Feasibility Study of Functional Movement Screening in Drug Abuse Population

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Research Article

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Abstract

Objective: To investigate the feasibility of functional movement screening (FMS) in drug abuse patients and to evaluate the relationship between functional motor ability and age, sex and drug type.

Methods: Random sampling was used to include 886 drug abusers from 5 provinces. The FMS test was conducted on 886 patients in compulsory isolation drug rehabilitation centers in five provinces of China, and the statistics were calculated.

Results: The FMS scores of the psychotropic drugs group were all lower than that of the narcotic drugs group, especially in the core stability items ($P < 0.01$). Men scored higher than women in core stability and lower than women in flexibility. The seven FMS scores of the 30-34 years old group were lower than those of 35-49 years old and 40-44 years old groups, respectively. The total FMS scores were significantly correlated with gender (r=0.198, $P < 0.01$), age (r=0.161, $P < 0.01$) and drug type (r=0.283, $P < 0.01$).

Conclusions: The application of FMS in the drug abuse population is viable, and drug type, sex and age can be used to predict the FMS composite score.

Introduction

According to the World Drug Report 2020, 270 million people worldwide take drugs and 35 million become addicted to drugs every year. The drugs market will likely further expand due to the impact of COVID-19[1]. Drug abuse can damage brain function and body function[2, 3]. Studies have found that long-term drug abuse leads to physical decline and deficiency[4] and also has a negative impact on the living and working ability[5]. The latter is one of the important challenges that drug abusers face while reintegrating into society and may lead to relapse [6]. Exercise is a proven method of enhancing the physique and physical condition[7]. However, research in the field of sports detoxification is still in its infancy both in China and elsewhere. There are numerous sports methods and procedures for drug detoxification, but the current sports intervention programs are lacking, and the definition standards of drug detoxification are incomplete. Some studies have shown that the functional level of drug abusers did not significantly improve with exercise [8], and there are even reports of sudden death during exercise[9, 10]. Therefore, in order to minimize injury in the drug abuse population, scientific methods of correction using personalized exercise plans should be implemented. Improving the physical fitness of drug abusers can assist their return to society. Further research in the field of rehabilitation is required to solve this important issue.

Functional Movement Screening (FMS) is a new tool for measuring and evaluating motor ability derived from functional movement training. FMS mainly collects the data of human movement patterns while performing functional activities to minimize the risk of injury. FMS evaluates the functional movement of the whole body by assessing seven different body postures and uncovering the limitation and asymmetry in muscle activity[11]. The test was developed by Cook and Bruton in the 1990s. It was first applied in the field of physical therapy and then gradually applied in the fields of physical fitness and rehabilitation [12,

13]. Studies at home and abroad mainly involved ordinary people and professional athletes, and the application in the drug abuse population has barely been studied[14]. Physical function is an essential part of the quality of life[15]. For drug abusers, unrestricted and pain-free movement lays a physical foundation for reintegration into society and improved health in daily life.

Some studies have proved that taking narcotic drugs causes memory and motor function damage. Furthermore, psychotropic drugs can cause severe neurotoxicity and motor dysfunction [16–18]. However, there is no literature on the functional damage of narcotic drugs and psychotropic drugs. This study reports preliminary normative values, asymmetries, and total FMS scores for drug abusers of different drug types in relation to sex, age, type of drug, and years of drug use. FMS was evaluated in 886 drug abusers from five provinces. This study is the first cross-sectional investigation of FMS in the drug abuse population and the first study to distinguish whether drug types exert different damage to the body. Therefore, this study has certain theoretical research value.

Study Subjects And Methods

Subjects

All measurements were taken between June and August 2021. 1124 drug abusers agreed to participate in the study (response rate = 93%). All participants met the criteria in the screening process performed by doctors. The inclusion criteria were: (1) all participants were narcotic or psychotropic drug users; (2) No systemic diseases, metabolic diseases, autoimmune diseases, cerebrovascular diseases, familial diseases and other neurological diseases that would seriously affect the FMS test, and no serious orthopedic trauma (such as a fracture or complete muscle rupture); (3) No individuals with visual or hearing impairment. (4) No stimulants such as caffeine were taken within 24 hours before exercise screening. The investigation process is shown in Fig. 1. The basic situation table is shown in Table 1.

This study was approved by the Ethics Committee of Hunan Normal University (Batch No. : 16-2010) and conducted according to the ethical requirements of clinical trials. All subjects signed informed consent.

Table 1
Basic information table

	Male (n = 608)	Female (n = 278)	Total (n = 886)
Age (year)	36.2 ± 3.5	37.6 ± 4.0	36.6 ± 3.7
Height (m)	1.67 ± 0.1	1.57 ± 0.1	1.64 ± 0.1
BMI (kg/m^2)	23.0 ± 2.9	24.0 ± 3.2	23.3 ± 3.1

Procedure

The study was conducted from December 2020 to August 2021. In December 2020, the authors conceptualized the study and contacted personnel in mandatory isolation centers. Basic information and FMS data were obtained from narcotic drug abusers and psychotropic substance abusers. The five provincial mandatory isolation centers were visited in June 2020. In July 2021, screening and willingness surveys were conducted on the recruited subjects to ensure the smooth execution of the experiment and that they were willing to participate. Basic information questionnaires were issued, and FMS tests were conducted in August 2021.

Research Methods

Test

Testing of the 886 drug abusers was completed in accordance with established testing techniques, standards, and guidelines. Testing process: 1) No exercise was required the day preceding the test, and the participants were told to pay attention to rest in order to better complete the test on the next day. 2) The whole test process was explained to all the drug addicts, following which the examiners carried out the test according to the test standards and verbal prompts. 3) Each participant completed 7 test actions three times, and the best score for each action was recorded. When the quality of the action lay between two scores, the lower score was considered. 4) Test time: Wednesday morning, Saturday afternoon. 5) Test equipment: FMS standard test suite. 6) Test site: compulsory isolation and drug rehabilitation centers in Guangxi, Guizhou, Yunnan, Shanxi and Hunan provinces. 7) Equipment requirements: uniform short sleeves, shorts and sneakers. 8) All tests in the study were performed by examiners who had completed FMS preliminary and advanced certification training courses. Before the test, the test procedure, scoring criteria, matters needing attention and instructions were reviewed. The test procedures were mastered, reducing the error caused by the heterogeneity between the test interpretation from different examiners.

Statistical Analysis

SPSS 22.0 and EXCEL 2016 were used for statistical analysis of the collected data. Non-parametric independent sample T-test was used to assess the difference in FMS score between the narcotic drugs group and psychotropic drugs group ($P < 0.01$). Spearman correlation was used to determine the correlation between the total score of the FMS test and gender, age, years of drug use and drug type. Subsequently, a multiple regression model was used to estimate the linear relationship between the total score of the FMS test and age, sex, drug type and years of drug use. Base case information data were expressed as mean ± standard deviation (M ± SD).

Results

FMS Test Score Analysis Of Drug Type

The psychotropic drugs group scored lower in five tests (squat, trunk stability push-ups, hurdle step, straight lunge and rotation stability) than the narcotic drugs group. The difference was statistically significant ($P < 0.01$). (Table 2).

Table 2
Comparison of drug types (Mean ± SD)

	Psychotropic drugs(n = 354)	Narcotics drugs (n = 532)	Total (n = 886)
Squat**	1.6 ± 0.7	1.9 ± 0.6	1.8 ± 0.6
Push-up**	1.3 ± 0.6	1.5 ± 0.8	1.4 ± 0.7
Hurdle**	1.4 ± 0.5	1.6 ± 0.5	1.5 ± 0.5
Lunge**	1.5 ± 0.6	1.8 ± 0.6	1.6 ± 0.6
Shoulder	1.3 ± 0.6	1.4 ± 0.7	1.3 ± 0.7
Straight leg	1.7 ± 0.9	1.8 ± 1.0	1.7 ± 0.9
Rotary stability**	1.2 ± 0.4	1.4 ± 0.5	1.4 ± 0.5
Total FMS scores**	10.0 ± 2.0	11.3 ± 2.4	10.8 ± 2.3

** indicates a significant difference in one-way FMS tests, $P < 0.01$

Gender And Age FMS Test Score Analysis

Males scored higher than females in the push-up test but lower in other items. The 30–34 age group scored lowest in all seven tests, while the 40–44 age group scored highest in most tests. A comparison by sex is shown in Table 3 and by age in Table 4.

Table 3

Comparison between males and females

	Men (n=608)	Women (n=278)	Total (n=886)
Squat	1.7±0.6	1.9±0.7	1.8±0.6
Push-up	1.6±0.7	1.2±0.7	1.4±0.7
Hurdle	1.5±0.5	1.6±0.5	1.5±0.5
Lunge	1.6±0.6	1.8±0.6	1.6±0.6
Shoulder	1.3±0.6	1.4±0.7	1.3±0.7
Straight leg	1.5±0.9	2.2±0.8	1.7±0.9
Rotary stability	1.3±0.5	1.4±0.5	1.4±0.5
Total FMS scores	10.5±2.3	11.4±2.3	10.8±2.3

Abbreviation: Total FMS™ score = sum of the seven individual test items in the Functional Movement Screen.

Table 4

Comparison of age categories

	30-34years(n = 248)	**35-39years(n = 418)**	**40-44years(n = 220)**
Squat	1.7 ± 0.6	1.8 ± 0.7	1.9 ± 0.6
Push-up	1.4 ± 0.6	1.5 ± 0.7	1.4 ± 0.8
Hurdle	1.5 ± 0.5	1.5 ± 0.5	1.6 ± 0.5
Lunge	1.5 ± 0.6	1.6 ± 0.6	1.8 ± 0.6
Shoulder	1.2 ± 0.6	1.3 ± 0.7	1.4 ± 0.7
Straight leg	1.5 ± 0.9	1.7 ± 0.9	2.0 ± 0.9
Rotary stability	1.3 ± 0.5	1.4 ± 0.5	1.3 ± 0.5
Total FMS scores	10.2 ± 2.0	10.8 ± 2.4	11.5 ± 2.5

Abbreviation: Total FMS™ score = sum of the seven individual test items in the Functional Movement Screen.

Asymmetry

Of the 886 participants in the study, 735 (83%) had asymmetry (intensity or range of motion) in at least one of the five FMS test items, including the bilateral assessment. (Table 5).

Table 5

Distribution of asymmetry

	Men（n=608）	Women（n=278）	Total(n=886)
One asymmetry	206	107	313
Two asymmetries	174	82	256
Three or more asymmetries	120	46	166
Range of motion			
Shoulder	207	83	290
Active straight leg raise	198	68	266
Strength (rotary stability)	173	106	279
Range of motion and strength			
In-line	195	66	261
Hurdle	159	93	252

Multiple regression model analysis

FMS scores were significantly correlated with gender (r=0.198, P < 0.01), age (R =0.161, P < 0.01) and drug type (R =0.283, P < 0.01), while years of drug use were not significantly correlated with FMS scores (R =-0.077, P > 0.05). The results of the multiple regression model are shown in Table 6. Gender, age and drug type were important predictors of the total FMS score (P < 0.01). Regression analysis revealed that gender, age, and drug type accounted for approximately 11.0% of the variability in total FMS scores. (Table 6).

Table 6
Multiple regression model analysis of FMS total score

Term	Estimate	SE	*t-test*	*p-value*
Intercept	7.321	0.74	9.9	0.000
Age	0.069	0.021	3.334	0.001
Drug use fixed number of year	0.001	0.001	1.061	0.289
Narcotics drugs	1.155	0.157	7.372	0.000
Women	0.555	0.166	3.347	0.001
R^2 = 11.0%				

Discussion

The average score of the 886 players participants was (10.8 ± 2.3) points, (10.0 ± 2.0) points in the psychotropic drug group and (11.3±2.4) points in the narcotic drug group. There was a significant difference between the narcotic drug group and the psychotropic drug group (P < 0.01). This isThe results are similar to the research results ofthose reported by Liu Zhaoqiang et al.et al, but the score is much lower than that of Liu Zhaoqiang et al. On the one hand, it this may be related due to the small limited sample size of the test subjects, and on the other hand, or it may be related to the group classification group, so it is difficult tomaking the comparison ofe the test results inaccurate[19] . In addition, foreign studies also pointed out that the test scores of healthy people ranged from (14.14±2.85) to (15.7±1.9), indicating that the score of the general population was higher than the total score of "14", which got scoring 2 points in each of the seven tests on average [20]. ThereAt present, there are few large-sample studies on scores of large sample ofinvolving the drug abuse population at home and abroad. Therefore, the results of this study cannot be compared across the boarddirectly. However, it can be confirmedthis study confirms that compared with the general population, the physical function of drug abusers is generally poorer, which is similar toin accordance with the study of Li Zhang et al.[21] .

There were also significant differences between The psychotropic drugs group scored significantly lower than and the narcotic drugs group in five tests of mobility of lower limbs and trunk mobility (squat, trunk stability push-ups, hurdle step, straight lunge, and rotation stability) (P < 0.01), and the scores of psychotropic drugs group were lower than that of narcotic drugs group. It is known that Mmost patients with cerebral palsy have abnormal posture and severe movement disorders, because thedue to central nervous system damage. of patients with cerebral palsy is damaged, which leads to Tthe discoordination of the skeletal musculoskeletal system, nervous system and soft tissue, affects the spinal stabilization system and impacts core strength[22] . In this study, the psychotropic drugs group scored significantly lower than the narcotic drugs group in the core stability items. The latter may be related to the greater damage of psychotropic drugs on the central nervous system, resulting in more pronounced core motor function damage.

Males scored higher than females in the push-up body stability item but lower in the other items. This may be related to the physiological structure of men[23] , having a stronger trunk than women. According to societal and cultural standards, males often participate in more physically demanding activities than women, whereas women are more flexible than men[24]. For example, in a sample of 44 women and 53 men, only 8 of 44 women (18%) scored 1 on the shoulder mobility test, but 26 of 53 men (49%) scored 1 on the shoulder mobility test. In contrast, no woman scored 0 on the active straight leg raising test, and only three women scored 1, while one man scored 0 and 15 men scored 1 on the active straight leg raising test. Men performed better in the push-up test, measuring upper body strength and stability, with 15 out of 53 men (28%) scoring a 3, while only 3 out of 44 women (7%) scored a 3 on the push-up test[25, 26] . The 30-34 age group scored lowest on all seven tests, and the 40-44 age group scored highest on most tests. Subjects aged 30-34 in the study had the lowest FMS scores compared with other age groups. This may be due to the larger population of people taking psychotropic drugs between 30 and 34 years old than the 34 - 44 age group. This phenomenon may be related to the relatively short history of psychotropic drugs in China and control by public security organizations[27] .

Asymmetries in the FMS test were identified in 735 of the 886 study participants (83%). The high incidence of asymmetry may be related to the decline of strength and flexibility caused by the deterioration of body function following drug abuse. Studies have also proved that the leg strength of drug abusers is related to body balance[28]. More than half of the subjects in this study demonstrated bilateral asymmetry in the FMS test, with the greatest asymmetry in shoulder range of motion (n=290). Inadequate or excessive shoulder movement affects the whole body movement chain [29], leading to labrum lesions and subacromial impingement [30], which may ultimately affect a person's ability to carry out daily activities [31]. The next highest numbers associated with asymmetry were rotational stability and active straight leg raising, with 279 and 266 subjects showing asymmetry, respectively. Both tests are complex and require core stability, involving the strength and flexibility available to the respective joints. Core stability is the ability to stabilize the lumbar spine and pelvic region through the coordinated contraction of the trunk muscles [32]. Damage to core strength may result from problems caused by the combined action of the spine, muscles or brain nerves[33] . Damage to the core strength may affect spinal stability, thereby hindering the correct execution of functional movements, reducing motor performance[34], and affecting posture control and balance[35] . The loss of core strength leads to asymmetry and functional limitation, potentially resulting in long-term dysfunction and disability [36]. Therefore, early detection of motor asymmetry can reduce the likelihood of injury, long-term dysfunction and disability [37].

The total score of FMS was significantly correlated with gender (r=0.198, $P < 0.01$), age (r=0.161, $P < 0.01$) and drug type (r=0.283, $P < 0.01$). Gender, age and drug type were important predictors of the total FMS score ($P < 0.01$). Regression models revealed that gender, age, and drug type accounted for approximately 11.0% of the variability in total FMS scores. Multiple regression was used to explore the relationship between the FMS score and other variables. Age, type of drug use, and gender were significantly correlated with the FMS score, accounting for about 11% of the total score variance, while years of drug use were not. Although age, type of drug use and sex were associated with physical activity,

these do not fully explain the variability in physical activity and its relationship with FMS, as other factors (such as motivation) may also be associated with physical activity. Additionally, the number of years of drug use serves as an objective criterion for evaluating the body's physical ability. It can only be assumed that the longer the duration of drug usage, the higher the physical damage, and the specific damage to the body must be explored further. On the other hand, FMS scores were more associated with balance, coordination, postural control, flexibility, and strength, which may be one important reason why years of drug use were not associated with FMS scores. To our knowledge, this is the first study to explore the relationship between total FMS score and gender, age, and type of drug use, confirming that gender, age, and type of drug use are predictors of the total FMS score model for the drug abuse population.

DEFICIENCIES AND ASSUMPTIONS

The scientific contribution of this study lies in its identification of deficiencies and comparisons in FMS among narcotic and psychotropic drug users. This study is an experimental observation with a strong objective evaluation. The types of drugs are classified according to the main types of smoking, which could impact this experimental study. A follow-up study can improve this aspect. In addition, the evaluation scale alone is not sufficient to predict functional motor disability. Factors such as the usual exercise habits, lifestyle and motivation for physical activity of people with substance abuse should also be considered. Subsequent experiments can be further verified by medical detection of FMS.

In addition, people who take drugs more than three times are sent to compulsory detoxification centers. Therefore, most people in compulsory detoxification centers are middle-aged people, so most of our subjects are between 30 and 44 years old. We hope there will be more comprehensive screening of age sample size in the follow-up study.

Conclusion

Functional exercise screening is feasible in the substance abuse population, and sex, age, and drug type can be used as predictors of the total FMS score.

Declarations

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CONFLICT OF INTEREST

We declare that this work was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions

Hanhui Yan, Jingsong Wang, Yin Guo, Lan Zheng, Jun Zhang conceived and designed the experiments. Jun Tan, Chunxia Lu, Yi Liu screened experimental subjects, signed the informed consent process and conducted the exercise intervention.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by The Institutional Review Board at the Hunan Normal University and also approved the study protocol. The patients/participants provided their written informed consent to participate in this study.

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DATA AVAILABILITY STATEMENT

All datasets generated for this study are included in the article.

Consent to publication

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Figures

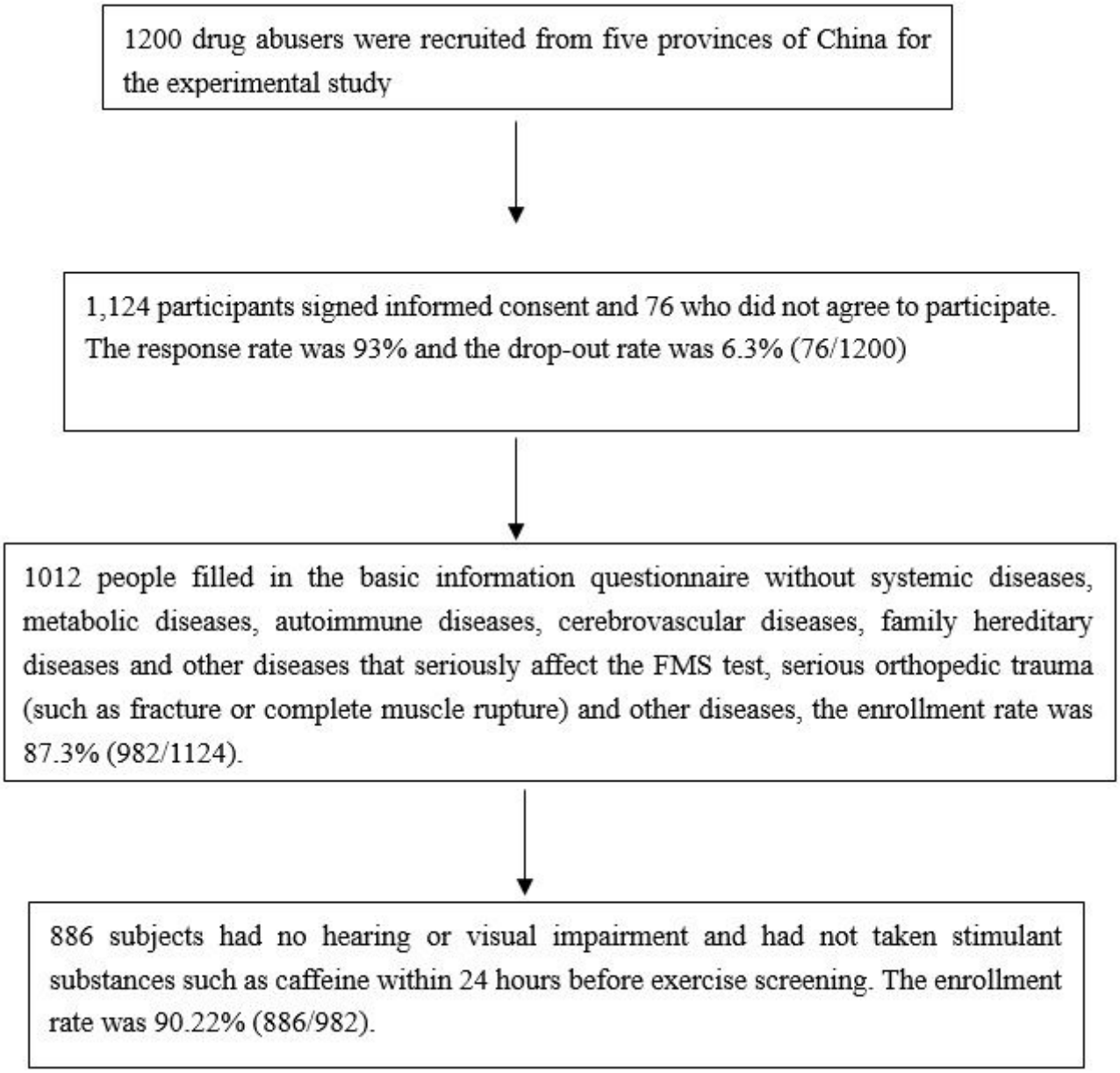

Figure 1

Legend not included with this version.