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Prevalence of attention deficit-/hyperactivity disorder (ADHD) and comorbid disorders in young male prison inmates*

■ **Abstract** *Objective* This study was performed to evaluate the prevalence of ADHD as well as comorbid conditions among young male prison inmates. *Method* We investigated 129 prison inmates (mean age ± SE: 19.2 ± 2.0 years) and 54 healthy male control subjects (mean age ± SE: 22.2 ± 3.12 years) for the presence of adult ADHD using the Wender Utah Rating Scale (WURS), the Eysenck Impulsivity Questionnaire (EIQ), the diagnostic criteria for ADHD according to DSM-IV and ICD-10-research criteria and the Utah criteria for adult ADHD. In order to determine comorbid personality disorders we applied the International Personality Disorder Examination (IPDE). Externalization (ED) and Internalization Disorders (ID) were evaluated by means of the Achenbach Scales. Alcoholism (ALC) was examined via the Alcohol Use Disorder Test (AUDIT) and substance use disorder (SUD) has been investigated with the Structured Clinical Interview for DSM-IV (SCID). *Results* The overall prevalence of ADHD according to DSM-IV was 45 %. The prevalence of disturbance of activity and attention (DAA) and hyperkinetic conduct disorder (HCD) via the ICD-10 research criteria was 21.7 %. Sole DAA without any comorbid condition could be detected in one case. The most common diagnostic combinations were DAA/HCD and SUD/ALC (89 % of all DAA/HCD cases). *Conclusion* The prevalence of DAA/HCD or ADHD in young adult prison inmates is significantly elevated when compared to nondelinquent controls. Generally the population of young adult male prison inmates exhibits a considerable psychiatric morbidity. Of the total sample, 64 % suffered from at least 2 disorders. Only 8.5 % had no psychiatric diagnoses. This indicates the urgent need for more psychiatric expertise in young offender facilities.

■ **Key words** ADHD · comorbidity · young offender · epidemiology · delinquency

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Introduction

ADHD represents one of the most frequent disorders in child and adolescent psychiatry. The prevalence rates range from 3–9 % (Biederman et al. 1993; Wender 1995; Spencer et al. 2002). Follow-up studies involving ADHD children suggest that 10–60 % of the cases have an incomplete or full syndrome into adult life (Mannuzza et al. 1993; Weiss et al. 1995; Barkley 1996; Wender et al. 2001; Spencer et al. 2002). The overall prevalence in adults is estimated at 2–5 % (Barkley and Murphy 1998). The characteristic symptoms such as attention difficulties, motor hyperactivity, and impulsivity are seen not only during childhood but also with some modifications in adult patients. Additional psychopathological symptoms in adults are disorganization and emotional dysregulation (Wender 1995). ADHD related psychopathology starting in early life may interfere with adequate education and social integration. In comparison to normal controls, individuals with ADHD are less likely to reach the level of educational and academic achievement expected on the basis of their intellectual abilities.

In addition, they display lower work ratings and they change their jobs more often (Barkley and Murphy 1998). Adult ADHD individuals display a significantly elevated risk for marital problems. They have more motor vehicle driving risks (Woodward et al. 1999) and have, compared with controls, a higher risk for accidents especially in cases resulting in serious injury (Grützmacher 2001).

Several lines of evidence suggest an increased risk for delinquency. The prevalence rates of ADHD in delinquent adolescents and young adults range from 4% to 72% (Vermeiren 2003).

ADHD is a condition with widespread comorbid disorders in childhood, adolescence and in adulthood (Jensen et al. 1997). During the course of ADHD nearly 50% of the cases develop conduct disorders, 30–50% suffer from learning disabilities, and up to 5% have tics or Tourette syndrome, while 25% have anxiety disorders, 20–35% suffer from affective disorders. In adolescence and early adulthood substance use disorder and alcoholism occur with a prevalence of 50% and more. A comparable proportion of ADHD patients display personality disorders (PD), in particular antisocial personality disorder (APD) and impulsive personality disorder (IPD) (Biederman et al. 1993; Mannuzza et al. 1993; Wender 1995; Pliszka 1998; Barkley and Murphy 1998). The variety of comorbid disorders creates a complex situation which makes it difficult to unequivocally determine the influence of each single disorder on social outcome and delinquency.

It was the objective of our study to determine the prevalence of ADHD and comorbid conditions in a representative sample of young adult male prison inmates using accepted diagnostic criteria as well as established rating scales and clinical interviews.

Method

A total of 129 male inmates of a German offender facility (JSA Ottweiler) for adolescent and young adult male prisoners were enrolled in the study after informed consent was given. The study design was approved by the authorities of the justice system. The facility "Ottweiler" is responsible for all young persons sentenced to imprisonment in the State of Saarland. The population investigated was nearly representative of young offenders of this state of Germany. Originally a population of 170 individuals was screened for inclusion in the study; 41 (31.7%) could not be examined because they refused to give informed consent or due to insufficient command of the German language. The latter persons did not differ from the study population with regard to age and ethnic origin.

Fifty-four healthy males without history of delinquency were examined as controls. They were recruited from sport clubs, the hospital staff, the relatives of some investigators and a student population. Basic socio-demographic characteristics of both populations are given in Table 1.

Both the index and control group populations differed in terms of education and occupational levels. The lower status of the delinquent population has been expected.

In order to determine the persistence of a childhood ADHD into adulthood we took 3 diagnostic steps. First we made a retroactive assessment of ADHD symptoms during childhood using the Wender Utah Rating Scale German short version (WURS-k, Ward et al. 1993; Wender 1995; Retz-Junginger et al. 2002, 2003). Then we looked for the presence of the diagnostic criteria for ADHD of DSM-IV and ICD-10 research criteria using a diagnostic checklist for experts (ADHD-DC, Rösler et al. 2003). Unfortunately the diagnoses of DSM-IV and ICD-10 differ in a remarkable way. DSM-IV offers 3 diagnoses: 314.01 ADHD combined type, 314.00 ADHD predominantly inattentive type and 314.01 predominantly hyperactive-impulsive type. ICD-10 however differentiates between the disturbance of activity and attention (DAA, F90.0) and hyperkinetic conduct disorder (HCD, F90.1). Nevertheless the contents of the 18 diagnostic criteria defining the hyperkinetic symptomatology are identical in both systems. Thus it is possible to evaluate the main symptoms of DAA and ADHD by use of a single rating instrument (ADHD-DC).

Childhood ADHD related symptoms (CARS) were diagnosed when the total score of the WURS-k exceeded 30 but the person did not fulfill the ICD-10 criteria for adult DAA or HCD.

Actual impulsivity was measured with the Eysenck Impulsivity Questionnaire (EIQ, Eysenck et al. 1990). Personality disorder diagnoses according to ICD-10 were made via the International Personality Disorder Examination (IPDE, Loranger et al. 1997). The IPDE disposes of two diagnostic levels: definite PD and probable PD.

Externalizing (ED) and Internalizing Disorders (ID) were investigated with the Youth Self Report or the Young Adult Self Report, respectively (YSR, YASR, Achenbach 1991, 1997). According to the validation studies of the YSR/YASR we diagnosed an ED if the t-value of the externalizing scale was greater than or equal to 63. The same cut-off level was used on the internalizing scale of the YSR/YASR for the diagnosis of ID. In our study we relied on the accepted concepts of ED

Table 1 Sociodemographic characteristics of the index and the control group. Significance level was alpha adjusted by Bonferroni correction

Item	Prison Inmates (N = 129)		Healthy Controls (N = 54)		Significance Level p < 0.013
Age	19.5 ± 2.0		22.2 ± 3.12		0.000, Mann-Whitney Test
Family status	Single	69.8%	Single	44.4%	0.006, Chi² Test
	Partner	28.7%	Partner	48.1%	
	Married	0.8%	Married	5.6%	
	Divorced	0.8%	Divorced	1.9%	
Education	Spec. Educ.	14.0%	Spec. Educ.	1.9%	0.000, Chi² Test
	Grade school unfinished	35.7%	Grade school unfinished	1.9%	
	Grade school	47.3%	Grade school	18.6%	
	High school	3.1%	High school	77.8%	
Vocational training	No training	46.5%	No training	27.8%	0.000, Chi² Test
	Training unfinished	45.0%	Training unfinished	1.9%	
	Succeeded	8.5%	Succeeded	70.4%	

and ID used in epidemiological studies, rather than the diagnosis of disruptive disorder according to DSM-IV or the social conduct disorder according to ICD-10.

Alcoholism (ALC) was diagnosed using the German version of the AUDIT test (Wetterling und Veltrup 1997). Substance Use Disorder (SUD) was diagnosed using the drug section of the SKID-I interview (Wittchen et al. 1997). The instrument recognizes two DSM-IV defined disorders – SUD dependence and SUD abuse.

Classical general personality dimensions were examined with the NEO Five Factor Inventory (NEO-FFI, Costa and McCrae 1992).

For statistical evaluations the following SPSS (Version 11.0) procedures were applied: Chi^2 test, Mann-Whitney test and logistic regression. In every group of the statistical comparisons a Bonferroni correction for multiple testing was applied.

Results

The types of offences are summarized in Table 2. Theft, assault, drug related offences and robbery were the most common crimes among the young adult male prison population.

A significant difference between prisoners without any childhood or adult DAA psychopathology and prisoners suffering from persistent adult DAA or having at least evidence of childhood ADHD related symptoms (CARS) was found in terms of the prevalence of theft. Theft was 2 times more frequent among the two DAA/ADHD populations than in the controls. Regarding other offences no differences could be detected between the three groups.

Among the prison population we found that 7 persons (5.4 %) met the research diagnostic criteria of ICD-10 for DAA (F90.0) and 21 individuals (16.3 %) for HCD (F90.1). HDC was diagnosed when the criteria for DAA were present and combined with an externalizing disorder.

Using the DSM-IV criteria we identified 28 persons (21.7 %) with ADHD combined type (314.01), 28 patients (21.7 %) with ADHD predominantly hyperactive-impulsive type (314.01) and 2 individuals (1.6 %) with ADHD predominantly inattentive type (314.00). The overall prevalence of ADHD diagnoses according to

DSM-IV was 45 %. Among the healthy controls the prevalence rates were 1.9 % for disturbance of activity and attention (F90.0), 1.9 % for HCD (F90.1), 1.9 % for DSM-IV ADHD combined type, 1.9 % for DSM-IV ADHD hyperactive impulsive type and 3.7 % for DSM-IV ADHD predominantly inattentive type.

The prevalence rates for DAA and comorbid conditions among the two study populations are summarized in Table 3.

In the index group we found ED in 78 persons (60.5 %). ID was present in 26 individuals (20.2 %). A diagnosis of definite PD was made in 21.1 % of the subjects, while 23.4 % of the cases met criteria for probable PD.

Alcoholism defined by a cut-off score of 8 or greater at the AUDIT scale was found in 83 prisoners (64.3 %). SUD Dependence and SUD Abuse based on DSM-IV criteria were found in 72 (55.8 %) and 43 (33.3 %) prisoners respectively. Of the index population, 84.5 % had at least one SUD or ALC diagnosis.

The corresponding prevalence rates for the healthy controls were 3.7 % for ED, 1.9 % for ID, 0 % for definite PD, 0 % for probable PD, 8 % for alcoholism, 0 % for SUD Dependence, 0 % for SUD Abuse and 8 % for at least 1 SUD or ALC diagnosis.

When we looked at the comorbidity structure of the diagnostic distribution in the index group only 11 persons (8.5 %) without any psychiatric disorder were detected. A total of 30 individuals (23.4 %) had a single diagnosis of SUD or ALC. Three males (2.3 %) had ED

Table 2 Prevalence rates for committed crimes among the 3 populations without DAA/HCD, with evidence of childhood ADHD related symptoms (CARS) and with persistent adult DAA/HCD. Multiple crimes are possible. Significance level was alpha adjusted by Bonferroni correction

	Adult DAA/HCD N = 28	CARS N = 64	No DAA/HCD N = 37	Significance Level p < 0.007, Chi^2 Test
Theft	68 %	59 %	35 %	0.001
Assault	39 %	42 %	38 %	ns
Drug related	18 %	34 %	30 %	ns
Robbery	25 %	31 %	22 %	ns
Manslaughter Murder	0 %	2 %	11 %	ns
Sexual	7 %	0 %	3 %	ns
Other	21 %	20 %	14 %	ns

Table 3 Prevalence of DAA, HCD, ADHD and comorbid disorders in young male prison inmates and control subjects. Significance level was alpha adjusted by Bonferroni correction

Diagnosis	Prisoners (N = 129)	Controls (N = 54)	Significance Level p < 0.003, Chi^2 Test
F90.0 DAA	5.4 %	1.9 %	ns
F90.1 HCD	16.3 %	1.9 %	0.003
314.01 ADHD-CT	21.7 %	1.9 %	0.000
314.00 ADHD-IT	1.6 %	3.7 %	ns
314.01 ADHD-HIT	21.7 %	1.9 %	0.000
Externalizing Dis	60.5 %	3.7 %	0.000
Internalizing Dis	20.2 %	1.9 %	0.001
Definite PD (F60)	21.1 %	0 %	0.000
Definite APD	9.3 %	0 %	ns
Definite IPD	10.1 %	0 %	ns
Other definite PD	14.7 %	0 %	0.001
Possible PD	23.4 %	0 %	0.000
Possible APD	20.9 %	0 %	0.002
Possible IPD	17.1 %	0 %	0.002
Possible other	7.8 %	0 %	ns
Alcoholism	64.3 %	8 %	0.000
SUD Abuse	33.3 %	0 %	0.000
SUD Dependence	55.8 %	0 %	0.000
SUD Abuse + SUD Dep + Alc	85.5 %	0 %	0.000

solely. The remaining comorbid associations were: DAA + SUD/ALC 3.9%, DAA + SUD/ALC + ED 11.6%, DAA + PD + SUD/ALC 0.8%, DAA + SUD/ALC + PD + ED 3.1%. Comorbid diagnoses in prisoners without DAA were as follows: ED + SUD/ALC 27.9%, ED + PD + SUD/ALC 12.4%, PD + SUD/ALC 1.6%, ED + PD 1.6%. The relationships between the diagnoses are shown in Table 4.

When we examined the relationship of persistent DAA to different sociodemographic and forensic factors we found that there was a trend in families of individuals with persistent DAA to live with significantly more persons (60.7%) with a history of delinquency than in families of young males without adult DAA and without evidence of childhood DAA symptoms (25.7%).

Persons with persistent DAA were not only younger (18.9 y vs. 20.1 y) at the time of the investigation but also when they were convicted for the very first time (15.5 y vs. 17.6 y). Table 5 presents the results of the evaluation regarding sociodemographic and forensic variables in more detail.

A logistic regression including the WURS-k, ADHD-DC, EIQ-impulsivity, ED, NEO-FFI five factors, "broken home" and "delinquents in the family" as possible confounding variables and "beginning of the delinquency before the age of 14 years" as target criterion revealed that childhood DAA measured by the WURS-k and actual impulsivity as assessed with the EIQ were significant predictors of delinquent behavior before the age of 14 years. The other items were dropped from the equation during the stepwise progression of the statistical procedure. More results from the Ottweiler study are reported elsewhere (Retz et al. 2004).

Discussion

An important finding of our study was the different prevalence of adult ADHD/DAA in the prisoner and control groups. The prevalence of adult ADHD was more than twice as high when diagnosed by DSM-IV criteria than when diagnosed according to the ICD-10 research criteria (45% vs. 21.7%). This result can mainly be explained by the presence of the hyperactive-impulsive type according to DSM-IV, which is not listed in the ICD-10 criteria. This finding was also found to be true in our control group of young healthy men without delinquency. The prevalence of DAA/HCD in controls was 3.8% (ICD-10) and 7.5% (DSM-IV) for ADHD, respectively. The prevalence rate of our controls was in line with earlier results for normal populations. Murphy and Barclay (1996) found an overall prevalence of 4.7% using the DSM-IV criteria in adults applying for or renewing their driver's licences. Heiligenstein et al. (1998) found a prevalence of 4% in college students. The higher prevalence of 7.5% in our sample seems to be a result of the gender difference in our population. We examined exclusively males. The two cited studies were performed with mixed cohorts of females and males. In adults the gender ratio is approximately 2:1 with males more likely to have the disorder than women (Barkley and Murphy 1998).

Previous studies from various western countries have revealed similar results. Haapasalo and Hamalainen (1996) in Finland found prevalence values of 51.4% for ADHD (DSM-IV) in a case control study involving 37 prison inmates (age 16–22) who had committed prop-

Table 4 Relationship of DAA and comorbid disorders in 129 young adult prisoners

Without diagnosis	N = 11	8.5%
SUD or ALC	N = 30	23.3%
ED	N = 3	2.3%
PD	N = 1	0.8%
DAA	N = 1	0.8%
ED + SUD/ALC	N = 36	27.9%
DAA + SUD/ALC	N = 5	3.9%
ED + PD	N = 2	1.6%
PD + SUD/ALC	N = 2	1.6%
HCD	N = 1	0.8%
PD + ED + SUD/ALC	N = 16	12.4%
HCD + SUD/ALC	N = 15	11.6%
HCD + PD	N = 1	0.8%
DAA + PD + SUD/ALC	N = 1	0.8%
HCD + PD + SUD/ALC	N = 4	3.1%
Total	N = 129	100.0%

ALC Alcoholism; *DAA* Disorder of activity and attention (ICD-10); *ED* Externalizing Disorder; *HCD* Hyperkinetic conduct disorder (ICD-10); *PD* Personality Disorder; *SUD* Substance Use Disorder

Table 5 Forensic and sociodemographic parameters in young male prisoners with adult DAA/HCD and without childhood or adult DAA/HCD. Significance level was alpha adjusted by Bonferroni correction

	DAA/HCD N = 28	No DAA/HCD N = 37	Significance Level p < 0.006
Broken home	42.9%	27.0%	ns
Delinquents in the family	60.7%	25.7%	0.009, Chi^2 Test
Low education	67.9%	29.7%	ns
No job	60.7%	35.1%	ns
Psychiatric treatment	32.1%	21.6%	ns
Age	18.8±1.7	20.1±2.3	0.014, Mann-Whitney Test
Age at first conviction	15.5±1.4	17.3±2.3	0.000, Mann-Whitney Test
Delinquency prior to age 14	51.9%	24.3%	ns

erty crimes. In the same study 52 violent offenders had a prevalence of 48.1%. However, other studies using DSM-III-R or DSM-IV criteria on delinquent adolescents showed lower prevalence rates: 33.3% in males and 52.3% in females in Korea (Chae et al. 2001), 28.9% in males and 18.2% in females in Canada (Ulzen and Hamilton 1998), 19% in Belgium (Vermeiren et al. 2000), 18% in a mixed male and female patient group in the USA (Pliszka et al. 2000), 16.6% in males and 21.4% in females in the USA (Teplin et al. 2002), 16% in a group with almost all males in the Netherlands (Doreleijers et al. 2000), and 15% in Sweden (Siponmaa et al. 2001). Very high ADHD prevalence rates in incarcerated juvenile males with 76% and juvenile females with 68% were reported by Timmons-Mitchell et al. (1997) in the USA.

However, these studies differed from our research approach with respect to several details. They included mainly adolescents aged 10–18 years and sometimes recruited the individuals from forensic psychiatric services as well as from different facilities of the criminal justice system which resulted in relatively heterogeneous index groups. In summary, one can say the research on the prevalence of ADHD in delinquent adolescents and young adults is converging. Prevalence rates which are three to fifteen times higher than in normal controls have been reported (Vermeiren 2003).

In our study SUD, ALC and ED as a particular form of conduct problems were the most frequent disorders in incarcerated young males. Their prevalence rates exceeded that of ADHD. This agrees with the findings of Milin et al. (1991), Pliszka et al. (2000), and Vreugdenhil et al. (2003). Young prison inmates frequently have two and more disorders. In our study 64.3% had at least 2 diagnoses of mental disorders. A similar result was published by Ulzen and Hamilton (1998). In this study 63.3% of the incarcerated adolescents had 2 or more psychiatric disorders.

Regarding the importance of ADHD and comorbid disorders on later delinquency, earlier research found antisocial and delinquent behavior to be linked to childhood aggression and unsocialized behavior (August et al. 1983). Mannuzza et al. (1989) found that childhood ADHD represents a risk factor of later criminality which is mediated by the development of antisocial behavior in early adulthood. In a study by Satterfield and Schell (1997) the risk of hyperactive children becoming an adult offender was associated with CD in childhood and antisocial behavior in adolescence. The significantly greater prevalence of antisocial personality disorder in the studies by Mannuzza et al. (1993, 1998) could not be attributed to comorbid conduct disorders (CD) since the authors tried to screen out persons with CD. Babinski et al. (1999) demonstrated that both hyperactivity-impulsivity and early conduct problems, but not inattention, predicted independently as well as jointly a greater likelihood of crimes in males but not in females.

In a 22 year prospective community based study with children initially evaluated at the age of 7 years, ADHD in combination with developmental coordination disorder was found to be associated with poor social outcome including the development of APD and criminality (Rasmussen and Gillberg 2000). According to a prospective community based cohort study (Lay et al. 2001), childhood DAA/ADHD is a predictor of recidivistic crimes in early adulthood. Another prospective study by Stevenson and Goodman (2001) examined symptoms from the ADHD psychopathological spectrum like activity, management difficulties and temper tantrums at an age of 3 years and came to the conclusion that these items can predict adult criminality.

In our study a logistic regression demonstrated that the presence of childhood DAA/ADHD and actual impulsiveness measured by the Eysenck impulsiveness questionnaire (Eysenck et al. 1990) were associated with delinquency before the age of 14 y.

In an earlier study we were able to demonstrate that more convictions occurred in prison inmates with childhood DAA/ADHD symptoms compared to delinquents without such psychopathology (Ziegler et al. 2003). A similar result has been described by Blocher et al. (2001). In a population of sexual offenders they were able to demonstrate that childhood ADHD related symptoms were a risk factor for the presence of higher rates of general and sexual delinquency (odds ratios: 1.3–7.5, 1.5–7.6 respectively). In summary it seems evident that DAA/ADHD in association with comorbid conditions has independent and joint influences on the onset, structure and outcome of delinquent behaviors. The problem of whether DAA/ADHD or comorbid CD or later APD is the most important factor for the development and continuation of delinquency is marked by two major weaknesses: The first problem is that CD, APD and delinquency share a broad range of behaviors. Thus they are by far not independent constructs.

A second problem has been revealed by new results of genetic research. There is a growing body of evidence that there might be no clear nosological difference between pure DAA/ADHD and HCD or ADHD in combination with CD. This hypothesis has been proposed on the basis of genetic family research showing that HCD or ADHD combined with CD could be a subform of ADHD (Faraone et al. 1998). In a study with 2082 twin pairs, a common genetic etiology for ADHD and CD and non-shared environmental factors influencing both categories have been described (Thapar et al. 2001). According to these findings ADHD with CD (in our study represented by HCD) appears to be a more severe subtype of DAA/ADHD in terms of genetic loading as well as clinical severity. Definite conclusions in this respect cannot be drawn since other recent studies seem to indicate that DAA/ADHD and HCD could be separate entities as considered in the ICD-10 (Banaschewski et al. 2003).

Nevertheless it would be interesting to start research evaluating therapies in order to elucidate whether the well established efficacy of pharmacological and/or psychotherapeutic treatments directed against the psychopathology of DAA/ADHD can also be used in the

treatment of the symptoms of comorbid disorders sharing the genetic basis with ADHD.

There are several limitations of our study. Our study groups were recruited from one single site. The population of the youth and young adult offender facility of Ottweiler is nearly representative for the State of Saarland, which has a mixed rural and urban population. With regard to other regions, however, some bias concerning the population in question cannot be ruled out. Bias seems evident for our control population, which was recruited from hospital staff, sports clubs and relatives of the investigators.

Our research focused only on the psychopathological spectrum of ADHD and related disorders. DAA/ADHD, PD and SUD were diagnosed according to DSM-IV or ICD-10 research criteria. However, these classification systems were not used for the diagnoses of conduct disorder and alcoholism. In our study externalizing and internalizing disorders were assessed using the Achenbach scales (YSR, YASR). In fact the concept of ED exhibits a considerable overlap with CD according to DSM-IV or to social conduct disorder (F91, ICD-10), but minor differences cannot be ruled out. Furthermore we did not administer diagnostic procedures for the determination of affective disorders or anxiety disorders. Due to economic reasons only the score of the anxiety and depression subscale of the YSR and YASR respectively was recorded.

For the diagnosis of alcoholism we used the AUDIT test as the diagnostic tool. The items of the AUDIT test incorporate most of the diagnostic criteria of DSM-IV or ICD-10 RC, but there are differences concerning the item contents and the quantification.

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