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High blood pressure in adults with disabilities: Influence of gender, body weight and health behaviors

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ABSTRACT

The aims of this study were to explore the mean and distribution of systolic and diastolic blood pressure, and to examine the influence of gender, body weight and health behaviors on hypertension in adults with disabilities. We analyzed the 2010 annual community health examination chart of adults with disabilities in east Taiwan. The study samples included 833 adults with disabilities whose age 30 years and over participated in the analyses. The mean value of diastolic and systolic blood pressure (mmHg) of the study participants was 76.51 ± 12.65 (range = 40–155) and 127.39 ± 20.32 (range = 77–221). Fifteen percent and 23.4% of the participants have high diastolic ($\geq$90 mmHg) and systolic ($\geq$140 mmHg) blood pressure. There were 27.4% of the participants who had hypertension, high diastolic or/and systolic blood pressure. Finally, we found that the factors of older age (OR = 2.45, 95% CI = 1.22–4.93), overweight or obese in BMI (OR = 6.72, 95% CI = 1.90–23.78; OR = 6.76, 95% CI = 1.84–24.84), waist circumference (OR = 1.64, 95% CI = 1.03–2.61) and vegetable/fruit intake (OR = 0.61, 95% CI = 0.39–0.94) were variables that could significantly predict the hypertension condition of the subjects after controlling factors of marital status, type and level of disability. To improve the healthcare for people who suffer with and prevention for hypertension, the study highlights the health authorities should pay much attention to blood pressure condition and their determinants for people with disabilities in the communities.

1. Introduction

Elevated blood pressure associated with higher risk of heart attack, heart failure, stroke, and kidney disease (Chobanian et al., 2003), and it is one of the components of the metabolic syndrome (Grundy et al., 2005). Hypertension is one of the cardiovascular disease risk factors for the development of functional disability (Hubert & Fries, 1994; Pinsky et al., 1985). Elias, Dore, Davey, Robbins, and Elias (2010) had examined the hypothesis that lowered cognitive performance plays a role in the relation between elevated blood pressure and physical disability in performing basic physical tasks.

Di Bari et al. (2001) found people with relative risks of incident cognitive impairment and disability were more likely to miss the assessment of hypertension and the appraisal of a protective effect of hypertension treatment. Furthermore, Wilmanska (1998) also found that therapy of hypertension in disabled elderly people was ineffective in most of the hypertensive patients. Therefore, it is an urgent need for establishing a more efficient concept of primary prevention as well

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as better and comprehensive treatment of the essential hypertension in order to reduce morbidity and disability of the people.

Regular health screening has an important contribution to make to improve the health of people with disabilities (Barr, Gilgunn, Kane, & Moore, 1999). In identification of health risk associated with higher blood pressure, the purposes of this study were to explore the mean and distribution of systolic and diastolic blood pressure, and to examine the influence of gender, body weight and health behaviors on hypertension in adults with disabilities whose age 30 and over by using data from 2010 community health examination.

2. Methods

The present study analyzed 2010 annual health examination chart of adults with people with disabilities in Taiwan. Those adults with disabilities can freely participate the health screening which provided by a local government – Yilan County. The study population included adults with disabilities participated in the annual health examination, and research cooperative approval was received from the local health department.

The study samples included 833 adults with disabilities (age 30 years and over) who participated in the analyses. The analyzed information included client's demographic characteristics (gender, age, education, marital status, disability type and level), body mass index (BMI: kg/m^2) and waist circumference, health status (disease history and medication), health behaviors (smoking, drinking alcohol, exercise, betel nut chewing, milk and vegetable/fruits consumption) and elevated blood pressure (BP; systolic BP $\geq$ 140 mmHg or diastolic DP $\geq$ 90 mmHg).

Data were analyzed by statistical software SPSS 18.0; we used number, percentage, mean, standard deviation (S.D.), and range to describe the sample demographic, health status and health behavioral characteristics, and to use chi-square method to analyze their relation with elevated blood pressure (hypertension). A logistic regression method which included Odd Ratio (O.R.) and 95% Confidence Interval (C.I.) was conducted to identify the potential risk factors associated with hypertension occurrence.

3. Results

3.1. Demographic characteristics of the subjects

Table 1 describes the demographic characteristics of the study participants. Of the 833 adults with disabilities in this study, 59.3% were men and 40.7% were women, and mean of age was 61.16 ± 16.59 years (range = 31–98 years). More than fifty percent of the study subjects were less than primary school educational level, and 74.4% were married. There was 17.5% of the subjects were multiple disabilities, 34% have a limb disability, 16.4% were chronic psychosis, 8.9% were hearing impairments, and 8% have intellectual disability. With regard to the participant's disability level, most of the adults with disabilities in this study were diagnosed as mild and moderate levels of disability (35.5% and 32.4%, respectively).

3.2. Health characteristics and health behaviors of the subjects

In terms of the body figure of the participants, results of BMI analysis indicated that the mean value of BMI was 23.86, and 11.1% subjects were underweight, 42.6% were normal, 25.7% were overweight, 11.6% were pre-obese, 6.8% were obese class I, 1.8% and 0.5% were obese class II and III. There were 48.4% subjects have wider waist circumference (male $\geqq$ 90 cm, female $\geqq$ 80 cm), there were 80.4% cases have chronic disease history which include hypertension, diabetes, cardiovascular disease, stroke, cancer, hyperlipidemia, hepatitis B, kidney disease etc. and 61.9% cases have to take drug medication regularly at their daily livings (Table 2).

With regard to the health behaviors of the participants, smoking rate was 11.8%, alcohol drinking rate was 1.9% and betel nut chewing rate was 1.1%. There were 20.9% participants do regular exercise which at least 3–5 times a week, and 18.6% women had ever used Pap smear tests. Nutritious food taking survey indicated that 36.7% cases have a habit of drinking milk and 57% eat fresh vegetables and fruits daily (Table 3).

3.3. Blood pressure distribution of the subjects

Table 4 presents the mean value of diastolic and systolic blood pressure (mmHg) of the study participants was 76.51 ± 12.65 (range = 40–155) and 127.39 ± 20.32 (range = 77–221). Fifteen percent and 23.4% of the participants have high diastolic ($\geqq$90 mmHg) and systolic ($\geqq$140 mmHg) blood pressure. There were 27.4% subjects have a hypertension which they have high diastolic or/and systolic blood pressure. Fig. 1 shows the prevalence of hypertension, high diastolic and systolic blood pressure in difference gender, the results illustrated female subjects have higher elevated percent of these three prevalences than male individuals with disabilities.

We analyzed chi-square correlation between hypertension rate and subjects' characteristics in the bivariant analysis (Tables 5–7). The results showed older age ($p < 0.001$), married status ($p < 0.001$), different disability type and level of disability ($p < 0.001$) were significantly correlated to the occurrence of hypertension. The body figure analysis of the subjects found factors of BMI ($p < 0.001$) and waist circumference ($p < 0.001$) were significantly correlated with hypertension

Table 1
Demographic characteristics of the study subjects.

Characteristics	Number	Percent	Mean ± S.D. (range)
Gender ($n = 833$)			
Female	339	40.7	
Male	494	59.3	
Age ($n = 833$)			61.16 ± 16.59 (31–98)
30–44 years	165	19.8	
44–64 years	278	33.4	
≧65 years	390	46.8	
Education ($n = 536$)			
Less than primary school	272	50.7	
Junior high school	120	22.4	
Senior high school	104	19.4	
College and more	40	7.5	
Marital status ($n = 833$)			
Unmarried	213	25.6	
Married	620	74.4	
Type of disability ($n = 833$)			
Limb	283	34.0	
Multiple	146	17.5	
Chronic psychosis	137	16.4	
Hearing	74	8.9	
Intellectual disability	67	8.0	
Vision	36	4.3	
Primary organs	36	4.3	
Dementia	32	3.8	
Other[a]	22	2.6	
Disability level ($n = 833$)			
Mild	296	35.5	
Moderate	270	32.4	
Severe	169	20.3	
Profound	98	11.8	

[a] Other disabilities include balancing mechanism disability, voice/speech, disfigurement or deformity, chronically unconscious, autism, stubborn (difficult-to-cure) epilepsy, rare disease.

Table 2
Individual health characteristics of the study subjects.

Health characteristics	Number	Percent	Mean ± S.D. (range)
BMI ($n = 813$)			23.86 ± 4.73 (11.8–47.9)
Underweight (BMI < 18.5)	90	11.1	
Normal (18.5 ≦ BMI < 24)	346	42.6	
Overweight (24 ≦ BMI < 27)	209	25.7	
Pre-obese (27 ≦ BMI < 30)	94	11.6	
Obese class I (30 ≦ BMI < 35)	55	6.8	
Obese class II (35 ≦ BMI < 40)	15	1.8	
Obese class III (BMI ≧ 40)	4	0.5	
Waist circumference ($n = 626$)			84.94 ± 10.84 (51–124)
Normal	323	51.6	
Large[a]	303	48.4	
Chronic medication ($n = 833$)			
No	317	38.1	
Yes	516	61.9	
Disease history ($n = 833$)			
No	163	19.6	
Yes	670	80.4	

[a] Large waist circumference: male ≧ 90 cm, female ≧ 80 cm.

occurrence in those individuals with disabilities. Generally, the BMI and waist circumference increased and hypertension rate increases consistently. With regard to the relations of hypertension and health behaviors, results show factor of eating fresh vegetables and fruits daily have a significant relationship with hypertension condition ($p < 0.001$). Those health behavioral factors of smoking, alcohol drinking, betel nut chewing, regular exercise and drink milk daily did not have significant relations to hypertension occurrence in people with disabilities.

3.4. Determinants of hypertension occurrence in study subjects

Table 8 tests the related risk factors of hypertension occurrence for the people with disabilities in logistic regression. The results found that the factors of age, BMI, waist circumference and vegetable/fruit intake were variables that could

Table 3
Individual health behaviors in the study subjects.

Health behaviors	Number	Percent
Smoking ($n = 833$)		
No	713	85.6
Occasional	22	2.6
Smoking ≦ 1 pack	70	8.4
Smoking > 1 pack	28	3.4
Alcohol intake ($n = 833$)		
No	722	86.7
Occasional	95	11.4
Often	16	1.9
Betel nut chewing ($n = 833$)		
No	799	95.9
Occasional	25	3.0
Often	9	1.1
Physical activity ($n = 833$)		
No	368	44.2
Occasional	291	34.9
Regular	174	20.9
Pap smear test ($n = 339$)		
No	276	81.4
Yes	63	18.6
Drink milk daily ($n = 833$)		
No	527	63.3
Yes	306	36.7
Vegetable and fruit intake ($n = 833$)[a]		
No	358	43.0
Yes	475	57.0

[a] At least 3 dishes of fresh vegetables and 2 kinds of fruits daily.

Table 4
Blood pressure distribution in the study subjects ($n = 833$).

Blood pressure	Number	Percent	Mean ± S.D. (range)
Diastolic blood pressure			76.51 ± 12.65 (40–155)
<90 mmHg	709	85.1	
≧90 mmHg	124	14.9	
Systolic blood pressure			127.39 ± 20.32 (77–221)
<140 mmHg	638	76.6	
≧140 mmHg	195	23.4	
Hypertension[a]			
No	605	72.6	
Yes	228	27.4	

[a] Hypertension: diastolic ≧ 90 mmHg or Systolic ≧ 140 mmHg.

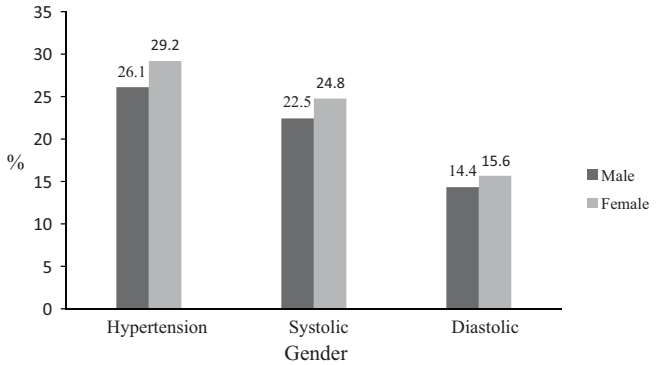

Fig. 1. Hypertension, high systolic and diastolic blood pressure by gender in study subjects.

significantly predict the hypertension condition of the subjects after controlling factors of marital status, type and level of disability. Elderly people with disability were more likely to have a hypertension condition than younger individuals with aged 30–44 years (OR = 2.45, 95% CI = 1.22–4.93). In terms of BMI to hypertension occurrence, those overweight or obese subjects were more likely to have a hypertension condition compared to underweight group (OR = 6.72, 95% CI = 1.90–23.78;

Table 5
Relation of hypertension and demographic characteristics of the study subjects.

Characteristics	Hypertension		χ^2	p value
	No; n (%)	Yes; n (%)		
Gender (n = 833)			0.97	0.326
Female	240 (70.8)	99 (29.2)		
Male	365 (73.9)	129 (26.1)		
Age (n = 833)			21.41	<0.001
30–44 years	141 (85.5)	24 (14.5)		
44–64 years	205 (73.7)	73 (26.3)		
≧65 years	259 (66.4)	131 (33.6)		
Education (n = 833)			3.63	0.304
Less than primary school	188 (69.1)	84 (30.9)		
Junior high school	92 (76.7)	28 (23.3)		
Senior high school	80 (76.9)	24 (23.1)		
College and more	29 (72.5)	11 (27.5)		
Marital status (n = 833)			15.78	<0.001
Unmarried	177 (83.1)	36 (16.9)		
Married	428 (69.0)	192 (31.0)		
Type of disability (n = 833)			37.61	<0.001
Limb	185 (65.4)	98 (34.6)		
Multiple	114 (78.1)	32 (21.9)		
Chronic psychosis	117 (85.4)	20 (14.6)		
Hearing	49 (66.2)	25 (33.8)		
Intellectual disability	55 (82.1)	12 (17.9)		
Vision	24 (66.7)	12 (33.3)		
Primary organs	18 (50.0)	18 (50.0)		
Dementia	27 (84.4)	5 (15.6)		
Other	16 (72.7)	6 (27.3)		
Disability level (n = 833)			12.65	<0.01
Mild	197 (66.6)	99 (33.4)		
Moderate	195 (72.2)	75 (27.8)		
Severe	133 (78.7)	36 (21.3)		
Profound	80 (81.6)	18 (18.4)		

Table 6
Relation of hypertension and health characteristics of the study subjects.

Health characteristics	Hypertension		χ^2	p value
	No; n (%)	Yes; n (%)		
BMI (n = 813)			39.35	<0.001
Underweight (BMI < 18.5)	81 (90.0)	9 (10.0)		
Normal (18.5 ≦ BMI < 24)	273 (78.9)	73 (21.1)		
Overweight (24 ≦ BMI < 27)	135 (64.6)	74 (35.4)		
Obese (BMI ≧ 27)	102 (60.7)	66 (39.3)		
Waist circumference (n = 626)			26.66	<0.001
Normal	264 (81.7)	59 (18.3)		
Large	192 (63.4)	111 (36.6)		
Chronic medication (n = 833)			2.44	0.118
No	240 (75.7)	77 (24.3)		
Yes	365 (70.7)	151 (29.3)		
Disease history (n = 833)			2.85	0.092
No	127 (77.9)	36 (22.1)		
Yes	478 (71.3)	192 (28.7)		

OR = 6.76, 95% CI = 1.84–24.84). Those subjects with large waist circumference tend to have a hypertension than those with normal size (OR = 1.64, 95% CI = 1.03–2.61). Finally, we found those subjects have a daily habit of eating fresh vegetables or fruits tend to have a hypertension condition than their counterparts (OR = 1.64, 95% CI = 1.06–2.54). This reverse result may possible due to those people with high blood pressure were more likely to take fresh vegetables and fruits instead of a causal-relationship in the study.

4. Discussions

Many studies had reported a positive relationship between high blood pressure and risk for coronary heart disease (Franklin, Khan, Wong, Larson, & Levy, 1999; MacMahon et al., 1990; Selmer, 1992; van den Hoogen et al., 2000). The present

Table 7
Relations of hypertension and health behaviors of the study subjects.

Health behaviors	Hypertension		χ^2	p value
	No; n (%)	Yes; n (%)		
Smoking (n = 833)			1.31	0.728
No	523 (73.4)	190 (26.6)		
Occasional	15 (68.2)	7 (31.8)		
Smoking ≦ 1 pack	48 (68.6)	22 (31.4)		
Smoking > 1 pack	19 (67.9)	9 (32.1)		
Alcohol intake (n = 833)			2.33	0.312
No	531 (73.5)	191 (26.5)		
Occasional	63 (66.3)	32 (33.7)		
Often	11 (68.8)	5 (31.3)		
Betel nut chewing (n = 833)			5.00	0.082
No	586 (73.3)	213 (26.7)		
Occasional	14 (56.0)	11 (44.0)		
Often	5 (55.6)	4 (44.4)		
Physical activity (n = 833)			4.69	0.096
No	278 (75.5)	90 (24.5)		
Occasional	211 (72.5)	80 (27.5)		
Regular	116 (66.7)	58 (33.3)		
Pap smear test (n = 339)			0.24	0.623
No	197 (71.4)	79 (28.6)		
Yes	43 (68.3)	20 (31.7)		
Drink milk daily (n = 833)			1.01	0.314
No	389 (73.8)	138 (26.2)		
Yes	216 (70.6)	90 (29.4)		
Vegetable and fruit intake (n = 833)			13.02	<0.001
No	283 (79.1)	75 (20.9)		
Yes	322 (67.8)	153 (32.2)		

Table 8
Logistic regression analysis of hypertension in the study subjects (n = 620).

Characteristics	β	S.E.	O.R.	95% C.I.	p value
Constant	−3.25	0.74	0.04		<0.001
Age (years)					
30–44			1		
44–64	0.48	0.34	1.62	0.83–3.16	0.16
≧65	0.90	0.36	2.45	1.22–4.93	0.01
Marital status					
Unmarried			1		
Married	−0.16	0.32	0.85	0.46–1.59	0.62
Type of disability					
Limb			1		
Multiple	0.01	0.40	1.01	0.46–2.22	0.98
Chronic psychosis	−0.63	0.34	0.53	0.28–1.03	0.06
Hearing	−0.13	0.32	0.88	0.47–1.66	0.70
Intellectual disability	−0.54	0.52	0.58	0.21–1.61	0.30
Vision	−0.01	0.44	0.99	0.41–2.35	0.97
Primary organs	0.55	0.44	1.73	0.74–4.08	0.21
Dementia	−1.63	0.79	0.20	0.04–0.91	0.04
Other	−0.08	0.64	0.92	0.27–3.19	0.90
Disability level					
Mild			1		
Moderate	−0.27	0.23	0.77	0.49–1.20	0.25
Severe	−0.43	0.34	0.65	0.34–1.26	0.20
Profound	−1.01	0.57	0.37	0.12–1.12	0.08
BMI					
Underweight			1		
Normal	1.23	0.63	3.41	0.99–11.69	0.05
Overweight	1.91	0.65	6.72	1.90–23.78	<0.01
Obese	1.91	0.66	6.76	1.84–24.84	<0.01
Waist circumference					
Normal			1		
Large	0.50	0.24	1.64	1.03–2.61	<0.05
Vegetable and fruit intake					
No			1		
Yes	0.50	0.22	1.64	1.06–2.54	0.026

O.R.: Odd Ratio; C.I.: Confidence Interval.

paper presents the profile of blood pressure in adults with disabilities, and to examine the factors which influence hypertension occurrence based on data of community health examination. We found that there were 14.9% and 23.4% of the participants have high diastolic BP and systolic BP, and 27.4% subjects have a hypertension which they have high diastolic or/and systolic blood pressure. Comparing with 2007 national survey in Taiwan, the overall prevalence of high blood pressure was 27.7%, the prevalence in men was 30.3% and women was 25.4% (Taiwan Epidemiology Association, 2008). In the United States, Wright et al. (2011) estimated for the period 2001–2008 of hypertension status in adults aged 18 and over in the United States, they found that the mean systolic blood pressure was 122 mmHg and mean diastolic blood pressure was 71 mmHg for all adults. The most recent report on hypertension which used data from the National Health and Nutrition Examination Survey estimated that 30% of adults aged 18 and over had hypertension (Yoon, Ostchega, & Louis, 2010). Bertoia, Waring, Gupta, Roberts, and Eaton (2011) estimated the burden of uncontrolled blood pressure among those at an increased risk of coronary artery disease using the updated task force guidelines, they found 8 million (21%) Americans aged 18–85 years have hypertension ($\geqq$140/90 mmHg).

Our results found that the factors of age, BMI, waist circumference and vegetable/fruit intake were variables that could significantly predict the hypertension condition of the subjects in logistic regression analysis. Wright et al. (2011) reported that there was a trend of increasing systolic blood pressure with increasing age, men had higher mean systolic and diastolic pressures than women. Numerous studies had proved that health behavioral factors such as smoking, dietary habits, physical activity, and alcohol intake have high correlations with morbidity and mortality (Andersen, Schnohr, Schroll, & Hein, 2000; Gmel, Gutjahr, & Rehm, 2003; Heidemann et al., 2008; Hu & Willett, 2002). Yamaki, Rimmer, Lowry, and Vogel (2011) found that prevalence of chronic health conditions and high blood cholesterol was significantly higher among overweight adolescents than healthy weight adolescents with disabilities. They suggested weight control and chronic disease prevention may be a critical component of health education and transition planning for adolescents with disabilities.

In many disability groups, Mendonca, Pereira, and Fernhallc (2011) had explored differences in cardiac autonomic function between adults with and without Down syndrome in response to dynamic exercise. While levels of smoking and alcohol abuse were low, the prevalence of poor diet, obesity in women and physical inactivity was high in people with intellectual disabilities (Robertson et al., 2000). Our previous study had found that there were 11.7% cases with intellectual disability had a hypertension, and the prevalence of hypertension was significantly higher than the general population at the same age, and the BMI had significantly correlated to hypertension (Lin, Lin, & Lin, 2010). Wahi et al. (2011) also found that children with developmental coordination disorder (DCD) were significantly higher in the mean systolic BP and mean diastolic BP than children without DCD. In Dutch, van de Louw, Vorstenbosch, Vinck, Penning, and Evenhuis (2009) found the overall prevalence rate of hypertension was 17.4% in people with intellectual disability; hypertension was significantly related to older age and absence of Down's syndrome and no correlation with gender or level of ID. They suggested that the risk factor hypertension should be detected and treated in the same manner as in the general population following national guidelines.

Hypertension is an important health issue for people with disabilities, Bertoia et al. (2011) found that adults with diabetes mellitus have the greatest population burden of uncontrolled blood pressure, followed by adults with chronic kidney disease and cardiovascular disease. They also pointed out that although individuals at a higher risk for coronary artery disease are more likely to be aware of their hypertension and to be taking antihypertension medication, they are less likely to have their blood pressure under control. To improve the healthcare for people who suffer with and prevention for hypertension, the study highlights the health authorities should pay much attention to BP condition and their determinants for people with disabilities in the communities.

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