Carolyn C. Johnson, Nina Ogińska-Bulik

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NINA OGIŃSKA-BULIK

Department of Health Psychology,
Institute of Psychology,
University of Łódź

CAROLYN C. JOHNSON

Department of Community Health Sciences,
Tulane University School of Public Health and Tropical Medicine,
New Orleans

A COMPARISON OF ANGER IN CARDIOVASCULAR HIGH RISK AND NORMAL ADOLESCENTS

INTRODUCTION

Much progress has been made over the last several decades in identifying coronary heart disease (CHD) risk factors, and a significant decrease in deaths due to CHD has been observed (Matthews *et al.* 1977). CHD, however, is still the leading cause of morbidity and mortality in industrialized countries (Miller 1993; Taylor 1991). Research continues to focus on the examination of both biological and psychological factors that have the potential for elevating risk for CHD, hypertension, and hyperreactive cardiovascular responses.

A psychological risk factor that has received considerable attention has been anger and its role in the development, exacerbation and/or maintenance of numerous medical disorders, but especially in the cardiovascular diseases (Diamond 1982; Harburg *et al.* 1991; Haynes *et al.* 1980; Matthews *et al.* 1977; Miller 1993; Siegman 1994; Siegman, Snow 1997; Vógele, Steptoe 1993).

The relationship between anger and cardiovascular diseases, mainly CHD, appears to operate both through the Type A Behavior Pattern (TABP), with cardiovascular arousability associated with anger being one

of the major characteristics of the TABP, and through other independent processes (Krantz *et al.* 1987; MacDougall *et al.* 1985). For example, adult studies have found positive relationships of personality and behavioral traits with blood pressure regulation mechanisms; however, many of these studies have been criticized because of methodologies that might introduce bias (Krantz *et al.* 1987). Even so, anger still emerges with regularity as a correlate of hypertension in patient samples.

Several population-based studies have investigated the development of cardiovascular risk in children and adolescents, e.g. the Bogalusa Heart Study (Berenson 1980) and the Muscatine Study (Lauer *et al.* 1975). Johnson *et al.* (1987) also found that anger-in and weight were major predictors of elevated blood pressure for both black and white males. Otherwise, little work has been accomplished regarding anger and its relationship to early development of cardiovascular risk in children and adolescents, although many investigators have hypothesized that styles of anger expression develop very early in life (Siegel 1984). In addition, longitudinal studies have shown that aggression, a behavioral manifestation of anger, is considerably stable over the entire lifespan (Matthews, Avis 1983). It is also becoming more obvious that studies during late childhood and adolescence are critical for understanding the atherosclerotic and blood pressure regulatory processes, since evidence has accummulated that these processes begin before (Berenson 1986) or during (Siegel 1984) the second decade of life.

It is believed, therefore, that investigations with youth of the relationship of anger and cardiovascular disease risk factors are an important approach for understanding the role of psychological factors in the development of cardiovascular disease. The purpose of this study was to determine if adolescents with identified risk factors for CHD differed in levels of anger from their peers with no obvious CHD risk factors. The relationship between anger and biological risk factors for CHD in the risk group was also investigated.

METHOD

PARTICIPANTS

This study was conducted in two parts: Part I was the assessment and analysis of CHD risk factors and Part II was the assessment of anger and analysis of anger and CHD risk factors. Part I included 350 secondary school students (53% female) from Łódź, Poland, ages 15–18 years. This assessment resulted in the identification of 56 (16% of the total sample) students (55% female) who were identified with one or more elevated

biological risk factors. An additional 52 (15% of the total sample) students (52% female) with no obvious biological risk factors were randomly selected from the remainder of the total sample as a comparison group.

INSTRUMENTS

Biological CHD Risk Factors. Part I of the research concerned the assessment of biological risk factors was undertaken in cooperation with the I Clinic of Childhood Diseases of the Institute of Pediatrics Medical Military Academy in Łódź, Poland. Assessments were conducted by a female physician and a nurse and included cardiovascular disease family history, tobacco use, physical activity levels, anthropometry, blood pressure, and blood lipids. An interview was used to determine family history, tobacco use, and physical activity levels. Height and weight were measured with a physician's balance beam scale with stadiometer. Three blood pressure measurements at rest were taken with both fourth and fifth Korotkoff phases.

Total blood cholesterol, high density lipoprotein and low density lipoprotein cholesterol, and triglyceride concentration were evaluated enzymatically.

Anger Expression Scale. The assessment of anger was accomplished with the Anger Expression Scale (AES) developed by Ogińska-Bulik and Juczyński (in press). The AES produces scores for two independent subscales, namely anger-in and anger-out, which contain 10 items each. The first subscale, anger-out, assesses how frequently anger is displayed by overt behaviors (i.e. *I slam doors when I am angry*), and the second subscale, anger-in, assesses how frequently anger is experienced but not overtly expressed (i.e. *I don't show my anger*). The AES has good psychometric characteristics. Cronbach's alpha coefficients ranged from 0.76 to 0.83 for anger-out and from 0.67 to 0.84 for anger-in. Six month test-retest reliability estimates were 0.71 for anger-out and 0.70 for anger-in. There were no gender differences both in anger-in and anger-out.

PROCEDURE

All measurements were conducted at the students' school site in a private room during the school day. In Part I, each participant was interviewed by the physician to obtain information about cardiovascular disease family history, smoking status, and physical activity levels. An adolescent was identified as having a positive family history when one or both parents

had CHD. Smokers were identified as individuals who smoked five or more cigarettes a day for longer than one year. Dispensation from physical education classes for six months or more, and the lack of involvement in other physical activities, were the criteria for being classified as sedentary. Body mass (kg) was calculated with the formula, weight (kg) divided by height (m^2), and then compared with a developmental percentile chart for classification as being over expected weight (BMI = 25÷30), or obese (BMI = > 30) (Wolański, Kozioł 1987).

An average of three independent blood pressure measurements was compared with the percentile charts published by the Second Task Force on Blood Pressure Control in Children (1987). The individual was classified as hypertensive if the average was equal to or greater than the 95th percentile. Blood samples (6 ml) were transported from school to the Childhood Disease Clinic Laboratory at the Medical Military Academy in Łódź for analysis. Boundary values for serum lipids established according to Ellefson *et al.* (1978) were used to identify elevated lipid levels: total blood cholesterol for girls $\geqslant$ 5.6 mmole/l and for boys $\geqslant$ 5.1 mmole/l; low density lipoprotein cholesterol for girls $\geqslant$ 3.76 mmole/l and for boys $\geqslant$ 3.25 mmole/l; and high density lipoprotein cholesterol for girls $\leqslant$1.1 mmole/l and for boys $\leqslant$ 0.9 mmole/l; and triglycerides > 1.3 mmole/l for girls and > 1.53 mmole/l for boys.

A psychologist administered the Anger Expression Scale. This administration took place after the biological risk assessment at the school site during the school day and in a private room where confidentiality was assured.

STATISTICAL ANALYSES

Descriptive statistics were used to classify individuals according to risk factor status and to determine group demographics. Pearson correlation coefficients were used to examine associations of anger with biological risk factor variables, and *t*- tests to examine group differences.

RESULTS

Mean anger scores for the risk and control groups were compared (Tab. 1), but no statistically significant differences were observed, although individuals with risk factors show higher level of anger-in and anger-out. There were also no differences in anger-in and anger-out between girls and boys from the risk and control group. The risk group (n = 56) comprised 29 adolescents with one or two risk factors, and 27 with three or more risk factors. Means anger scores for these groups are also presented. The

findings indicate that adolescents with three or more risk factors reveal stronger anger expressed outwardly that the counterparts from the control group ($p < 0.05$).

Table 1

Means and standard deviations of anger scores for risk and control group

	Anger-in		Anger-out	
	M	SD	M	SD
Risk group ($n = 56$)				
Total	29.39	6.16	28.75	6.09
Girls	29.68	6.09	28.01	5.87
Boys	29.03	6.11	28.79	5.71
Group with 1 or 2 risk factors ($n = 29$)	29.41	6.13	28.13	6.24
Group with 3 or more risk factors ($n = 27$)	30.57	6.78	30.94*	5.96
Control group ($n = 52$)				
Total	28.59	6.25	26.44	5.64
Girls	27.14	5.06	26.57	5.12
Boys	29.34	6.05	26.49	5.97

* $p < 0.05$.

Classification of the study group by elevated risk factor levels was reviewed and verified (Tab. 2); however, so few subjects were smokers ($n = 3$), and such a low number of subjects had elevated triglycerides ($n = 3$), elevated low density lipoprotein cholesterol ($n = 4$), positive history ($n = 8$), and sedentary lifestyle ($n = 10$), so that these categories were eliminated.

Table 2

Numbers and percentages of adolescents with biological risk factors ($n = 56$)

Coronary Heart Disease Risk Factors	*n*	%
Positive family history*	8	14
Cigarette smoking*	3	5
Sedentary lifestyle*	10	18
Body mass: overweight/obesity	22	39
Systolic blood pressure	12	21
Diastolic blood pressure	12	21
Blood total cholesterol	12	21
Low density lipoprotein cholesterol*	4	7
High density lipoprotein cholesterol	27	48
Triglycerides*	3	5

* Category elimated from analyses because of small *n*.

Table 3 presents anger means and standard deviations for anger scores for subjects in the analyzed risk factor categories. T-tests were performed with anger-in and anger-out mean scores for each category of risk factor and compared with the anger-in and anger-out mean scores for the control group. Significantly higher anger-out scores, were found in individuals who were overweight, and who had elevated levels of total blood cholesterol compared to subjects from the control group. The higher level of anger-in was observed in adolescents with diastolic blood pressure, compared the control group.

Table 3

Means and standard deviations for anger scores within coronary heart disease risk factors

		Risk group			
		anger-in		anger-out	
Risk factors	*n*	M	SD	M	SD
Overweight/obesity	22	29.00	4.36	29.33*	6.11
Systolic blood pressure	12	31.00	7.89	26.42	5.35
Diastolic blood pressure	12	31.25*	9.09	27.00	5.61
Total cholesterol	12	31.33	7.26	29.83*	6.24
HDL cholesterol	27	30.96	7.18	28.11	6.10
Control group					
	52	28.59	6.25	26.44	5.64

* $p < 0.05$.

Table 4

Pearson correlation coefficients for anger and coronary heart disease risk factors ($n = 108$)

Risk factors	Anger-in	Anger-out
Overweigh/obesity	–0.03	0.25*
Systolic blood pressure	–0.02	–0.06
Diastolic blood pressure	0.36*	0.24*
Blood total cholesterol	0.05	0.25*
HDL cholesterol	0.13	–0.24*

* $p < 0.05$.

Pearson correlation coefficients between anger and biological risk factors for the whole group (Tab. 4), although rather low, indicate that anger-out is positively associated with total cholesterol level, diastolic blood pressure,

and being overweight ($p < 0.05$). Positive relationship is also observed for anger-in with diastolic blood pressure. These associations should be viewed carefully, however, because of the small n's in particular factor groups that could result in bias based on restriction of range.

DISCUSSION

The results of this study, coupled with the results from proceding studies, reveal a complex pattern of relationship between anger and CHD risk factors in adolescents. This study demonstrated a positive relationship between anger-out and blood total cholesterol. These results are consistent with anger data presented by Hunter *et al.* (1982) and Siegel, and Leitch (1981) which consistently showed that components of Type A behavior (among them anger) were related to high level of total cholesterol. Data obtained from a previous study in Poland (Ogińska-Bulik, Juczyński 1996a, b) also confirm the positive relationship between anger measured within the Type A paradigm and enhanced lipid level in teenagers. Interestingly, both anger-out and anger-in were positively related to diastolic blood pressure. These data indicate that anger in general, whether it is outwardly expressed or actively suppressed, can relate to blood pressure in adolescents. These data are not completely consistent with the results concerning adults, A recent review of the literature (Siegman 1993) reports that five of seven studies that tested the presumed differential relationship between trait anger-out, trait anger-in, and cardiovascular diseases obtained significant positive correlations between anger-out and systolic blood pressure and six obtained significant positive correlations between anger-out and diastolic blood pressure, and there were no significant correlations between anger-in and cardiovascular diseases. Although some studies reported that both anger-out and anger-in have been positively related to adolescent blood pressure. For example, Siegel (1984) observed that adolescents characterized by frequent anger-out tended to have elevated blood pressure and a relatively sedentary life style, especially during leisure time. Data reported by Matthews *et al.* (1986) also showed that adolescents who were frequently angry and expressed their anger outwardly displayed elevated levels of diastolic blood pressure.

Regarding anger-in, Vógele and Steptoe (1993) found data that underlined the relationship between that variable and positive family history and elevated blood pressure in adolescent males. Johnson *et al.* (1987) found that suppressed anger and weight were major independent predictors of elevated blood pressure in black and white adolescent males. Intense and prolonged blood pressure responses were also found among individuals with frequent

experience of anger coupled with chronic suppression of angry feelings (Goldstein *et al.* 1988; Miller 1993). Suppressed anger has been stressed as an important behavioural contributor to elevated essential hypertension (Harburg *et al.* 1991).

On the other hand, investigations within the Bogalusa Heart Study found no significant relationship among children and adolescents between either anger-in or anger-out with other cardiovascular risk factors, such as smoking, blood pressure, blood cholesterol levels, or obesity (Johnson *et al.* 1994; Johnson *et al.* 1996). Similarly, the Healthy Heart Study conducted by the University of Alabama School of Nursing with third grades has also reported no relationship between anger and cardiovascular risk (in Johnson, *et al.* 1996).

Of course, differences in methodology have to be examined as possible explanatory factors for variations in outcomes, as well as different characteristics of the study populations. With correlation data it is also not possible to ascertain whether anger precedes or is included as a consequence of elevated risk factors. Accumulated study results, however, seem to indicate that anger plays a role in increased cardiovascular disease risk, especially CHD. It would be appropriate, therefore, to recommend a meta-analysis to determine the strenght of the relationship between anger and cardiovascular risk factors, that includes children and adolescents, or adolescents separately.

It is definitely desirable, whatever the case, to focus efforts at modyfying style of anger expression in adolescents for many reasons, such as enhanced psychosocial functioning and reduced risk of future disease. Such anger--reduction intervention program including among other things, cognitive restructuring and relaxation for Polish adolescents was developed and implemented. Significant decrease in anger expressed outwardly was noted (Ogińska-Bulik 1998).

Additional studies need to be accomplish in order to determine if anger characteristics can predict future health status in a population of children and adolescents.

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NINA OGIŃSKA-BULIK, CAROLYN C. JOHNSON

NASILENIE GNIEWU U MŁODZIEŻY Z CZYNNIKAMI RYZYKA CHORÓB SERCOWO-NACZYNIOWYCH

Celem podjętych badań było ustalenie związku między gniewem a biologicznymi czynnikami ryzyka niedokrwiennej choroby serca u młodzieży w wieku 15–18 lat. Dokonano porównania poziomu gniewu mierzonego Skalą Ekspresji Gniewu u 56 nastolatków, u których zidentyfikowano czynniki ryzyka niedokrwiennej choroby serca oraz 52 nastolatków bez takich czynników. Zarówno gniew kierowany na zewnątrz (*anget-out*) jak i gniew kierowany do wewnątrz (*anger-in*) korelowały pozytywnie z rozkurczowym ciśnieniem krwi. Gniew zewnętrzny był także dodatnio związany z otyłością oraz poziomem cholesterolu całkowitego. Wyniki wskazują, że gniew bez względu na to, czy jest wyrażany na zewnątrz czy kierowany do wewnątrz, jest związany z czynnikami ryzyka niedokrwiennej choroby serca u młodzieży.

Słowa kluczowe: gniew, młodzież, ryzyko chorób sercowo-naczyniowych.