# Psycho-physiological Studies for Attendance of the Persons with Wheelchairs (Second Report)

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## Introduction

Recently, the chance of meeting the persons with physical disabilities moving with the wheelchairs in the town increased because a thought of "barrier-free" had spread in general by the leading of communal facilities. Moreover, positive social participation of persons with physical disabilities has recieved our attention by the influence of the Normalization and Independence Living[18, 19] of the persons with disabilities introduced by the United States. In this background, "Payment System of Supporting Cost for Living of Persons and Children with Disabilities" which started from 2003 have positioned the movement nursing (guide help service) as profitable public systems, aimed for social participation of persons with disabilities that could be selected by persons with disabilities on their own. But the finance shortage came out by increased needs of the users. As a result, "Act on persons with disabilities to aid independent livings[4, 5]" was enforced in April, 2006, and the principle of 10 percent load among the total fee of all welfare services for the disabled was introduced. Moreover, the category of use services that separated social welfare systems into three (the person physical disabilities, one with mental disabilities, and one with mentally retarded) was unified.

In addition, by this revision of the law, the guide help service was reorganized as a "regional living support service[6]" offered by the discretion of each municipality, although on the Payment System of Supporting Cost, the guide help service on the going out of nursing persons with disabilities had been secured as a national system so far. This means that there is a possibility that

the utilizing of the guide helper by persons with disabilities is restricted by the differences of financial situations and eagerness on the social welfare services among municipalities.

It is considered that because the frequency of going out of home for persons with disabilities is usually lower than that for general persons, restricts of using guide help services would cause not only the limitation of social participation of persons with disabilities but also the increase of mental stress on them, resulting in the harmful influences on the health condition of persons with disabilities[14, 16].

On the other hand, depending on the guide helper's quality such as the level of understanding of the kind and degree of disabilities, the knowledge about the function and shape difference of wheelchairs, and their gap of communication skills with the person with disabilities, it is possible that the person with disabilities might have the uneasiness, the stress, and harmful influences on physical and mental health conditions, when going out[1, 2, 7].

Considering these matters, in our previous report[8], the attendance with the wheelchairs on the treadmill was carried out for ten healthy individuals who had no experience on the guide help and two individuals with disabilities, the heart rates of both attendants and persons under help were recorded, and the STAI test[9, 10] was executed on both, before and after the help. As a result, a remarkable change was observed depending on the speed and the angle of the treadmill gradient for the heart rates of the attendants, indicating that the physiological loads on attendants were severe with respect to the maximum heart rates while helping[15, 17]. Moreover, the change of the level 20b/min was observed on the heart rates of the persons with disabilities although no significant change of heart rates was observed by changing the treadmill speed and angle of gradient. By the STAI test which reflect the state of anxiety, the anxieties of attendants became greater after the help than before while those of healthy persons on wheelchairs became smaller. However, on the pair of persons with disabilities and attendants during helping, the tendency to lower the anxiety after helping was observed on both of attendants and the persons with disabilities. These results show that the mental stresses of the attendants would be different between during helping the healthy persons on wheelchairs and during helping the persons with disabilities even if the physical stresses are similar, indicating that it is necessary to recognize the importance of the communications between persons with disabilities and attendants.

In continuation of our previous report[8], we investigated the psycho-physiological stresses of persons with disabilities, healthy persons on wheelchairs, and attendants during guide helping in the urban area, instead of in our laboratory, aimed for the ideal way of safe and comfortable wheelchair helps.

## Methods

Subjects were the same as our previous report[ 8 ], 10 general persons and 4 persons with physical disabilities. The attendance area with wheelchairs was 3.5 km distance of circumference (out side area) of the campus of the Osaka Pref. Univ.

The experiments were performed using two kinds of wheelchairs (A and B) with different shapes (Table 1, same ones used in our previous report[8]). Attendants (general persons) pushed a wheelchair ridden by the person with disabilities or other general person. Attendants, general persons on the wheelchair, and persons with disabilities were recorded their heart rates (HR). Before and after (pre- and post-) attendance, the STAI test (degree of anxiety) was performed on three groups. The HR was measured by using Cardiography Apparatus while moving with a wheelchair (VINE Co., Nagoya, Japan).

Table 1 Characteristics of Wheelchairs

| Wheelchairs | Weight (kg) | Wheel Diameter (inch) | Height of hand grips (cm) |
|---|---|---|---|
| A | 13.0 | 24 | 90 |
| B | 13.5 | 22 | 77 |

## Results

Fig. 1 shows the HR variations of the attendant subject F.R. during pushing five general persons on the wheelchair A. The general person N.K. showed the highest value of HRs with maximum HR of 164b/min, averages of the HRs during attendance were 140.5±18.3b/min, the highest among the five general persons on the wheelchair. Attendance times (42 min) by the subjects S.T. and N.K. were the shortest, while 50 min was the longest by the subject N.T.

The state anxiety of the F.R. at pre- and post-attendance showed the different values depending on each general person (Table 2). Particularly, the subject N.T. showed decrease of the value by 13 with 46 (pre-attendance) and 33 (post-attendance). In the case of the subject S.T. showed the same values at pre- and post-attendance, while the subject N.K. showed the increase with 37 at pre-attendance and 40 at post-attendance, revealing that the degree of change of the state anxiety is variable by general persons on wheelchairs. Average values on the post-attendance (34) decreased compared with the pre-attendance (38.6) (Table 2).

Fig. 2 shows the HR variations of the attendant subject F.R. during pushing 5 general persons on the wheelchair B. The general person N.T. showed the highest value of HRs with maximum HR of 173b/min, averages of the HRs during attendance were 146.5±15.6b/min, however, the

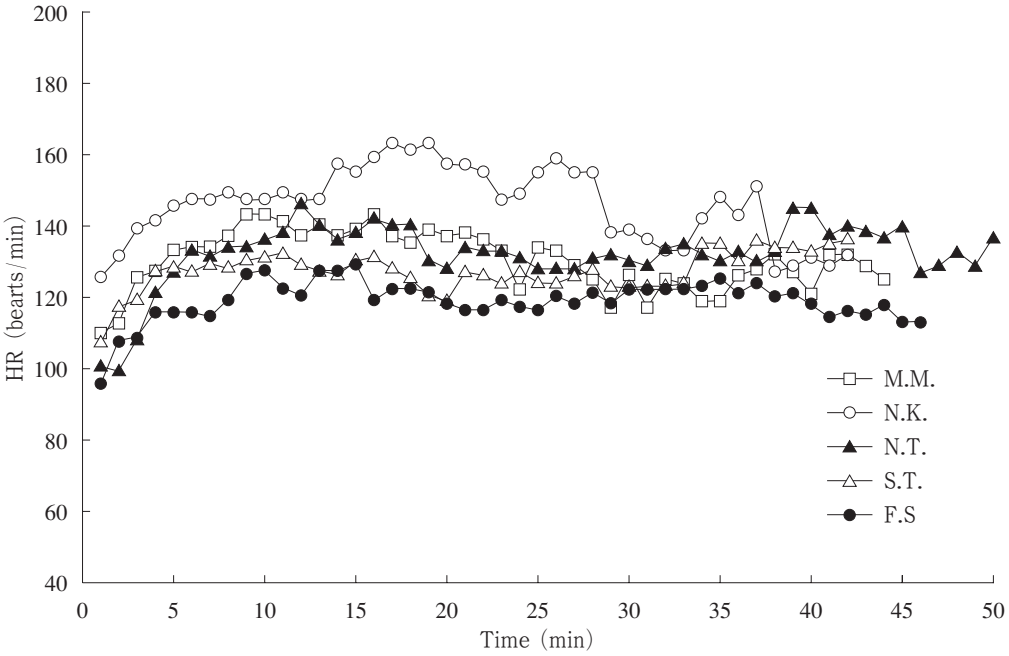


Fig. 1　Heart rate variation of the attendant subject F.R. during walking with pushing the wheelchair (type A) when ridden by five general persons.

Table 2　Results of the STAI test for the subjects F.R. (pushing the wheelchair A) with attending on each general person.

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| M.M | 54 | 41 | 36 | −5 |
| N.K | 54 | 36 | 40 | 3 |
| N.T | 54 | 46 | 33 | −13 |
| S.T | 54 | 34 | 34 | 0 |
| F.S | 54 | 35 | 27 | −8 |
| mean | 54 | 38.6 | 34 | −4.6 |
| S.D. | 0.0 | 4.4 | 4.2 | 5.7 |

highest average HR during attendance was by the subject M.M. with 156.8±8.2b/min average. The longest attendance time was 50 min in the subject M.M. The average HRs of the attendant subject F.R (Figs. 1 and 2) showed the tendency of higher values with the wheelchair B compared with the wheelchair A in all of general persons on the wheelchairs. Also, the attendance times showed longer by the wheelchair B than by the wheelchair A. Therefore, attendance times and HRs during attendance showed the difference depending on the person on the wheelchair and configuration of the wheelchair.

State anxiety of the subject F.R. at pre- and post-attendance showed the different values

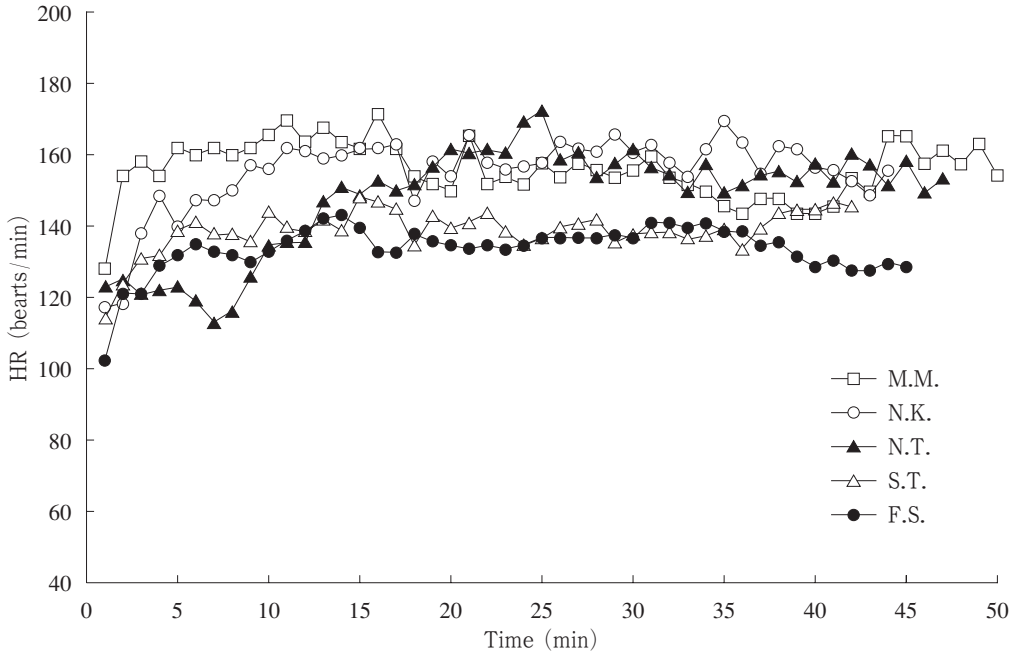


Fig. 2 Heart rate variation of the attendant subject F.R. during walking with pushing the wheelchair (type B) when ridden by five general persons.

Table 3 Results of the STAI test for the subjects F.R. (pushing the wheelchair B) with attending on each general person.

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| M.M | 54 | 39 | 35 | −4 |
| N.K | 54 | 38 | 33 | −5 |
| N.T | 54 | 42 | 34 | −8 |
| S.T | 54 | 37 | 34 | −3 |
| F.S | 54 | 38 | 34 | −4 |
| mean | 54 | 38.8 | 34 | −4.8 |
| S.D. | 0.0 | 1.7 | 0.6 | 1.7 |

depending on the general persons also by using the wheelchair B (Table 3). But it showed lower values at post-attendance compared with the pre-attendance, particularly for the subject N.T. on the wheelchair B showed the remarkable decrease with 42 of pre-attendance and 34 of post-attendance (Table 3).

Fig. 3 shows the HR variation of each general person on the wheelchair A attended by the subject F.R. Variations of HRs of all general persons were relatively little, within 65.8±4.8b/min and 90.2±4.7b/min by HR averages.

The state anxiety of general persons on the wheelchair A showed differences between persons.

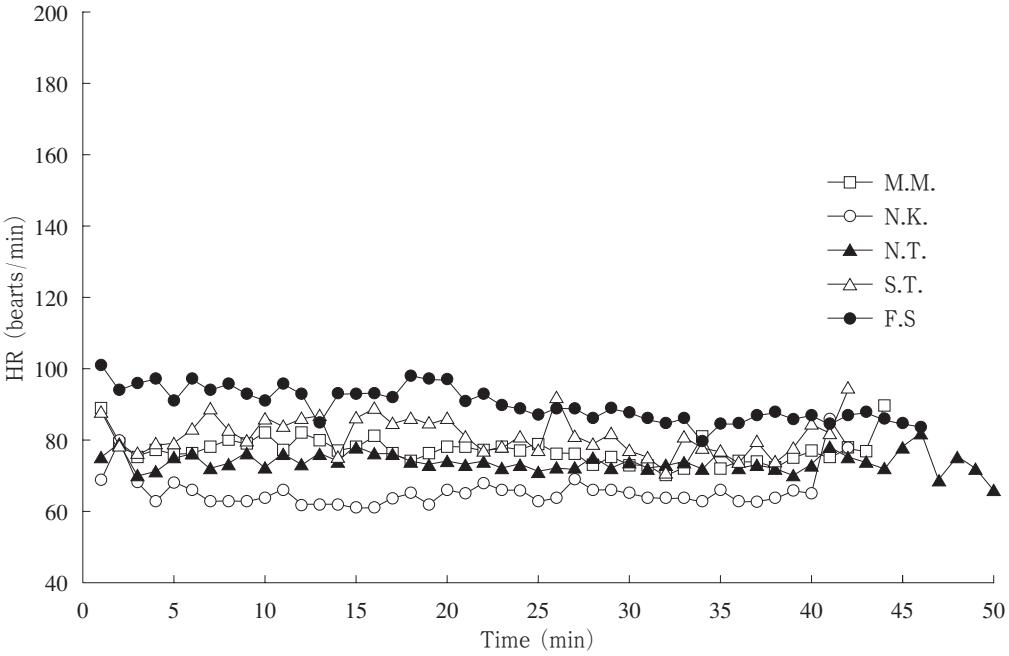


Fig. 3 Heart rate variation of each general person riding on the wheelchair (type A) during the attendance by F.R. with pushing the wheelchair.

Table 4 Results of STAI test for the each general person attended by the subject F.R. (pushing the wheelchair A).

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| M.M | 34 | 29 | 25 | −4 |
| N.K | 52 | 34 | 42 | 8 |
| N.T | 32 | 34 | 36 | 2 |
| S.T | 49 | 47 | 46 | −1 |
| F.S | 54 | 38 | 34 | −4 |
| mean | 44.2 | 36.4 | 36.6 | 0.2 |
| S.D. | 9.3 | 6.0 | 7.2 | 4.5 |

The state anxiety values of the subject N.K. were 34 at pre-attendance and 42 at post-attendance, meaning increase by 8. In contrast, the subject M.M. and F.S. showed decreases by 4 at post-attendance compared with pre-attendance. Average values of the state anxiety at pre- and post-attendance were 36.4 and 36.6, respectively, meaning the tendency of little increase after attendance (Table 4).

Fig. 4 shows the HR variation of each general person on the wheelchair B attended by the subject F.R. Similar with the case of using the wheelchair A, variations of HRs of all general persons were relatively little, within 65.8±4.4b/min and 96.6±3.3b/min by HR averages. But, depending

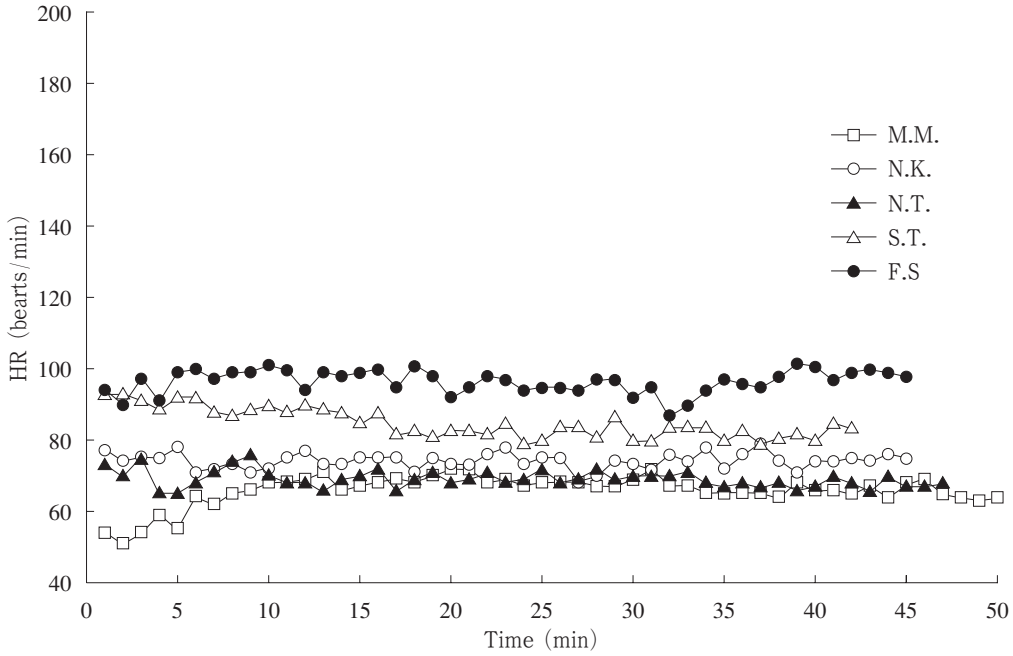


Fig. 4 Heart rate variation of each general person riding on the wheelchair (type B) during the attendance by F.R. with pushing the wheelchair.

Table 5 Results of STAI test for the each general person attended by the subject F.R. (pushing the wheelchair B).

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| M.M | 34 | 29 | 22 | −7 |
| N.K | 52 | 38 | 33 | −5 |
| N.T | 32 | 40 | 29 | −11 |
| S.T | 49 | 38 | 42 | 4 |
| F.S | 54 | 38 | 42 | 4 |
| mean | 44.2 | 36.6 | 33.6 | −3 |
| S.D. | 9.3 | 3.9 | 7.7 | 6.0 |

on the persons different physiological responses probably caused by the function and configuration differences of wheelchairs were observed, because some persons showed the lower average HR by the wheelchair B than by the wheelchair A while other persons showed the reversed tendency.

The state anxiety of general persons on the wheelchair B, similarly as the wheelchair A, showed differences by persons. Especially, the state anxiety of the subject N.T. was lower at post-attendance (29) than at pre-attendance (40), the decrease by 11. In contrast, for the case of subjects S.T. and F.S increase by 4 at post-attendance was observed. Average values of the state

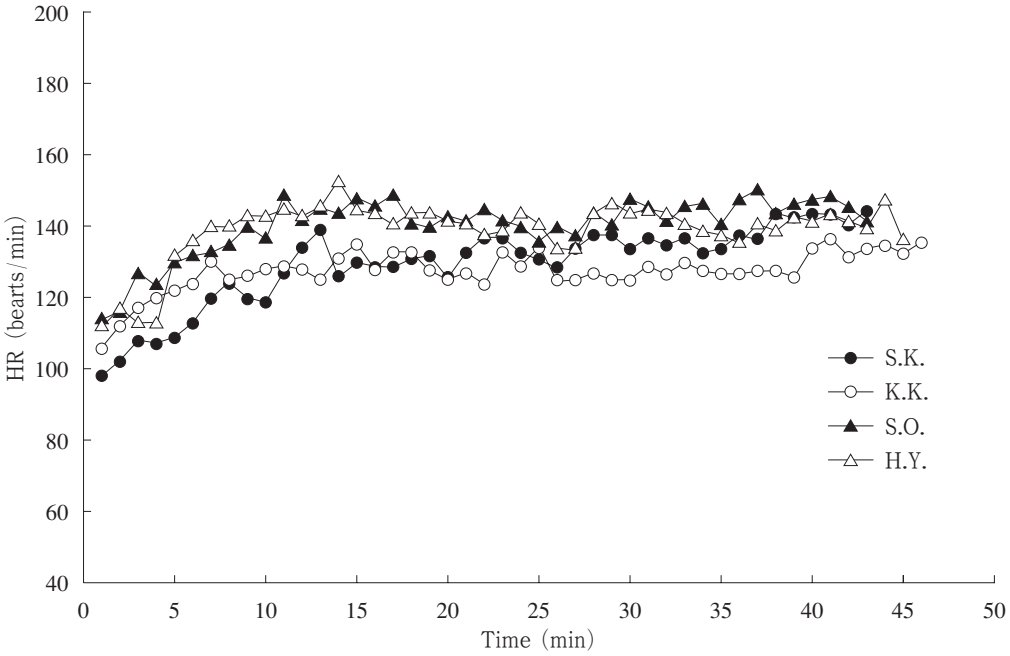


Fig. 5　Heart rate variation of the attendant subject F.R. during walking with pushing the wheelchairs ridden by four persons with disabilities.

Table 6　Results of the STAI test for the attendant subject F.R. (pushing the wheelchair) with each person with disabilities.

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| S.K. | 54 | 47 | 33 | −14 |
| K.K | 54 | 46 | 37 | −9 |
| H.Y. | 54 | 44 | 38 | −6 |
| S.O. | 54 | 44 | 38 | −6 |
| mean | 54 | 45.3 | 36.5 | −8.8 |
| S.D. | 0.0 | 1.3 | 2.1 | 3.3 |

anxiety at pre- and post-attendance were 36.6 and 33.6, respectively, meaning slight decrease after the attendance (Table 5).

Fig. 5 shows the HR variation of the attendant F.R. during pushing the wheelchairs of persons with disabilities. The HR of F.R. showed similar tendency of slight increase for all persons with disabilities. The state anxiety of F.R. decreased at post-attendance compared with pre-attendance for all persons with disabilities, however, the width of decrease of the state anxiety were different by persons with disabilities, especially for the subject S.K. with disabilities decrease by 14 was the most prominent (Table 6).

Fig. 6 shows the HR variation of all persons with disabilities attended by F.R. The HRs of per-

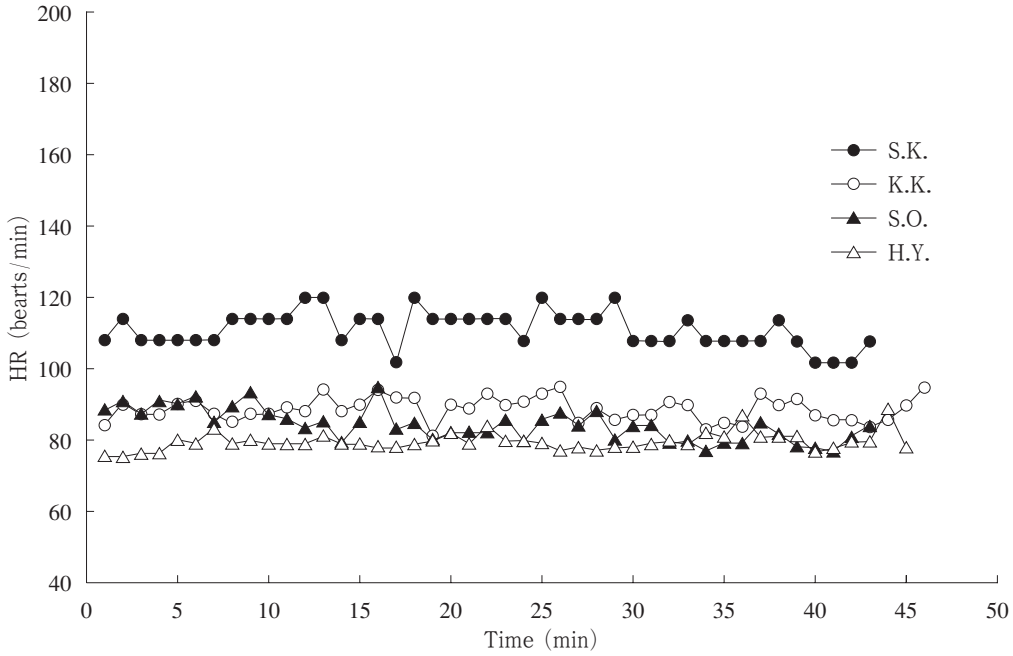


Fig. 6 Heart rate variation of each person with disabilities riding on their own wheelchairs during the attendance by F.R. with pushing the wheelchairs.

Table 7 Results of the STAI test for each person with disabilities to the subject F.R. (pushing the each disabilities wheelchair).

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| S.K. | 31 | 29 | 37 | 8 |
| K.K. | 46 | 27 | 25 | −2 |
| H.Y | 35 | 29 | 25 | −4 |
| S.O. | 45 | 29 | 31 | 2 |
| mean | 39.25 | 28.5 | 29.5 | 1.0 |
| S.D. | 6.4 | 0.9 | 5.0 | 4.6 |

sons with disabilities showed higher tendency than general persons (see Figs. 3 and 4). Average HRs of persons with disabilities during attendant showed the highest of the 111.2±5.0b/min for S.K. and the lowest of 79.5±2.6b/min for H.Y. However, the variation width of HRs for each person with disabilities were little. The state anxiety of persons with disabilities were decreased in 2 persons with disabilities but increased for other 2 persons with disabilities after attendance, meaning the different results from the results of general persons on wheelchairs (Tables 4, 5, and 7).

Fig. 7 shows the average HRs of the subjects S.T and F.R who were untrained and that of the subject O.T. who was trained, during pushing the wheelchair rideen by S.O. with disabilities.

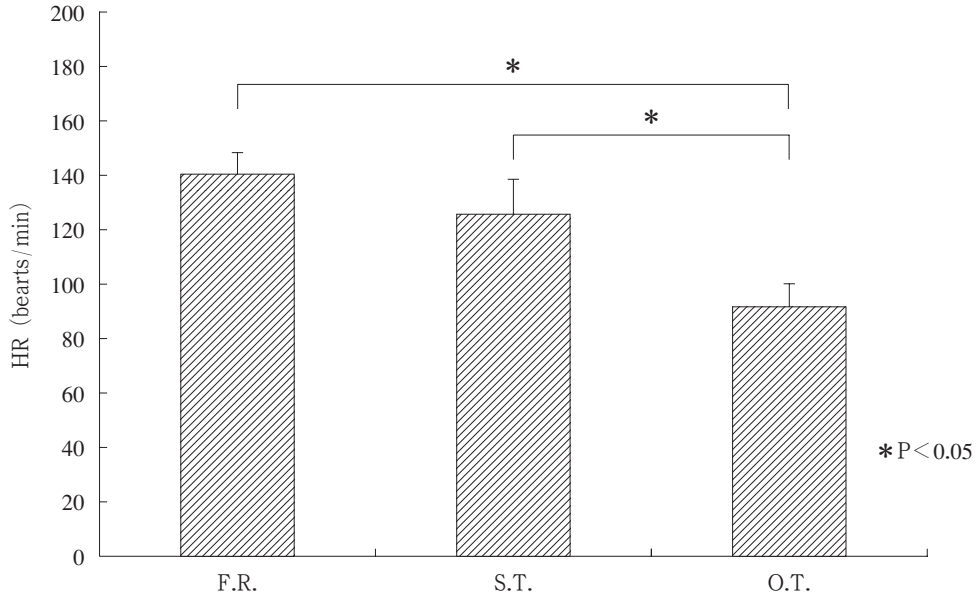


Fig. 7　Comparison of mean values of heart rate of the trained attendant subject O.T. and an untrained attendant subjects F.R. and S.T attending the subject S.O. with disabilities.

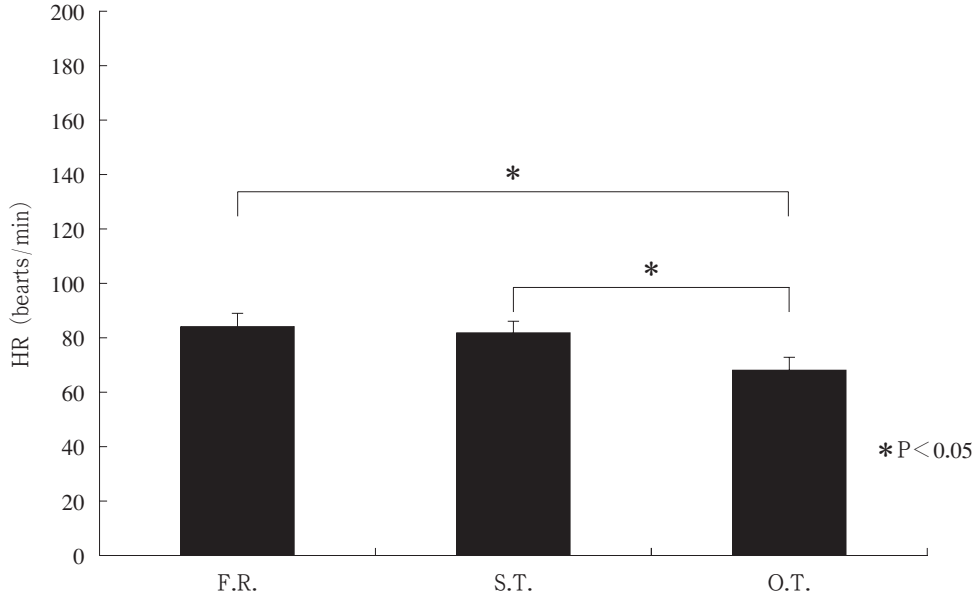


Fig. 8　Comparison of mean values of heart rate of the subject S.O. with disabilities attended by the trained subject O.T. and untrained attendant subjects F.R. and S.T.

Average HR of O.T. was 81.8±4.2b/min, that of F.R. was 140.7±8.3b/min, and that of S.T. was 125.9±13.2b/min, and the average HRs were significantly different ($p<0.05$) between the trained attendant and untrained attendants. Fig. 8 shows the average HRs of S.O. with disabilities

Table 8 Results of the STAI test for the trained attendant O.T. and two untrained attendants F.R. and S.T. during attendance of the subject S.O. with disabilities.

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| F.R | 54 | 38 | 36 | −2 |
| S.T | 49 | 53 | 48 | −5 |
| O.T. | 42 | 35 | 33 | −2 |

Table 9 Results of the STAI test for the subject S.O. with disabilities attended by a trained attendant O.T. and an untrained attendants F. R. and S.T.

| Subjects | Trait anxiety | State anxiety (pre) | State anxiety (post) | Variation |
|---|---|---|---|---|
| F.R | 45 | 29 | 31 | 2 |
| S.T | 45 | 31 | 34 | 3 |
| O.T. | 45 | 33 | 32 | −1 |

during attendance by the subjects S.T and F.R (untrained) and by O.T. (trained). The average HR of S.O. was 68.5±4.4.b/min by O.T. attendance, while that of S.O. was 84.1±4.5b/min (by F.R.) and 81.8±4.2b/min (by S.T.), both significantly higher than the HR during attendance by O.T. ($p<0.05$). The state anxiety of attendants during attendance of S.O with disabilities decreased at post-attendance in both of untrained and trained attendants (Table 8), whereas the state anxiety of S.O. with disabilities decreased by the trained attendant but increased by the untrained attendants (Table 9).

## Discussion

In this paper, following the previous report[8], discussed about the body burdens judging from the HR and the state anxiety from STAI test on attendant subjects of general persons, general persons on wheelchairs using wheelchairs A and B of different configurations, during walking around the urban area. Even for the simple operation of pushing a wheelchair, burdens on the persons with disabilities were clearly different between when they were attended by trained persons and untrained persons because the average HRs of persons with disabilities were significantly greater ($p<0.05$) by the untrained persons than by the trained persons. Body burdens of general persons on wheelchairs and persons with disabilities are thought to be little because they are passive during receiving the attendance, however, the HR levels were higher in persons with disabilities compared with general persons. The reason is considered to be the self-defense reactions of persons with disabilities during most lives on wheelchairs[11, 12, 13]. Moreover, the body burden be-

came greater judging from the average HR significantly ($p<0.05$) as mentioned above by untrained attendants compared with by the trained attendants. Therefore, wheelchair attendants are suggested to have the skills of the operations on wheelchairs and cares on persons with disabilities.

The attendance times were different between the trained attendants and untrained attendants, with tendency of shortage by untrained attendants. Considering various levels and degrees of disabilities in the persons with disabilities, the concominant variety of configurations of wheelchairs, and proper attending times are necessary during operation of wheelchairs for the safety and comfort of the persons with disabilities.

Differences of influences depending on configurations of wheelchairs on psycho-physiology were prominent in the attendants rather than in general persons on wheelchairs. Burdens on the body was greater in the wheelchair B than in the wheelchair A judging from the HRs, especially for the attendants. The handgrip of the wheelchair A locates at higher position than that of the wheelchair B allowing almost straight positions during pushing, whereas the wheelchair B forces the attendants into a little forward bends. This fact might be the reason for the greater burdens on the body of attendants by the wheelchair B than by the wheelchair A[15, 17].

As for the state of anxiety, individual differences of changes by persons on wheelchairs between pre- and post-attendance around the university were observed in this study, similar results of our previous report[8] that used the treadmill during the attendance. However, there were no significant difference of the state of anxiety between using the wheelchair A and the wheelchair B, similar as the previous report[8]. That is, on general persons, no remarkable difference in the state of anxiety between pre- and post-attendance depending on the differences of configurations of two wheelchairs. However, persons with disabilities clearly decreased in the state of anxiety at post-attendance compared with at pre-attendance. On attendance by the trained attendants showed no changes in the state of anxiety between at post-attendance compared with at pre-attendance, while on attendance by the untrained attendants increased the feelings of strain and anxiety in the psycho-physiological condition of persons with disabilities judged from the introspection reports of persons with physical disabilities. These results revealed that the difference of experience of attendants gives different psycho-physiological influences on both attendants and the persons with physical disabilities.

As a future problem for the attendance who seems simply to push the wheelchair, it is thought to be hurried that upbringing of the attendant-experienced persons in the view of situations of persons with physical disabilities receiving the attendance. Moreover, it seems necessary to consider about the effective methods of the wheelchair attendance taking the morphological aspects such as the height of persons with disabilities.

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〔共同研究：車いす介助に関する生理心理学的研究〕

# 車いす介助に関する生理心理学的研究（第２報）

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要約

本報では，介助の実際を市街地において行った時の介助者―障害者間の生理心理的負担について検討し，前報に引き続き安全で心地よい車いす介助のあり方を検討することを目的とする。

協力者は，前報同様，障害者４名，健常者10名である。

前報で示した形状の異なる車いすＡ，Ｂを用いた健常者同士（介助者及び介助協力者）の介助と実際の障害者における介助で，大阪府立大学キャンパスの外周およそ3.5km を車いすで押してもらった。

介助者，介助協力者及び障害者には，携帯用心拍記録装置を装着させ，介助中の心拍数を記録した。また，介助前後には，STAI テストを測定した。

介助者の平均心拍数は，いずれの介助協力者の場合でも，車椅子Ａに比べて車椅子Ｂの方が，高い値を示した。また介助時の心拍数，及び介助時間は，車椅子の形状及び介助協力者によって，異なる結果を示した。介助前後の状態不安は，介助前に比べて介助後の方が低かった。

介助協力者の心拍数は，車椅子Ａ，Ｂ共に，いずれの協力者においても，介助中の心拍の変動幅は少なく示された。しかし，協力者によっては，心拍数平均値からみて車椅子ＡよりＢの方が低値を示した者や，逆に高値を示す者がおり，車椅子の機能や形状によって，介助協力者の生理反応も異なることが示された。各介助協力者の状態不安は，車椅子Ａ，Ｂ共に介助協力者間で異なる傾向を示した。

障害者を対象とした車椅子介助時における平均心拍数は，介助経験者に比べ未経験者の方が有意（$p<0.05$）に高かった。また，障害者の平均心拍数についても，未経験者介助時の方が有意（$p<0.05$）に高かった。

障害者を介助した時の介助者の状態不安は，介助経験者および未経験者共にいずれも介助

前に比べ介助後に減少し，介助経験による差は認められなかった。障害者の状態不安は，介助未経験者による介助では介助後に増加し，介助経験者では，減少した。

以上のことから，身体障害者に対する介助経験の差が，介助者と身体障害者のいずれにも生理心理的影響を及ぼすことが明らかとなった。今後の課題として，車椅子を押す簡単と思われる介助についても，介助を受ける身体障害者の立場に立った視点での介助経験者の育成が急務と考えられる。