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Physical Fitness of Adolescents With Auditory Impairments

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The Project UNIQUE Physical Fitness Test was administered to 153 hard of hearing, 892 deaf, and 686 hearing subjects in the age range of 10 to 17 years to contrast their physical fitness status. Relatively few significant differences between groups were found. Only on the sit-up test did hearing subjects surpass the performance of at least one of the two auditory impaired groups in at least two of the three age groups contrasted. Although some gender and age interactions were found on other test items, no clear pattern relative to a comparison of hearing and auditory impaired groups occurred. Age and gender performances within the auditory impaired groups were similar to those expected of hearing groups.

The physical fitness of American boys and girls has been periodically appraised, and normative data to evaluate physical fitness status has been periodically revised (Hunsicker & Reiff, 1976; Pate, Ross, Dotson, & Gilbert, 1985; Ross, Dotson, Gilbert, & Katz, 1985). Various writers have suggested that the physical fitness of adolescents with auditory impairments may be lower than that of their hearing peers, primarily because of a tendency to withdraw from social participation (Fait & Dunn, 1984; Sherrill, 1981; Winnick, 1979). However, relatively little data describes their physical fitness status and how it is affected by severity of impairment, age, or gender. The lack of research on the physical fitness of adolescents with auditory impairments has limited knowledge which undergirds sound practical application.

Knowing whether adolescents with auditory impairments have needs that are unique, and how needs are influenced by age, gender, or differences in severity of condition is important. It serves as a foundation for the construction of tests of physical fitness, physical fitness appraisal, the grouping of pupils for program development, and information pertaining to level, intensity, and duration of phys-

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ical activity. Of some relevance to these questions, Winnick and Short (1984) reported that the factor structure of physical fitness of adolescents with auditory impairments is similar to that of hearing peers and recommend the same test items for testing physical fitness and the same components for the programmatic development of physical fitness. Data supporting these comments are provided in detail by Winnick and Short (1985). The emphasis of this study is to contrast the physical fitness of hearing and auditory impaired youngsters and to examine influences of age, gender, and severity of auditory impairment on fitness status.

Method

Subjects

The subjects in this study included 686 hearing (H) and 1,045 auditory impaired (AI) adolescents in the 10 to 17 age range. AI subjects included 153 hard of hearing (HH) and 892 deaf (DF) subjects. All H and AI subjects in the original UNIQUE test standardization sample who were administered all test items (Winnick & Short, 1985) were selected as this study’s sample. Subjects were tested in schools and agencies throughout the United States. H subjects were youngsters who were not identified as handicapped by their local school district, who were free from physical impairments or disabilities that may have influenced test results, and who attended regular classes in noninstitutionalized regular schools.

Hard of hearing was defined as a hearing loss ranging from 27 to 90 db or a subnormal or defective but functional sense of hearing with or without a hearing aid. Hard of hearing also meant a hearing impairment, whether permanent or fluctuating, that adversely affected a child’s educational performance but was not included under the definition of deaf. Deafness was a hearing loss of 91 db or greater in the better ear, nonfunctional for the ordinary purposes of life, and/or hearing impairment so severe that the youngster was impaired in processing linguistic information through hearing with or without amplification, and which adversely affected educational performance. AI subjects from both institutionalized (n = 917) and noninstitutionalized (n = 127) settings were grouped and classified as HH or DF by their local school or agency. The number of subjects in the study categorized by group membership, gender, and age is presented in Table I.

The UNIQUE Test

The UNIQUE test1 (Winnick & Short, 1985) is a six-item battery that may be used for both AI and H adolescents. The six items and the components of physical fitness each purports to measure are as follows: (a) sum of the triceps and subscapular skinfolds (body composition), (b) sum of the right and left hand grip strengths (strength), (c) flexed knee sit-ups (power-strength), (d) sit and reach

1The UNIQUE test is appropriate for adolescents with visual impairments, auditory impairments, cerebral palsy, and spinal neuromuscular conditions as well as for non-handicapped adolescents. For a description of test construction procedures, including estimates of validity and reliability, see Winnick & Short (1984).
Table 1
Number of Subjects Categorized by Group Membership, Gender, and Age (N = 1713)

<table>
<thead>
<tr>
<th>Age</th>
<th>Hearing</th>
<th></th>
<th>Hard of hearing</th>
<th></th>
<th>Deaf</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10-12</td>
<td>Female</td>
<td>92</td>
<td>Male</td>
<td>83</td>
<td>Female</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>83</td>
<td></td>
<td></td>
<td>Male</td>
<td>17</td>
</tr>
<tr>
<td>13-15</td>
<td>Female</td>
<td>251</td>
<td>Male</td>
<td>90</td>
<td>Female</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>90</td>
<td></td>
<td></td>
<td>Male</td>
<td>37</td>
</tr>
<tr>
<td>16-17</td>
<td>Female</td>
<td>80</td>
<td>Male</td>
<td>38</td>
<td>Female</td>
<td>187</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>90</td>
<td></td>
<td></td>
<td>Male</td>
<td>203</td>
</tr>
<tr>
<td>Total</td>
<td>423</td>
<td>263</td>
<td>61</td>
<td>92</td>
<td>389</td>
<td>503</td>
</tr>
</tbody>
</table>

Data Analysis

Data were initially analyzed by a three-way group membership (H, HH, or DF), by gender by age (10 to 12, 13 to 15, or 16 to 17) MANOVA. Univariate F ratios and simple main effects were calculated post hoc. In an effort to reduce error, the .01 level of significance was adopted for the univariate ANOVAs and the simple main effects. The Scheffé procedure was used to make other multiple comparisons. Since the Scheffé procedure is very conservative, the alpha level for all comparisons was set at .05.

Results

Results on the six UNIQUE test items are depicted in Figure 1. Using multivariate analysis, it was found that all three two-way interactions were significant: group by gender, $F(12, 3414) = 5.52$; group by age, $F(24, 6826) = 4.09$; gender by age, $F(12, 3414) = 23.61$.\(^2\)

\(^2\)Table of means and standard deviations is obtainable from the first author.
Figure 1 — Means and standard deviations of physical fitness test scores. (Continued on next page.)
All three two-way interactions were significant for skinfolds. An analysis of these interactions suggests that where significant group differences existed, H females had smaller skinfolds than either HH or DF females. The group by gender interaction, $F(2, 1713) = 12.22$, is due to the fact that there were no group membership differences for males on the skinfold test. Gender had a similar influence on skinfold measures for all three groups; females generally had larger values although an analysis of the gender by age interaction, $F(2, 1713) = 7.60$, indicated there were significant gender differences for the upper two age groups (13 to 15, 16 to 17) only. Age, as indicated by the significant group by age interaction, $F(4, 1713) = 4.18$, had a somewhat different effect on skinfolds within each group. Age was not a significant factor at the .01 level for HH subjects. For DF subjects, members of the two older groups (13 to 15, 16 to 17) had significantly larger folds than members of the younger group (10 to 12). This contrasts with the profile for H subjects (particularly females) wherein the largest measures were obtained by the middle group (13 to 15).

Grip Strength

An analysis of grip strength scores yielded significant group by age, $F(4, 1713) = 3.51$, and gender by age, $F(2, 1713) = 107.01$, interactions. With one exception, however, no significant grip strength differences were found among the three groups of subjects. A significant difference favoring the HH group was identified at ages 13 to 15. An inspection of the means suggests that this exception was due primarily to the relatively high scores obtained by HH females. Gender
had a similar influence on the three groups; males generally made higher scores than females, although significant gender differences were found at the upper ages (13 to 15, 16 to 17) only. Age also had a similar, although not identical, influence on the grip strength performance of the three groups, with older subjects generally making higher scores. For H and DF subjects, significant differences were found among each of the three age groups (improved performance with age). For HH subjects, significant differences favored the older groups (13 to 15, 16 to 17) over the younger group (10 to 12), but no significant differences existed between the two older groups. Performance generally improved with age regardless of gender or group membership, although an exception was noted for HH females.

**Sit-Ups**

As with grip strength, the group by age, $F(4, 1713) = 10.45$, and gender by age, $F(2, 1713) = 6.09$, interactions were significant for sit-ups. Significant differences were found among the three groups at ages 13 to 15 and 16 to 17, but not at ages 10 to 12. H subjects scored significantly higher than DF subjects, and DF subjects significantly higher than HH subjects at 16 to 17. At 13 to 15, H and HH subjects scored significantly higher than DF subjects (no significant differences between H and HH subjects). Males generally scored higher than females although an exception was noted for HH subjects 10 to 12. In general, males made significant improvement among the three age groups, while females made significant improvement only between the 10 to 12 and 13 to 15 age groups. (The finding with regard to males was apparently influenced by the relatively large number of DF subjects.) Age had a somewhat different effect on the sit-up performance of each group. For H subjects, significant differences were found between the two older age groups (13 to 15, 16 to 17) and the younger age group (10 to 12). For HH subjects, the highest scores were obtained by the middle age group (13 to 15), with no significant differences between the youngest and oldest groups. For DF subjects the oldest group made significantly higher scores than either of the other two age groups.

**Sit and Reach**

The group by gender interaction was significant, $F(2, 1713) = 6.84$, for sit and reach. H females were significantly more flexible than DF and HH females; no significant differences between the latter two female groups or among the three male groups were noted. Females made significantly higher scores than males at all three age groups regardless of group membership. Age, $F(2, 1713) = 44.55$, was generally associated with higher sit and reach scores. The Scheffé analysis of the main effect of age indicated significant differences among all three age groups, although an inspection of the means suggests that this finding is due primarily to the contribution of the H and DF subjects.

**50-Yard Dash**

Group by age, $F(4, 1713) = 3.60$, and gender by age, $F(2, 1713) = 20.80$, interactions were significant for the 50-yard dash; however, no significant differ-
ences among the three groups were found. Gender had a similar influence for all three groups; males generally had faster times although the gender differences were significant at the upper ages (13-15, 16-17) only. Performance generally improved with age. H and DF subjects showed significant improvement among all three age groups while HH subjects only showed significant improvement between the 10-to-12 and 13-to-15 age groups.

Long-Distance Run

The analysis of long-distance run scores yielded a significant gender by age interaction, $F(2, 1713) = 21.94$. Males generally scored higher than females at each age although an exception was noted for HH subjects 10 to 12. Age was found to be a significant factor for males (increased performance was generally associated with increased age), but not for females. The main effect of group was not significant, $F(2, 1713) = .94$.

Summary of Results

Relatively few significant differences among the three groups were found. Of the six items analyzed, H subjects surpassed the performance of at least one of the two AI groups at at least two of the three age groups on only the sit-up test. Other significant differences appeared to be limited to specific gender by group and age by group interactions for specific test items. Most notably, DF and HH female subjects had larger skinfolds and were less flexible than H females. Generally, no consistent patterns relative to a comparison of H and AI subjects emerged from these differences.

Gender and age appeared to exert similar influences on the physical fitness measures obtained for all groups. The established pattern of higher scores for females on skinfolds and sit and reach, and better scores for males on grip strength, sit-ups, 50-yard dash, and long-distance run was observed for AI as well as H subjects. With regard to the influence of age, males generally improved performance scores with age and females showed small change, a leveling off, or even a decline in performance in the top two age groups. The most notable exceptions to this pattern were due to scores obtained by HH subjects.

Discussion

The few significant differences found among the groups (excluding some gender and age with group interactions) demonstrates that youngsters with auditory impairments can and do develop their physical fitness to an extent comparable to hearing youngsters. The finding that H subjects significantly surpassed the performance of AI subjects on the sit-up test was not expected. In their comparison of congenitally deaf and hearing students, ranging in age from 6 to 11, Pender and Patterson (1982) found that hearing children scored better on the sit-up test but the difference was not significant. In regard to the present study, it is speculated that the rapid up and down movements associated with the sit-up may have resulted in disorientation due to unstable visual cues and/or to vestibular involve-
ment with concomitant reduction in the sit-up performance of AI subjects. This possibility is supported to a degree by Morsh (1936), who stated that many people with semicircular canal involvement walk with a staggering gate or "walk wide" with legs apart at night when visual cues are absent. It also appears compatible with the results of several studies that report inferior balance by deaf subjects and that attribute such deficiency with the lack of visual cues and/or semicircular canal involvement (Brunt & Broadhead, 1982; Lindsey & O’Neal, 1976; Myklebust, 1964; Pender & Patterson, 1982). Unfortunately, the number of AI subjects with vestibular involvement in the present study is not known. In regard to gender and group interactions, the fact that DF and HH females had larger skinfolds and were less flexible than H females may be due to AI females being less involved in physical activity.

The influence of age within the AI groups appears to be compatible with results found with H subjects in this and other studies (Winnick, 1979). In the present study, males showed an improvement in physical fitness scores with increase in age while females showed smaller increases than males and some leveling off and even decline on some measures. This pattern was violated most notably by HH subjects. HH subjects in the 16 to 17 age group more often than not showed a decline in performance scores when compared with the 13 to 15 age group. Although it may be reasonably argued that older HH subjects are less active and therefore less fit, the reason this occurs within the HH groups and not the DF group is not known.

Results pertaining to gender differences are similar to those found with H subjects. Males exceeded females on all performance items except flexibility, and skinfold measures of females were significantly higher than those of males.

The results of this study support the practice of combining AI and H pupils with separation according to gender and age at adolescence in activities involving physical fitness. Remedial physical education may be required in those instances where deficiencies may occur. With the possible exception of the sit-up test, AI pupils may be evaluated against the same physical fitness standards as H adolescents of the same age and gender.

References


