). SEM has a statistical advantage over ANOVA when finding the relationship between two independent and dependent variables. So, for all further works, SEM was used to study the direct and indirect effects of organisational, social and personal factors on occupational stress, WMSDs and work performance.

3.8. CONCLUSION

The validity of the JDC and JDCS model was checked for the Indian middle-level managers working, especially in a telecom organisation. The effect of workload, job control, and "support at work" on psychological stress and job satisfaction in employees was also studied. To validate the JDC and JDCS model, ANOVA was used using six different approaches for cut-off points for job categorisation. Results of all these six approaches were compared. Every approach of cut-off points used in ANOVA has not

resulted in a concrete conclusion. Also, ANOVA does not analyse the indirect effect of exogenous variables on endogenous variables. So, SEM was used to study the direct and indirect effect of workload, control and support on psychological stress and job satisfaction. The results of the SEM have been concluded further in relation to the JDC and JDCS models.

The workload was found to have no significant effect on behavioural, somatic, and cognitive stress. SEM suggested a significant negative effect on behavioural, somatic, and cognitive stress. SEM suggested that increasing job control can reduce stress in employees significantly. These results were similar to the buffer hypothesis of the Job Demand Control Model.

Similarly, SEM suggests a significant positive relationship between "support at work" and somatic and cognitive stress. These results are similar to the buffer hypothesis of the Job Demand Control Support Model. SEM showed a direct negative effect of workload on job satisfaction. Job control had a significant direct effect on job satisfaction, but "support at work" had none.

The direct hypothesis of the JDC and JDCS model was partially supported for both psychological stress and job satisfaction. The buffer hypothesis of the JDC and JDCS model was also partially supported by the study.

The result of the study suggests that more focus should be given to job enrichment to provide more control to employees over their work and "support at work". This will also increase their job satisfaction and as well as their psychological well-being. This study only considers the control over the work dimension of the job control. Other dimensions of job control related to work time can also be studied to analyse their effect on psychological stress.