

## Smoking Withdrawal Symptoms in Two Weeks of Abstinence

SAUL M. SHIFFMAN<sup>1,2</sup> and MURRAY E. JARVIK<sup>2,3</sup>

<sup>1</sup> Department of Psychology, University of California, Los Angeles, California

<sup>2</sup> Department of Psychiatry

<sup>3</sup> Veterans Administration Hospital Brentwood, Los Angeles, California 90073, U.S.A.

*Abstract.* In order to study trends in smoking withdrawal symptoms, 35 participants in a smoking cessation clinic completed four questionnaires daily for 2 weeks. The questionnaire dealt with a variety of symptoms which a factor analysis showed could be grouped into four factors: stimulation, desire to smoke, and physical and psychological symptoms. Changes were observed in reports of symptoms over days. Trend analyses found that each symptom group except stimulation showed significant patterns or changes as a function of days in abstinence. These symptom clusters were all found to have U-shaped functions. In addition, desire to smoke and psychological symptoms showed linear decreases as abstinence proceeded. Light and heavy smokers were found to differ in the pattern of reported stimulation. Ss who were totally abstinent reported less severe craving overall for cigarettes than those who only reduced their cigarette consumption by an average of 60%. Also, the craving of totally abstinent Ss dropped off more sharply as abstinence proceeded. The import of these patterns and trends in withdrawal symptoms as a function of time is discussed.

*Key words:* Cigarette smoking — Withdrawal syndrome — Abstinence syndrome.

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Although much has been written on the cigarette abstinence syndrome, the existence, nature, and course of the syndrome has not yet been adequately documented. The Surgeon General's Report (1964, p. 352) describes a variety of symptoms of increased or decreased excitability, but concludes that 'no characteristic abstinence syndrome occurs' following cessation of smoking. Russell (1971) describes similar symptoms, but reaches the opposite conclusion that an abstinence

syndrome can be said to occur. The reviews of Brecher (1972) and of Larson and Silvette (1968, 1971) describe a wide variety of symptoms which have been reported to occur in abstinence from smoking, including irritability, restlessness, inability to concentrate, lightheadedness, insomnia, tremor, increased hunger, and craving for cigarettes. Knapp, Bliss and Wells (1963) studied a group of smokers deprived of cigarettes and report that their subjects experienced craving and other distressful symptoms as well as cardiac slowing and changes in blood pressure. Similar findings have been reported by Weybrew and Stark (1967), who showed that both physiological changes and mood changes returned to normal upon resumption of smoking.

A number of authors report that these discomforts are widespread among those attempting abstinence from smoking (Guilford, 1966; Wynder et al., 1967; Horn, 1970). Others have emphasized the possibility of asymptomatic withdrawal from smoking (Gsell, 1964; Surgeon General, 1964). The Surgeon General's Report (1964) also notes that reports on the duration of the abstinence syndrome are inconsistent, ranging from days to months. Thus, despite the existence of a body of literature on the smoking abstinence syndrome, withdrawal from smoking is far from well understood. Indeed, the Report of Work Group I of the World Conference on Smoking and Health (1967) emphasized that 'withdrawal symptoms following cessation of smoking are inadequately described', and recommended that '. . . further studies of the nature and duration of the cigarette deprivation syndrome should be prosecuted' (p. 259, p. 141).

The present study attempts to explore the cigarette abstinence syndrome and to map its course using the approach of Gritz and Jarvik (1973). Gritz and Jarvik developed a questionnaire instrument designed to assess the abstinence syndrome and administered it to subjects periodically over a 48-h period of ab-

stinence. They showed that their 'smoking index', a measure of craving for cigarettes, was elevated during abstinence and returned to normal after two cigarettes were smoked, and they conclude that 'a quantifiable measure of the effects of cigarette deprivation is possible' (p. 1040).

The present study was conducted to extend and elaborate Gritz and Jarvik's (1973) findings. They found no difference between the first 2 days of abstinence in the strength of the desire to smoke reported. As abstinence proceeds beyond this point, however, it may be that marked changes appear in the severity of the withdrawal syndrome. Johnston (1952) has suggested, for example, that desire to smoke declines sharply after the second day of abstinence. Anecdotal lore also insists that levels of dysphoria change radically as abstinence proceeds, but it is contradictory in predicting the direction of change. The present study was undertaken in order to locate changes which might occur in the abstinence syndrome as a function of days in abstinence and to examine trends or patterns shown by withdrawal symptoms over time. A revised version of Gritz and Jarvik's (1973) instrument was used to trace of the course of a number of different withdrawal symptoms over a 12-day period of abstinence. Differences between totally and partially abstinent subjects, which have been reported by both Guilford (1966) and Burns (1969) were also examined. In addition, comparisons of abstinence in light and heavy smokers were made.

## METHOD

*Subjects.* Ss were 40 volunteers (22 males and 18 females) participating in a smoking cessation clinic conducted by the Psychology Department of the University of California, Los Angeles. Ss ranged in age from 18–44 years (mean age = 25.5 years) and they had been smoking from 1–32 years (mean = 8 years). Initial cigarette consumption ranged from 11 to 39 cigarettes daily, with a mean of 23.5 cigarettes per day. All Ss received a lactose placebo daily. Only Ss who completed all of the required materials were included in the study ( $N = 35$ ). Ss were divided into light and heavy smokers on the basis of their reported average cigarette consumption. Light smokers ( $N = 12$ ) were defined as those smoking 20 cigarettes per day or less (mean = 15.7 cigarettes) and heavy smokers ( $N = 23$ ) as those smoking more than 20 cigarettes per day (mean = 26.6 cigarettes). Orthogonal groups of totally and partially abstinent Ss were formed on the basis of cigarette consumption during a 16-day abstinence period. Totally abstinent Ss ( $N = 11$ ) smoked an average of 0.08 cigarettes per day during this period, while partially abstinent Ss ( $N = 24$ ) smoked an average of 8.92 cigarettes daily.

*Materials.* For the purpose of this study, 25 items were abstracted from the 43-item questionnaire used by Gritz and Jarvik (1973). These items were selected on the basis of their loadings in the factor analysis performed on the Gritz and Jarvik data. The wording of some items was modified and the scaling revised. Ss responded to each item by checking one of seven responses ranging from

'very definitely' to 'very definitely not'. The wording of the items was such that a response of 'very definitely' indicated high dysphoria for half the items and low dysphoria for the other half. In addition to items designed to assess Ss' desire to smoke, other items were included which assessed such symptoms as tremor, insomnia, anxiety, and inability to concentrate.

*Procedure.* On their first day of participation in the clinic, before they had made any attempt to abstain from smoking, Ss completed one questionnaire which served as a measure of baseline levels of the variables assessed by the questionnaire. For a 13-day period thereafter, Ss self-administered the questionnaire four times daily (at 7 AM or upon arising, 12 Noon, 7 PM, and 11 PM or at bed time). Ss also kept a daily record of how many cigarettes they consumed, if any.

*Data Analyses.* A factor analysis using Varimax rotation was performed on 2160 completed questionnaires. Four factors emerged with Eigenvalues greater than 1.5. Items with high loadings on a given factor and low loadings on all other factors were treated as subscales, and subscales were named on the basis of the semantic content of their component items. A 'craving' subscale consisted of seven items assessing Ss' craving or desire to smoke. Four items relating to physical symptoms, such as tachycardia and tremor, comprised a 'physical symptoms' subscale. A 'stimulation' subscale was composed of four items assessing Ss' level of stimulation and alertness relative to his norm for that time of day. Lastly, a 'psychological symptoms' subscale was composed of three items relating to Ss' psychological state, assessing such variables as anxiety and contentment. Thus, each questionnaire was reduced to four subscores, one for each factor. Mean daily subscores were computed by averaging across questionnaires completed on a particular day<sup>1</sup>. (Data concerning within-day variation in subscores will be reported at a later date.)

Subscores were treated as dependent variables in all subsequent analyses, each of which was run separately for each subscore. In the first series of analyses, Ss were grouped into light and heavy smokers. Trend analyses were then performed on the data collected from Day 2 to Day 13 of abstinence to determine what trends were present in the subscores as a function of Days. A series of Days  $\times$  Groups ( $12 \times 2$ ) repeated-measures analyses of covariance (trend analyses) was performed, with baseline scores covaried to control for baseline differences (Winer, 1962). To determine differences between partial and total abstinence, analyses were run in which Ss were classified as totally or partially abstinent, yielding a series of Days  $\times$  Abstinence ( $12 \times 2$ ) trend analyses.

## RESULTS

Table 1 shows the mean number of cigarettes smoked daily prior to abstinence and during the abstinence period for all Ss and for the different groups. The percent reduction in cigarette consumption during abstinence as compared to prior averages is also shown.

Table 2 shows the means for each of the subscores for the entire sample and separately by groups.

<sup>1</sup> These daily means were always based on at least two completed questionnaires. Five Ss who had missed more than two questionnaires in a day were dropped from the study, yielding an effective  $N = 35$ .

Data from Days 1 and 14 were also discarded because of missing data.

Table 1. Daily cigarette consumption before and during abstinence for all Ss and by groups

	All Ss (N=35)	Smoker groups		Abstinence groups	
		Light	Heavy	Partial	Total
		(N=12)	(N=23)	(N=24)	(N=11)
Smoked before	22.83	15.67	26.56	22.08	24.46
Smoked during	6.14	3.74	7.39	8.92	0.08
% Reduction	73.1	76.1	72.2	59.6	99.7

All subscores have a range from 1 to 7, with a neutral value of 4. High subscores reflect greater stimulation, more severe physical and psychological symptoms, and greater desire to smoke, respectively. Only effects associated with linear, quadratic, and cubic components of trends were examined and are reported. Higher-order effects are by-passed in the interest of limiting Type I error, as well as in the interest of interpretability.

*Stimulation.* The mean stimulation score for all Ss was 4.56, which reflects mild stimulation. Although light and heavy smokers did not differ in the mean level of stimulation ( $F[\text{Group}] = 2.39, df = 1, 32, ns$ ), they did differ in the pattern of stimulation across days. Figure 1 shows this Days  $\times$  Group interaction. In particular, the two groups differed in the linear trend of the scores across days ( $F[\text{Days}(1) \times \text{Group}] = 6.77, df = 1, 33, P < 0.02$ ).

When the totally abstinent Ss were compared to the partially abstinent Ss, no differences were found in levels of stimulation ( $F[\text{Abs}] < 1$ ).

*Physical Symptoms.* Overall, Ss reported very few and mild physical symptoms (grand mean = 2.72), and light and heavy smokers did not differ in this respect ( $F[\text{Group}] < 1$ ). Reports of physical symptoms did, however, show significant change across Days. The trend for physical symptoms reported as a function of days shows significant quadratic curvature, ‘dipping’ slightly in the middle of the 12-day abstinence period ( $F[\text{Days}(2)] = 7.51, df = 1, 33, P < 0.01$ ). Although totally and partially abstinent Ss do not differ in their mean physical symptoms score, the data suggest that the above-mentioned quadratic curvature is affected by the abstinence status of the Ss ( $F[\text{Days}(2) \times \text{Abs}] = 3.47, df = 1, 33, P < 0.07$ ). It appears that totally abstinent Ss experience a greater drop in physical symptoms in the middle of the abstinence period than do partially abstinent Ss.

*Psychological Symptoms.* Overall, Ss reported mild psychological discomforts such as anxiety and rest-

Table 2. Mean subscores for all Ss and groups

	All Ss (N=35)	Smoker groups		Abstinence groups	
		Light	Heavy	Partial	Total
		(N=12)	(N=23)	(N=11)	(N=24)
Stimulation	4.56	4.28	4.70	4.51	4.66
Physical symptoms	2.72	2.73	2.72	2.76	2.63
Psychological symptoms	4.34	4.46	4.28	4.41	4.19
Craving	4.16	4.32	4.08	4.58 <sup>a</sup>	3.25 <sup>a</sup>

<sup>a</sup> Different at the 0.005 level

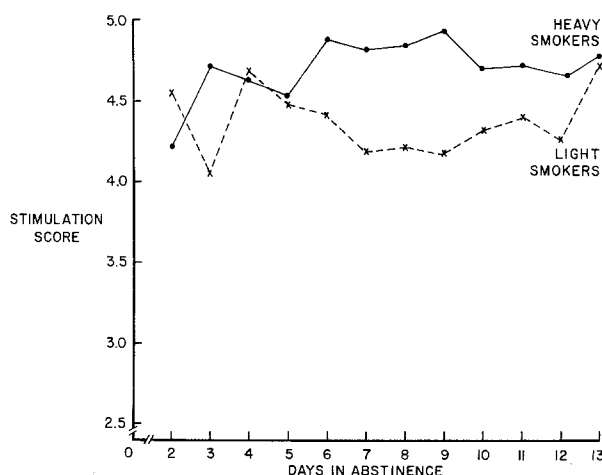


Fig.1. Stimulation scores plotted as a function of days in abstinence for light and heavy smokers. Data points represent raw (unadjusted) group means. Light and heavy smokers differ significantly in the linear trend of this curve

lessness (grand mean = 4.34), with light and heavy smokers reporting similar levels of discomfort ( $F[\text{Group}] < 1$ ). Reports of psychological symptoms did, however, show changes as a function of days in abstinence. There is a significant linear decrease in reports of psychological discomforts over time ( $F[\text{Days}(1)] = 6.32, df = 1, 33, P < 0.02$ ). Also, the curve of psychological symptoms plotted by days shows significant quadratic curvature, falling from Day 2 to Day 5, and then slowly rising again ( $F[\text{Days}(2)] = 7.18, df = 1, 33, P < 0.02$ ). The cubic component of this trend is also significant ( $F[\text{Days}(3)] = 7.17, df = 1, 33, P < 0.02$ ). Thus, reports of psychological symptoms vary in a complex manner over 12 days of abstinence.

Partially and totally abstinent Ss did not differ in their mean psychological symptoms score ( $F[\text{Abs}] = 1.66, df = 1, 32, ns$ ). However, the data analysis

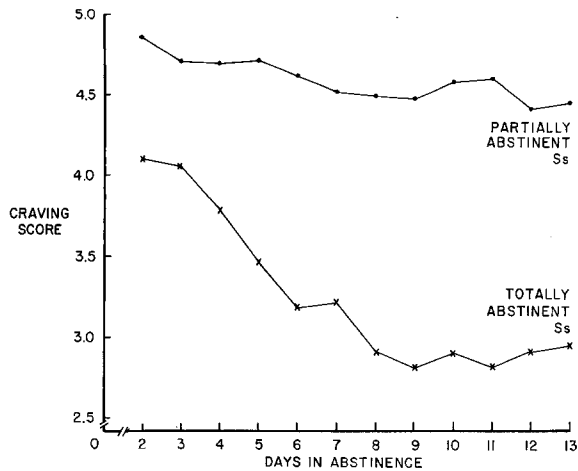


Fig. 2. Craving scores plotted as a function of days in abstinence for partially and totally abstinent Ss. The linear and quadratic trends of the curve are significantly different for the two groups. Note how the totally abstinent Ss' craving drops off sharply

suggests that the pattern of symptom reports over days may be different for the two groups. The Ss in the totally abstinent group appear to report a greater decrease in psychological symptoms as abstinence proceeds ( $F[\text{Days}(1) \times \text{Abs}] = 3.47$ ,  $df = 1, 33$ ,  $P < 0.07$ ).

*Craving.* On the average, Ss reported experiencing a mild desire to smoke (grand mean = 4.16), with no significant differences between light and heavy smokers ( $F[\text{Group}] < 1$ ). Desire to smoke was found to vary significantly as a function of Days. Craving showed a significant linear decrease over the 12 days studied ( $F[\text{Days}(1)] = 25.44$ ,  $df = 1, 33$ ,  $P < 0.0005$ ). Craving for cigarettes also showed significant quadratic curvature as a function of days of abstinence, the rate of decrease slowing as abstinence proceeds ( $F[\text{Days}(2)] = 9.79$ ,  $df = 1, 33$ ,  $P < 0.005$ ).

As Figure 2 shows, however, these trends are not uniform for all Ss. There are highly significant differences between totally and partially abstinent Ss in desire to smoke as a function of Days. Both the linear and quadratic trends of this curve interact with the abstinence status of the Ss ( $F[\text{Days}(1) \times \text{Abs}] = 8.48$ ,  $df = 1, 33$ ,  $P < 0.006$ ;  $F[\text{Days}(2) \times \text{Abs}] = 4.62$ ,  $df = 1, 33$ ,  $P < 0.04$ ). As the figure shows, the craving of the totally abstinent Ss drops more sharply and consistently than that of the partially abstinent Ss, which drops only slightly. In fact, the mean craving score of the partially abstinent group (4.58) reflects a moderate desire to smoke, while the overall mean of totally abstinent group (3.25) reflects a moderate desire not to smoke. This difference is significant ( $F[\text{Abs}] = 10.50$ ,  $df = 1, 32$ ,  $P < 0.004$ ).

## DISCUSSION

These results suggest that withdrawal symptoms are not uniformly severe across a 12-day period of abstinence. Three of the four classes of symptoms examined—physical and psychological symptoms and craving for cigarettes—show significant trends as a function of days in abstinence. These curves for withdrawal symptoms as a function of Days all show significant U-shaped (quadratic) curvature. These symptoms decrease in severity during the early days of abstinence, and then gradually increase in severity again. Psychological symptoms and craving for cigarettes also decrease in a linear fashion as abstinence proceeds. Thus, the mild discomfort experienced in withdrawal from cigarette smoking decreases in the first few days of abstinence and then levels off or partially rebounds in the second week of abstinence.

No overall differences were found between light and heavy smokers. This is consistent with Gritz and Jarvik's (1973) findings concerning craving, but differs from Burns' (1969) observation that smokers who experienced abstinence symptoms were generally heavier smokers than those whose abstinence was symptom-free. The two studies are difficult to compare, however, as Burns' (1969) approach to the question was quite different from the present one. It may be that original cigarette consumption needs to be treated as a continuum, rather than the present light-heavy dichotomy.

Light and heavy smokers did differ in the pattern of stimulation scores as abstinence proceeds. Heavy smokers report increasing stimulation, light smokers decreasing stimulation.

With the important exception of craving scores, partially and totally abstinent Ss did not differ significantly in their reports of abstinence symptoms (though there were two nearly significant trends). This may reflect a threshold for the experience of the abstinence syndrome upon reduction of cigarette consumption. That is, a certain amount of reduction may result in the full-blown abstinence syndrome even without total cessation. Knapp, Bliss and Wells (1963) report physiological signs of abstinence in subjects who reduced, but did not eliminate, their intake of nicotine. Burns (1969) reports that withdrawal symptoms were more likely to be present in Ss who reduced their cigarette intake without abstaining totally.

Partially and totally abstinent Ss did differ in craving for cigarettes, with totally abstinent Ss reporting less desire to smoke. This is consistent with the finding of Burns (1969) that Ss in partial abstinence were more likely to report abstinence-related dysphoria. The totally abstinent Ss in the present study also reported that their craving decreased sharply

as abstinence proceeded, while the craving of the partially abstinent *Ss* remained fairly constant. As Figure 2 shows, the two groups report similar levels of craving early in abstinence and then diverge as abstinence proceeds. The conclusion of Johnston (1952) and Ochsner (1954) that the craving for cigarettes declines sharply after a few days of abstinence thus seems to apply only when abstinence is total. When abstinence is partial, craving is maintained at fairly constant levels for at least 13 days. Guilford (1966) reports data consistent with this pattern. She found that the *Ss* who were most likely to smoke during anti-smoking therapy were also more likely to report craving, and this effect grew more marked as abstinence proceeded. This pattern, present in both studies, suggests that total abstinence results in a decrease in craving.

This finding suggests that immediate total withdrawal from smoking might be a more effective method of smoking cessation than gradual reduction of cigarette consumption. Many authors have suggested that abrupt cessation is the superior method (Johns, 1944; Johnston, 1952; Ochsner, 1954; Ware, 1962; Guilford, 1966; Boyle, 1968), although this conclusion is by no means universally endorsed (cf. Stieglitz, 1943; Georges, 1962; Hochbaum, 1965). It may be that the inferiority of the gradual reduction method is due to the maintenance of craving for cigarettes, possibly combined with other withdrawal symptoms for which the threshold has been passed.

The present study shows that important changes occur in the smoking withdrawal syndrome as abstinence proceeds. It also suggests factors which may affect these changes. Further research is clearly needed to determine more definitely the course of the abstinence syndrome. The importance of prolonged—indeed indefinite—abstinence from smoking to public health makes urgent the need for studies of the long-term course of protracted abstinence from cigarette smoking.

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## REFERENCES

- Boyle, C. M.: Some factors affecting the smoking habits of a group of teenagers. *Lancet* **1968** II, 1287–1288
- Brecher, E. M.: Licit and illicit drugs. Boston: Little, Brown, 1972
- Burns, B. H.: Chronic chest disease, personality, and success in stopping cigarette smoking. *Brit. J. prev. soc. Med.* **23**, 23–27 (1969)
- Georges, M.: L'intoxication par le tabac: Manifestations thérapeutiques. *Presse méd.* **70**, 1419–1421 (1962)
- Gritz, E. R., Jarvik, M. E.: A preliminary study: Forty-eight hours of abstinence from smoking. Proceedings of the 81st Annual Convention of the American Psychological Association, vol. 1, pp. 1039–1040 (1973)
- Gsell, O.: Warum kommt es nach Aufgabe des Rauchens zu Gewichtszunahme? *Med. Klin.* **59**, 1528 (1964)
- Guilford, J. S.: Factors related to successful abstinence from smoking. Pittsburgh: American Institutes for Research 1966
- Horn, D.: Adult use of tobacco. Report of the National Clearinghouse for Smoking and Health, U.S. Public Health Service, Department of Health, Education, and Welfare Publication No. (HSM) 73-8727 (1970)
- Johns, W. S.: Tobacco, drug and delight. *Historic. Bull.* **9**, 23–31 (1944)
- Johnston, L.: Cure of tobacco-smoking. *Lancet* **1952** II, 480–482
- Knapp, R. P., Bliss, C. M., Wells, H.: Addictive aspects in heavy cigarette smoking. *Amer. J. Psychiat.* **119**, 966–972 (1963)
- Larson, P. S., Silvette, H.: Tobacco: Experimental and clinical studies. Suppl. I. Baltimore: Williams and Wilkins 1968
- Larson, P. S., Silvette, H.: Tobacco: Experimental and clinical studies. Suppl. II. Baltimore: Williams and Wilkins 1971
- Ochsner, A.: Tremendous increase in cancer of the lung. *Life and Hlth.* **62**, 6–7 (1954)
- Russell, M. A. H.: Cigarette smoking: natural history of a dependence disorder. *Brit. J. med. Psychol.* **44**, 1–16 (1971)
- Stieglitz, E. J.: *Geriatric medicine*, p. 35. Philadelphia: W. B. Saunders 1943
- United States Public Health Service. Smoking and health. Report of the Advisory Committee to the Surgeon General of the Public Health Service, Publication No. 1103 (1964)
- Ware, G. W.: How to stop smoking and why. *Maryland med. J.* **11**, 290–293 (1962)
- Weybrew, B. B., Stark, J. E.: Psychological and physiological changes associated with deprivation from smoking. U.S. Naval Submarine Medical Center Report No. 490 (1967)
- Winer, B. J.: *Statistical principles in experimental design*. New York: McGraw-Hill 1962
- Work Group 1 of the World Conference on Smoking and Health. Report on "Addiction, habituation, and pharmacology of tobacco". Summary of the Proceedings of the World Conference on Smoking and Health (1967)
- Wynder, E. L., Kaufman, P. L., Lesser, R. L.: A short-term follow-up on ex-cigarette smokers with special emphasis on persistent cough and weight-gain. *Amer. Rev. resp. Dis.* **96**, 645–655 (1967)

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