Original article

Social support level in relation to metabolic syndrome – results of the SOPKARD study

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Abstract

Background: Low level of social support is one of the psychosocial cardiovascular risk factors. Moreover, social support level (SSL) has been reported to be associated with components of metabolic syndrome (MS).

Aim: To evaluate the association of SSL with MS in 50- and 60-year-old citizens of Sopot.

Methods: The study covered 476 citizens of Sopot (218 males – M; 258 females – F), aged 50-60 years, invited to take part in the screening project SOPKARD aimed at increasing detectability of hypertension, dyslipidaemia and diabetes mellitus in 2002-2003. Patients with MS were diagnosed according to the AHA/NHLBI criteria (2007). The Berkman and Syme's questionnaire was used for assessment of SSL which was categorised into 3 groups: low, medium and high.

Results: Metabolic syndrome was diagnosed in 34% (W 29%, M 39%, p <0.05) of examined subjects. The prevalence of MS criteria was as follows: elevated blood pressure 68% (F 67%, M 69%, NS), elevated fasting glucose 48% (W 45%, M 53%, p=0.08), elevated waist circumference 30% (W 33%, M 25%, p=0.06), hypertriglyceridaemia 42% (F 41%, M 42%, NS) and low level of HDL cholesterol (HDL-C) 23% (W 23%, M 23%, NS). Low SSL was observed in 50% of studied subjects (W 58%, M 39%), middle SSL in 31% (F 29%, M 35%) and high in 19% (F 13%, M 26%). In men with low SSL, MS and low level of HDL-C were found twice as frequent as in men with high SSL (45 vs. 22%, p <0.05; 24 vs. 12%, p <0.05). High level of triglycerides was observed significantly more frequently in women with low SSL than in those with high SSL (51 vs. 21%, p <0.05). Results of regression analysis showed that in men (all and 60-year olds) SSL was significantly associated with MS prevalence (p <0.05). In women, SSL was related to elevated fasting glucose prevalence (p <0.001). Moreover, in 50-year-old women SSL was significantly associated with MS (p=0.05) and elevated waist circumference (p <0.0001). All these relationships were independent of education.

Conclusions: The examined group of middle-aged persons, especially women, was characterised by high frequency of low SSL. Metabolic syndrome and its components were found more frequently in persons with low SSL, compared to those with high SSL. Low SSL was significantly associated with occurrence of MS and dyslipidaemia in men and women, and elevated fasting glucose and elevated waist circumference in 50-year old women.

Key words: social support level – metabolic syndrome

Introduction

The concept of metabolic syndrome was introduced in the nineteen eighties. The idea resulted from numerous observations and large epidemiological studies pointing at the coexistence of certain cardiovascular risk factors. Syndrome X is described in the literature as coexistence of insulin resistance, intolerance of glucose, high insulin levels, increased triglyceride concentrations and systemic hypertension as well as obesity, decreased levels of HDL cholesterol (HDL-C) and hyperuricaemia. Diagnostic criteria of metabolic syndrome (MS) for clinical and scientific use have been developed by WHO and the National Cholesterol Education Program NCEPATP III [1]. In 2007, a panel of AHA/NHLBI experts changed the cut-off point of abnormal fasting glucose level. The experts accepted criteria modified in this manner as valid guidelines for the diagnosis of MS in the USA.

Complex genetic and environmental factors play the major role in the aetiology of MS [2]. Current studies focus on behavioural factors involved in the development of MS.

Low social support level (SSL) is one of the independent psycho-social cardiovascular risk factors. Social support is defined as 'help and support obtained by interaction with the social environment' [3]. Problems of SS are within the main line of studies on the impact of psycho-social factors on health status. Social support is thought to be an important factor that can either induce or prevent disease development.

Studies conducted in recent years suggest a strong relationship between low SSL and increased risk of coronary artery disease, acute cardiovascular events and MS. Social isolation was documented to be associated with 2 to 3-fold increased incidence of coronary artery disease in previously healthy individuals and 3-fold increased risk of recurrent cardiac events among patients with previous myocardial infarction [4, 5]. Similarly, low SSL correlates with more prevalent manifestations of MS such as central obesity [6], high blood pressure (BP) [7], glucose intolerance [8] and dyslipidaemia in males [9]. The CORDIS study revealed significantly higher levels of total and LDL cholesterol as well as more frequent tobacco use in single women than among married ones [10].

Several studies confirmed an association between SS and MS in women [11]. However, studies assessing this relationship in both female and male populations are scarce.

The aim of the study was to evaluate the relationship between SS and MS in 50 and 60-year-old inhabitants of Sopot.

Methods

The study included 476 consecutive inhabitants of Sopot (281 males and 258 females) aged 50 years (263 individuals) and 60 years (213 individuals) in 2002 and 2003. All of them were participants of the SOPKARD study (conducted in 2002 and 2003) – a screening programme for primary prevention of sytemic hypertension, diabetes and lipid abnormalities was accomplished by sending individual invitations to all inhabitants of the same age group. Fifty-seven percent of 50-year-olds and 75% of 60-year-olds were screened.

The following cardiovascular risk factors were evaluated: age (age groups: 50-year-olds and 60-year-olds), gender, tobacco use, systemic hypertension, obesity, lipid and glucose metabolism abnormalities. Metabolic syndrome was diagnosed according to AHA/NHLBI guidelines when 3 of the following 5 criteria were met: high BP (systolic BP ≥130 mmHg and/or diastolic BP ≥85 mmHg and/or on antihypertensive medications), increased fasting glucose level (Glc ≥100 mg/dl), abnormal waist circumference (males: >102 cm, females: >88 cm), increased triglyceride concentration (TG ≥150 g/dl), abnormal level of HDL-C (males: <40 mg/dl, females: <50 mg/dl). Standard methods of assessment of each MS component were used [12].

The SS questionnaire (by Berkman and Syme) recommended by the WHO MONICA Psychosocial Project was employed to evaluate SSL. The questionnaire was standardised for the Polish population in 1998. It identifies qualitative and quantitative aspects of interpersonal relations of surveyed individuals in private and professional life. The identification of three groups of patients with low, medium and high SSL was performed using special code tables.

Statistical analysis

The SAS software (version 8.2) was used to perform all statistical analyses. The relationship between gender, age, education and SSL was verified with the χ^2 test. The same test was employed to evaluate the differences in distribution of each MS criterion in groups of individuals with different SSL. The relation between frequency of MS and SSL was assessed using a multivariate logistic regression model as well. It included education level, gender and age (groups of 50- and 60-year-old patients) as independent variables and the presence of MS as the dependent variable.

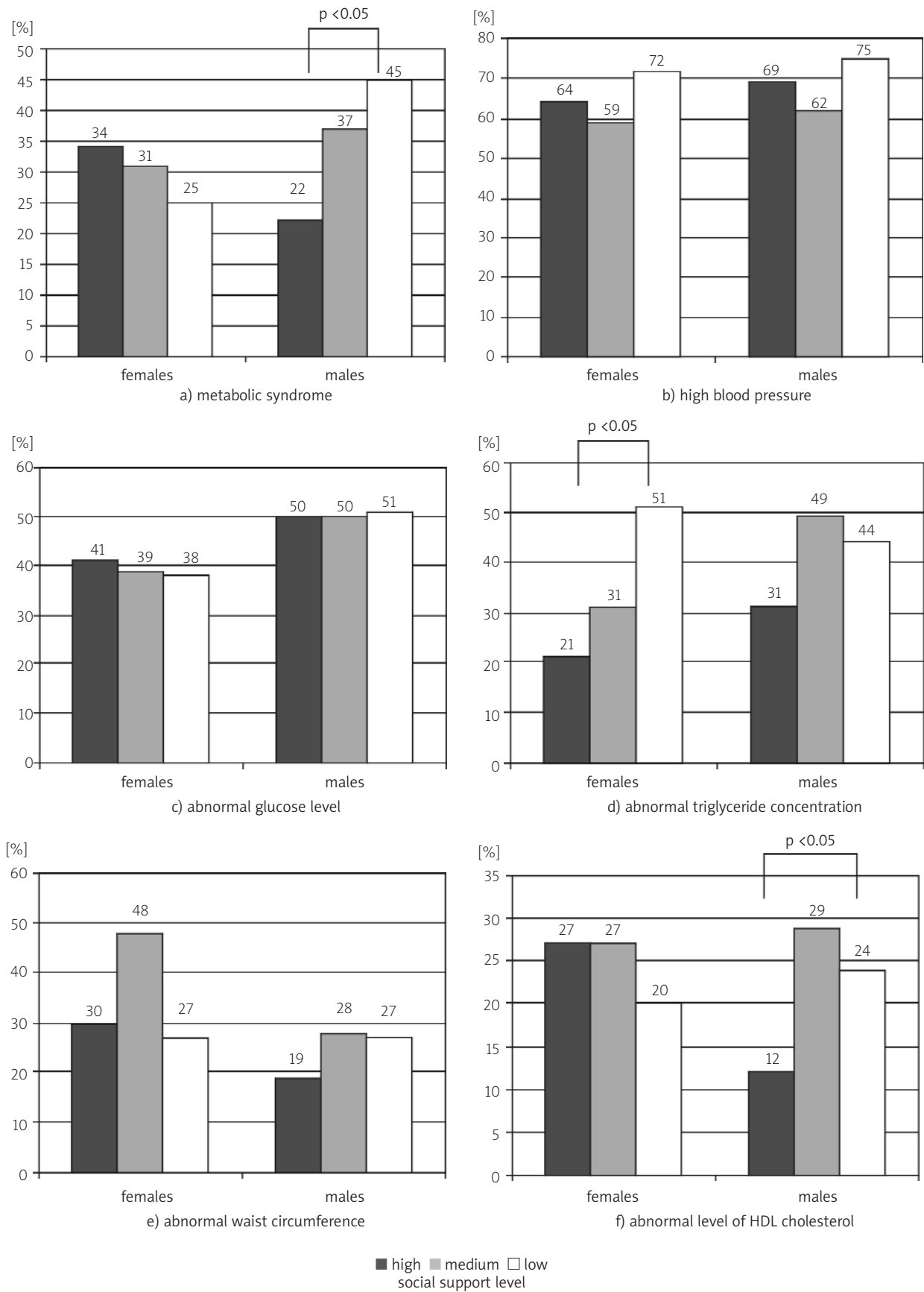A p value <0.05 was considered significant in all tests.

Results

The distribution of each MS component in the studied population is presented in Table.

The group of middle-age individuals was characterised by a high rate of low SS (50%). Low SSL was observed significantly more frequently in women than in men

Table. The distribution of metabolic syndrome components and metabolic syndrome in the studied population

Parameter	Total [%]	Females [%]	Males [%]	p/CC
Metabolic syndrome	34	29	39	0.03/01
High blood pressure (SBP ≥130 mmHg and/or DBP ≥ 85 mmHg)	68	67	69	NS
Glucose level ≥100 mg/dl	48	45	53	0.08/0.08
Triglyceride concentration ≥150 g/dl	42	41	42	NS
Abnormal level of HDL cholesterol (males <40 mg/dl, females <50 mg/dl)	23	23	23	NS
Abnormal waist circumference (males >102 cm, females >88 cm)	30	33	25	0.06/0.08

Abbreviations: SBP – systolic blood pressure, DBP – diastolic blood presure, CC – contigency weffirient

a) metabolic syndrome

b) high blood pressure

c) abnormal glucose level

d) abnormal triglyceride concentration

e) abnormal waist circumference

f) abnormal level of HDL cholesterol

■ high ■ medium □ low
social support level

Figure. Metabolic syndrome and component disorders according to the social support level

(58 vs. 39%, p <0.05). Individuals with technical (61%) and secondary education (53%) had significantly more frequent low SS (p <0.05) in comparison to patients with university education (32%). A low SS was more frequent in 50-year--olds (56%) than in 60-year-olds (42%).

Individual components of MS were observed significantly more frequently (p <0.05) in patients with low SSL than in the respective group with high social support. This relationship was found both in men and women. However, the influence of SSL on distribution of each MS component was gender-related (Figure).

Males presenting low SSL had 2-fold more frequent MS as well as abnormal HDL-C level than males with high SS. High concentration of triglyceride, elevated BP and abnormal waist circumference occurred more frequently in men with low SS than in ones with high SSL, although without reaching statistical significance. Similarly, an abnormal concentration of triglyceride was found more often among females with low social support level.

Individuals with low SSL (both women and men) had significantly more frequent metabolic syndrome (32 vs. 27%, p <0.05), increased concentration of triglyceride (49 vs. 27%, p <0.05) and high BP (73 vs. 68%, p <0.05).

The logistic regression model revealed a trend towards a significant association between low SSL and the presence of MS in 50-year-old females [p=0.05; OR=(0.99-3.48)]. Moreover, a low SSL was associated with abnormal fasting glucose level [p <0.001; OR=(0.884-3.018)] and abnormal waist circumference [p <0.0001; OR=(2.04-7.37)] in this group, low SSL was significantly related to the presence of MS in 60-year-old males as well [p <0.05; OR=(0.977-2.629)]. A similar relationship was found in the population of all males with respect to MS (p <0.05). An abnormal fasting glucose level characterised all females with low SS (p <0.05). All these relations were education-independent. No significant association between social support and triglyceride concentrations, blood pressure or levels of HDL-C were found in the logistic regression model.

Discussion

Our study revealed a wide dissemination of low SSL in the population of Sopot, especially among 50-year-old individuals with low education level. A similar phenomenon was observed in the Pol-Monica study in the population of Warsaw [13]. All conclusions drawn from the SOPKARD study regarding the distribution of different SSLs are valid only for the urban population. Therefore, the analysis of SS at the nationwide level is warranted.

The SOPKARD study showed a significant association between SSL, MS and abnormal level of HDL-C in males, whereas in females SS affected triglyceride concentrations. Moreover, the study documented that the level of SS was significantly associated with the presence of MS, abnormal waist circumference and abnormal fasting glucose concentrations in the group of 50-year-old women. A low social support level favoured the occurrence of MS in 60-year-old men as well. All aforementioned relationships were education-independent. Is seems that conclusions drawn from the SOPKARD study can be extrapolated to a nationwide population.

The prospective Swedish-American study [11] revealed a 3-fold greater risk of MS among socially isolated women in comparison to their counterparts with high SSL. This study involved a group of initially healthy women. Diagnostic criteria of MS different from NCEP ATP III guidelines were used.

Studies on the association between SS and MS should consider the direction and the type of this relationship. Is it only a coincidence of certain variables or are there cause-effect relations between them? The SOPKARD study is a cross-sectional study. The evaluation of causative relations would certainly be possible after several years of follow-up.

Another question that can be raised is: does low SSL contribute to the development of MS, or does the metabolic syndrome favour the low SSL?

One of the Finnish prospective studies on 425 healthy women evaluated certain psycho-social factors (SS was not included) and components of metabolic syndrome at the beginning of the programme and after 8 years of follow-up. The majority of psychological factors (such as depression, anxiety and hatred) contributed to the development of MS. A reciprocal relationship was found in the case of hatred [14]. It is highly suspected that social support may be one of the behavioural factors increasing the risk of MS development.

The results of numerous studies showed that social isolation directly impacts the development of MS irrespectively of its negative impact on the patient's lifestyle [11, 15]. We should keep in mind that low SSL can favour either a sedentary lifestyle or tobacco use [15]. Thus, it cannot be ruled out that the association between MS and SS observed in the SOPKARD study partially depends on the potential negative impact of SS on lifestyle.

Many investigators evaluated SS in the context of its protective action against negative results of stress. Psycho-social factors are suspected to be the major stimuli of hyperactivity of the hypothalamo-pituitary-adrenal axis (HPA). Activation of the neuroendocrine axis of stress in MS was demonstrated in numerous studies, e.g. in the Whitehall II study [16]. It is well known that SS changes the response of the HPA axis to stress both in men and women [15, 17, 18]. The hypothesis of effects of social support on the function of the HPA axis is supported by the finding of a relationship between SS and the frequency of lipid abnormalities as well as visceral obesity from SOPKARD and other studies [6, 9].

Low SS can influence the autonomic balance, resulting in an increase of sympathetic activity and a decrease in

parasympathetic tone. Increased heart rate, BP and insulin concentrations are the consequences [19]. The SOPKARD study confirmed the influence of low SSL on wide dissemination of high BP among women.

Reports published in recent years provide evidence for the impact of psycho-social factors on inflammatory and immunological reactions. Social isolation is accompanied by increased concentrations of IL-6, CRP and fibrinogen [20]. The activation of inflammatory and immunological processes lead to metabolic disturbances such as insulin resistance, type 2 diabetes and syndrome X.

The results of the SOPKARD study confirmed previous reports on the relationship between SS and components of metabolic syndrome X. It seems that all aforementioned biological mechanisms can be triggered by social isolation and can lead to the development of MS. The results of the SOPKARD study interpreted in the light of the reviewed literature lead to hypothesis that SS may play a significant role in the aetiology of MS. This raises the question of the level of probability of future diagnosis of MS in today's single individuals. This issue will be addressed by the SOPKARD 1999-2009 programme with 10-year follow-up.

Conclusions

1. High frequency of low social support level is observed in middle-age individuals, especially in females.
2. Metabolic syndrome and its component disorders are more frequent among individuals with low social support level in comparison to their counterparts with high SS.
3. A significant relationship between social support and the presence of metabolic syndrome as well as lipid abnormalities in men and women can be found. Finally, social support is associated with abnormal fasting glucose level and abnormal waist circumference in the group of 50-year-old women.

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Poziom wsparcia społecznego a występowanie zespołu metabolicznego – wyniki programu SOPKARD

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Streszczenie

Wstęp: Niski poziom wsparcia społecznego (WS) jest jednym z psychospołecznych czynników ryzyka sercowo-naczyniowego. W wielu badaniach wykazano jego związek ze zwiększoną częstością chorób układu krążenia. Doniesienia ostatnich lat wskazują na istnienie zależności między poziomem WS a zaburzeniami wchodzącymi w skład zespołu metabolicznego (ZM), będącymi niezależnymi czynnikami ryzyka sercowo-naczyniowego.

Cel: Ocena związku pomiędzy poziomem WS a rozpowszechnieniem ZM wśród 50- i 60-letnich mieszkańców Sopotu.

Metodyka: Badaniem objęto 476 mieszkańców Sopotu (218 mężczyzn i 258 kobiet) w wieku 50–60 lat, zaproszonych do badań przesiewowych w programie prewencji pierwotnej nadciśnienia tętniczego, cukrzycy i dyslipidemii SOPKARD w latach 2002 i 2003. Rozpowszechnienie ZM oceniono na podstawie wytycznych AHA/NHLBI z 2007 r. Poziom WS oceniano kwestionariuszem Berkmana i Syme'a, wyodrębniając grupy osób z niskim, średnim i wysokim poziomem wsparcia.

Wyniki: Zespół metaboliczny występował u 34% badanych (29% kobiet, 39% mężczyzn, p <0,05). Częstość występowania poszczególnych kryteriów ZM była następująca: podwyższone ciśnienie tętnicze stwierdzono u 68% badanych (67 *vs* 69%, kobiety *vs* mężczyźni, odpowiednio, NS), podwyższony poziom glukozy na czczo u 48% badanych (45 *vs* 53%, p=0,08), nieprawidłowy obwód w pasie u 30% (33 *vs* 25%, p=0,06), hipertrójglicerydemię u 42% osób (41 *vs* 42%, NS), a nieprawidłowy poziom frakcji HDL cholesterolu (HDL-C) u 23% (23 *vs* 23%, NS). Niski poziom WS stwierdzono u 50% osób (58 *vs* 39%), średni – u 31% (29 *vs* 35%), wysoki – u 19% (13 *vs* 26%). Zespół metaboliczny i nieprawidłowy poziom HDL-C występowały dwukrotnie częściej w grupie mężczyzn z niskim poziomem WS niż w grupie z wysokim poziomem WS (45 *vs* 22%, p <0,05; 24 *vs* 12%, p <0,05). Wśród kobiet z niskim poziomem WS ponaddwukrotnie częściej niż w grupie kobiet z wysokim poziomem WS zaobserwowano nieprawidłowy poziom trójglicerydów (51 *vs* 21%, p <0,05). Analiza regresji wykazała, iż u mężczyzn (w całej populacji badanych mężczyzn oraz w grupie 60-latków) poziom WS był istotnie związany z występowaniem ZM (p <0,05). U kobiet poziom WS był związany z występowaniem podwyższonego poziomu glukozy na czczo (p <0,001), a w grupie kobiet 50-letnich – również ZM (p=0,05) i nieprawidłowego obwodu w pasie (p <0,0001). Wszystkie opisywane zależności były niezależne od poziomu wykształcenia.

Wnioski: W badanej populacji osób w średnim wieku obserwowano duże rozpowszechnienie niskiego poziomu WS, szczególnie w grupie kobiet. W grupie osób z niskim poziomem WS częściej obserwowano ZM i jego składowe niż w analogicznej grupie z wysokim poziomem WS. Wykazano istotny statystycznie związek pomiędzy poziomem WS a występowaniem ZM i niektórych zaburzeń lipidowych u mężczyzn i kobiet oraz nieprawidłowej glikemii na czczo i nieprawidłowego obwodu w pasie u kobiet 50-letnich.

Słowa kluczowe: wsparcie społeczne, zespół metaboliczny

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