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Role of herbs at the crossroads of metabolic syndrome and mental illness

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The potential use of herbs in treating and managing comorbidities is emerging. Mental illnesses (MIs) are a widespread cause of distress and dysfunction and substantially impact one's quality of life. While the precise reason for the onset of mental illness is elusive, several chronic health complications, including metabolic syndrome (MetS), affect an individual's well-being. Thus, it is beneficial to identify the intercepts and explore the role of herbs in combating MetS-associated MIs or vice versa. This study explores the relationship between Mets and mental illness and assesses which herbs may have properties that benefit both conditions. The research design and selection process were done among the mental disorder individuals with two sets of keywords and expanded controlled vocabulary phrases, nine databases for systematic literature searches, critical assessment of the papers obtained, and meta-analysis. Our findings suggest that the excess levels of inflammatory cytokines such as C-reactive protein, interleukin, and leptin resistance in MetS strongly correlate with MIs such as depression. The resulting cross-sectional pooled odds ratio was 1.75 (95% CI 1.60-1.92), indicating a strong relationship between Mets and MIs. This study provides an essential theoretical foundation for therapeutic options and prospective intervention methods for comorbid Mets and mental illness. Some herbs have a relevant effect in treating both cases, broadening the breadth of knowledge to guide future research on this topic.

Keywords: Herbs, Mental illness, Metabolic disorders, Mets

The World Health Organization defines quality of life as "an individual's view of their place in life with their goals, aspirations, standards, and concerns in the context of the culture and value systems in which they live. People with persistent physical illnesses are more likely to suffer from mental illness. Chronic physical issues are linked to poor mental health.

Mental illness symptoms are a widespread cause of distress and dysfunction, significantly influencing the quality of life. Approximately 14.8 million American adults in any given year, or roughly 6.7 percent of the US population, suffer from major depressive illness[1]. In addition, personality disorders, nervous disorders, and major depression will be the leading causes of global illness burden by 2020. If one of these diseases affects the other, it creates a tremendous dilemma. Metabolic syndrome and its associations with mental illness and quality of life. Epidemiological evidence has suggested that Mets are associated with mental illness, including psychological, genetic, and environmental factors. A review article by Ri Li and Wenchen Li suggests that Mets' global Prevalence is estimated between the range of 20- 25% (2005). Metabolic syndrome (Mets) is defined by several factors, including central obesity, dyslipidaemia, and high blood pressure, all of which influence the development of cardiovascular disease (CVD), coronary heart disease (CHD), cerebrovascular disease, and, finally, type 2 diabetes mellitus, which increases insulin resistance and contributes to excess morbidity and mortality[1]. Mets and mental illness are becoming increasingly common in both developed and developing countries, with people in low- and middle-income countries bearing the burden. CVD linked to Mets has been proven one of the top ten causes of death, with mortality rates comparable to cancer[2]. So, this dramatically impacts the quality of life globally. It is reported that 35% of all US adults get affected by the Mets[3]. Research shows a link between growing BMI, cardiovascular risk, and mortality, while sedentary lifestyles and bad food habits also play a part in

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developing Mets[4]. Therefore, if an individual begins to control the Met risk factor, CVD and Mets can be key preventative. Moreover, all of these risk factors of Mets are associated with major mental illness, which is suggested by the epidemiological data. Obesity is another significant public health issue. It is the central part of the definition of the Mets. There are two forms of obesity: general obesity, which is measured by the body mass index (BMI), and abdominal obesity, which is measured by the waist circumference (WC) or waist-hip ratio (WHR). According to a review by Shoelson and colleagues, abdominal adiposity raises the risk of disease by establishing a chronic and subacute BMI that reflects the general fat distribution and is less efficient in measuring abdominal fat than WC[5]. However, other researchers have found that combining BMI with WC did not enhance the predictive value of health risk compared to WC alone, confirming the significance of abdominal fat in inflammatory pathogenesis[6]. Psychological issues such as depression or anxiety have been linked to Mets with a high prevalence and substantial relationship[7]. Research studies indicate social anxiety disorder is a frequent mental disorder globally, with a 12-month prevalence of 8.3% and median lifetime prevalence of 14.3%[26]. Furthermore, an article by Scott and Lim found the result of a survey from 17 countries. They mentioned anxiety disorders had been linked to a higher chance of developing a variety of chronic physical illnesses, including factors of Mets[8]. Because Mets and mental illness serve such a substantial public health threat, it is the challenge to identify any link between them is critical[9]. Multiple pathways have been anticipated to mediate the interaction between mental illness and Mets[10]. First, depression which is a part of the mental illness that has been strongly associated with central obesity[11], chronic inflammation and insulin resistance is a common etiological mechanism that causes Mets. Second, depression is also defined as neuroendocrine effects which play a crucial role inthe activation of the sympathetic nervous system and also dysregulation of the hypothalamic-pituitary-adrenocortical axis[12], which may have an impact on Mets risk by influencing abnormal fat formation, glucose metabolism, and blood pressure control[13]. Third, those peoples are suffered from mental illness that has a poor diet, sleep disturbances which ultimately participate in less physical activity. These characteristics have been linked to the development of Mets. Fourth, antipsychotic and antidepressant medication may directly impact several components of Mets, which might help explain the observed link between mental illness and Mets. Alternatively, it observed that the opposite side as well, then we can prove that it is a case of vice-versa where people with Mets have a higher level of inflammatory cytokines, including C-reactive protein, interleukin, and also leptin resistance, both of which may have a role in mental disorder including depressive mood disorder. In contrast, pathophysiological depression and progressive neuro disorders are linked to metabolic disturbances such as insulin-glucose homeostasis, mitochondrial respiration, high-density lipoprotein cholesterol, apolipoprotein A, and paraoxonase-1[14]. As a mixture of vascular risk factors, Mets have the potential to cause subclinical vascular damage, which can cause mental illness that contributes to depressive symptoms[15]. Several epidemiological studies have been examined to find out the relationship between mental illness and Mets. However, the outcomes have varied. Some researchers have found that Mets patients have a higher rate of mental illness, whereas others have been unable to replicate these findings. A poly-pharmaceutical treatment is typically necessary for the clinic management of Mets and mental illness. However, this might produce adverse effects and limit patient compliance[16]. On the other hand, the second-generation or atypical and antipsychotic medications for the treatment of the psychotropic patient can be associated with adverse metabolic effects through the use of selective serotonin reuptake inhibitors (SSRIs), and bupropion increases the chance of developing type 2 diabetes mellitus (T2DM) which influence the Mets. Natural and side effect free treatment strategies might be a valuable weapon in the treatment against Mets and Mental illness since they are genuine and effective[17]. It has been suggested that using functional foods and herbal medicine, might have positive benefits on maintain the Body mass index, glucose metabolism, lipid profile (HDL-C; LDL-C), blood pressure, oxidative stress, endothelium damage, and inflammation[18]. Herbal and natural medicines are traditionally used for a variety of conditions and research shows the potential of many herbs in regulating blood biomarkers associated with Mets (*e.g.* Cinnamon and Turmeric)[19], or for use in mental illness (*e.g.* chamomile for relaxation).

Herbal interventions

The second aim of this study was to determine which herbs were potentially useful for treating the

Mets and mental illness together and some individuals' cases.

Possible effects of Herbs in the treatment of Mets and mental illness

A proper treatment strategy to combat the Mets and Mental illness is essential. Mets are treated with dietary and lifestyle changes as the initial step in the treatment process[20], and Mental illness can be treated with Relaxation exercises as initial treatment[21], where regular exercise might be a valuable weapon in the treatment against Mets and mental illness[22]. A decrease in caloric intake, especially for obese people, decreases sodium, saturated fats, cholesterol, and simple carbohydrate intake and is recognized to aid in treating Mets' comorbidities. Pharmaceutical therapy may be essential in some situations. This medication often has adverse effects and reduces patient compliance[23]. The search for a non-toxic, natural method for treating Mets and mental illness patients is critical to postpone the emergence and progression of the comorbidities. Many of the natural herbs included paper have identical upright effects in the treatment of Mets and mental illness. This review explores the relationship between Mets and mental illness and assesses which herbs may have properties that benefit both conditions.

Table 1 — Study eligibility criteria with definition and search terms

Study Eligibility Criteria	Definition	Search Terms
Mental illness	Something that disrupts the mental state and interrupts how people feel, think, communicate and behave	• Mental disorder • Depression • Personality disorder • Emotional disorder • Nervous disorder • Mental sickness • social stress, family stress, or marital stress • Perceived stress
Metabolic syndrome	A cluster of metabolic abnormalities, including abdominal obesity, insulin sensitivity, hypertension, and dyslipidemia	• metabolic abnormality • metabolic syndrome • metabolic disorder • metabolic syndrome X

Materials and Methods

Research design and Selection process

With a combination of two sets of keywords and expanded controlled vocabulary phrases, nine databases for systematic literature searches, critical assessment of the papers obtained, and meta-analysis (Table 1), the following databases were searched: PubMed, Sci Finder, PsycINFO, and Embase, Cochrane database, Science Direct, Springer, Taylor and Francis, Select, Ovid Full text, Blackwell/Wiley Interscience, Medline. Designed to find herbs that treat Mets and mental diseases, the PICO method has been developed for better screening (Table 2). The reference screening was designed for systematic review filtering and was based on the following inclusion and exclusion criteria: First, the outcome must be needed to focus on patients with defined Mental illness with Mets or Metabolic abnormalities (*e.g.*, central obesity, dyslipidemia, type 2 diabetes mellitus, LDL, HDL,

Table 2 — Methodological quality of included studies in the systematic review

Study	Selection bias				Information bias				
	A	B	C	D	E	F	G	H	Total
Adamowicz *et al*., 2020	*	*	*	*		*	*	*	7/8
Ahlberg *et al*., 2002	*	*	*	*	*		*		6/8
Chen *et al*., 2015	*	*	*		*		*		5/8
Dunbar *et al*., 2008	*	*	*	*	*	*		*	7/8
Grover *et al*., 2020	*	*	*	*	*	*	*	*	8/8
Hildrum *et al*., 2009	*	*	*	*	*	*	*	*	8/8
Ikeda *et al*., 2014	*	*	*	*		*		*	6/8
Kinde *et al*., 2004	*	*	*	*	*	*	*	*	8/8
Kwobah *et al*., 2021	*	*	*	*	*	*	*	*	8/8
Lee *et al*., 2012	*	*		*	*	*	*	*	7/8
Ma *et al*., 2010	*	*	*	*	*	*	*	*	8/8
Miettola *et al*., 2008	*		*	*		*	*	*	6/8
Sahpolat *et al*., 2021	*		*	*	*	*		*	6/8
Teshome *et al*., 2020	*	*		*	*	*	*	*	7/8
Tzeng *et al*., 2020	*	*	*	*	*	*	*	*	8/8
Vogelzangs *et al*., 2007	*	*	*		*	*		*	6/8

BMI). Studies were excluded if studies were without subjects of mental illness and Mets or Metabolic abnormalities. Similarly, it was also excluded if the authors had failed to investigate the connection between mental illness and Mets. Second, the research must consider mental illness, including schizophrenia, bipolar disorders, manic disorders, Depression, Alzheimer's disease, and anxiety disorder. This study only included research papers that evaluated mental illness[24] by well-established psychometric scales or a clinical interview. Both measurements were regarded as valid and accurate to reflect mental illness; however, studies were excluded if mental illness was reported by self-reported Mental illness history. Third, the Mets study employing the NCEP/ATP-III, IDF, and JIS (2009) criteria was included only (Table 3) and excluded studies using non-standardized definitions of metabolic syndrome. Fourth, including only studies on adults (excluding studies in those not under 18 years and over 89 years) as variations in Mets in older and younger patients may warrant separate analysis. Studies with non-standardized metabolic syndrome definitions were excluded. Mets are particularly interested in the prevalence rates for each clinical context, depending on the stage of illness, place of origin, and given drug (inpatient, outpatient, or mixed settings). Finally, we excluded studies with inadequate data for extraction. When finding the herbs to treat Mets and mental diseases, we only include certain herbs subject to clinical trials or approved herbs, excluding herbs in the preclinical model. For additional possible articles to be included, reference lists of relevant articles were also scanned. We did not exclude articles based on language or date of publication.

Evaluation of study quality

Quality assessment

The New castle-Ottawa Scale was used to create a checklist of different aspects of research quality whose content validity and interrater reliability have been taken for this study. The evaluated aspects of study quality included representative sampling strategy, sampling sources of both Mets and non-Mets groups and Mental illness group, response rate, measurement of Mets and Mental illness, and control of confounders. In this study, 60% was utilized as a cut-off point in this systematic review. Based on the inclusion/exclusion criteria, attrition guideline, study characteristics, probability of bias, resulting in consistency, durability, statistical vigour, comparative group quality, *etc*., based on the weights of each research characteristic were evaluated, and each object was scored on a scale of 0 to 8 seen in (Table 3). Along with that study, quality assessment was also evaluated by the two authors to get more accurate results. The results of all authors were evaluated, and appropriate standard results were found after discussion (Table 4) is attached. Given that higher ratings imply greater quality, studies with scores ranging from 0 to 3 are of poor quality, 4 to 6 are of moderate quality, and 7 to 8 are of high quality.

Data analysis

Using a predesigned compilation method, two authors independently derived the following information from each study: research characteristics (research traits), name, writer, year and journal of publication, research location, number of participants, and years of follow-up for cohort studies, Characteristics of participants (*e.g*., age range or gender). Depression and Mets steps, analysis technique, mean age and female composition

Table 3 — Formation of the PICO for finding the herbs that treat Mets and mental illness

Items	Meaning	Possible keywords	Website may be retrieved
P	Patients	• Mental disorder • Nervous disorder • metabolic abnormality • metabolic syndrome	Websites and sequence during retrieval: Cochrane library. PubMed-limits: retrieval after limiting age, gender, type of article, *et al*., including its clinical queries (the five categories of PubMed clinical queries are: aetiology, diagnosis, therapy, prognosis, clinical prediction guides)
I	Intervention	Herbs treat -Mets -mental illness	
C	Comparison	• Herbal medicine vs Other therapy	
O	Outcome	• People's perceptions • Quality of life • Symptoms • Hospitalization rate	
T	Type of study design	• Meta-analysis • Systematic review • Randomized controlled trials	

Table 4 — Summary of the studies examine the relationship between Mets & Mental Illness

Study country name (Years)	Total Population	Age	Male	Female	Mental illness type (Total each case)	Mets - total	Non-Mets	Mental illness Measure	Mets Measure	Prevalence (%)
Singapore (2012)	100	20-70	66	34	Schizophrenia (46)	46	54	DSM-IV	IDF	46
Japan (2007)	3936	30-60	1592	2344	Insomnia (1427)	1684	2252	ISAI	JASSO	42.4%
Taiwa (2012)	1359	70–79	680	679	Athens insomnia scale (50)	666	693	Athens insomnia scale	NCEP/ATP-III	49.90%
USA (2006)	2917	70–79	1430	1487	Depression (641)	1108	1809	CES-D	NCEP/ATP-III	38.60%
Norway (2009)	9571	20–89	4882	4689	Depression (2036)	2716	6855	HADS	IDF	28.4%
USA (1988-1994)	6189	17-39	3186	3003	Depression (545)	479	5710	MDE	NCEP/ATP-III	7.8%
USA (2005-2006)	1857	40-47	0	1857	Anxiety and Depression (837)	1441	416	PHQ-9	NCEP/ATP-III	77.5%
Finland (2005)	480	31-66	230	250	Depression (178)	211	269	BDI-21	NCEP	44%
USA (2000)	59	20-40	59	0	Depression & Anxiety (26)	25	34	HDS, MADRS, BDI, HAS	NCEP/ATP-III	42%
Australia (2004-2006)	1690	25–84	805	885	Depression (1345)	936	409	HADS	IDF	55.3%
Poland (2020)	87	19 - 67	32	57	Schizophrenia (87)	60	27	ICD-10	IDF	71.08%
Hawassa, Southern-Ethiopia 2019	245	20-80	143	102	Total-245 [schizophrenia-120, major depressive disorder-70, bipolar disorders-30, delusional disorders-11, schizophrenic disorder-11, schizoaffective disorder-3]	66	179		NCEP/ATP-III, IDF	26.93%
2015-2019	59	18-30	not defined	not defined	bipolar disorder -7	39	20	DSM-IV	NCEP/ATP-III	66.10%
Taiwan 2019	260	20-80	134	126	Total-260 [schizophrenia-141, bipolar disorder-67, and major depressive disorder-52]	106	154	DSM-IV	NCEP/ATP-III	40.8%
Turkey 2020	38	20-40	20	18	Schizophrenia (16)	19	19	DSM-IV	NCEP/ATP-III, IDF	31.5%
Eldoret, Kenya (2018-2029)	300	18-67	139	161	psychosis-300	172	128	Psychosis	NCEP/ATP-III	28.60%

(Adjusted regression equations and covariates) in the models), as well as outcomes should be as per the criteria (Prevalence, incidence, unadjusted or adjusted OR, and 95% CI). We also maintain the flowchart of the search strategy in (Fig. 1).

Meta-analysis

Review Manager (RevMan) version 5.4 has been used to conduct the meta-analysis (The Cochrane Collaboration, London, United Kingdom). The association between Mets and mental illness was

estimated by calculating an odd ratio with 95% confidence intervals (95% CIs). First, In the part of statistics, the Cochran–Mantel–Haenszel test (CMH) was implemented in the analysis of the included studies,

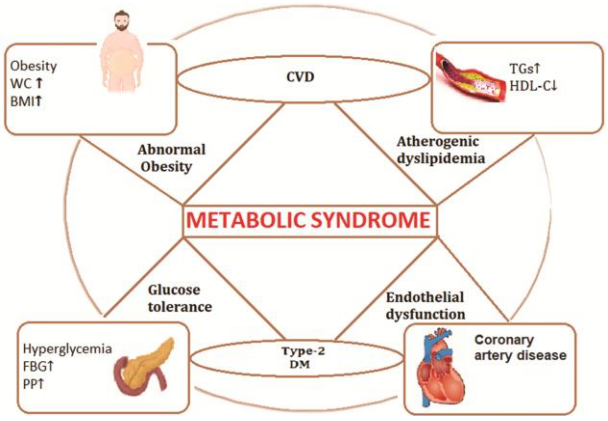

Fig. 1 — Pathophysiology of the metabolic syndrome. Abbreviations: Increase: ↑; Decrease: ↓; CVD: Cardiovascular disease; HDL-C: High-density lipoprotein cholesterol; Type-2 DM: Type 2 diabetes mellitus; FBG: Fasting Blood Glucose; PP: Postprandial; TGs: Triglycerides; BMI: Body Mass Index; WC: Waist circumference

and fixed effects of the analysis model were used[25]. Forest plots have been created for graphical representation to illustrate each study. The heterogenicity was assessed by the Chi^2.The statistical significance limit was chosen at P <0.05 in (Table 2) OHA: Oral Hypoglycaemic Agent; RFP*: Rishyagandha* fruits powder; T2-DM: Types -2 Diabetes Mellitus; DM: Diabetes Mellitus; FBG: Fasting Blood Glucose; PP: Post Prandial sugar; SBP: systolic blood pressure (mmHg); FG: Fasting glucose (mg/dL); TC: Total cholesterol (mg/dL); HbA1c (mmol/mol; PPBG: postprandial blood glucose; BMI: body-mass-index, BF%: body-fat-percent, WC: waist-circumference; HC: hip-circumference, BP: blood pressure, lipidprofile (cholesterol, HDL-cholesterol, LDL-cholesterol, and TG), and CRP: C-reactive protein; BMI:Body Mass Index; FBS: Fasting Blood Sugar; MDA: Malondialdehyde.

Results

Characteristics of included studies

The selection procedure of recognized research papers is summarized in (Fig. 2). The screening

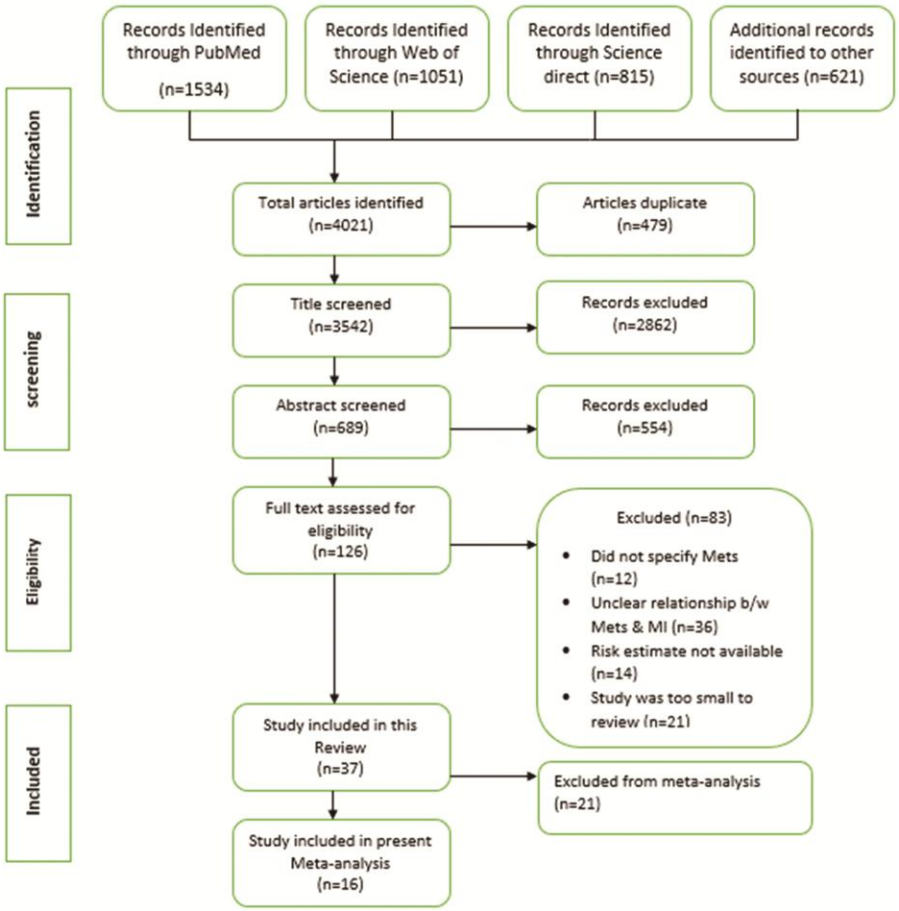

Fig. 2 — Summarizes the inclusion and exclusion of articles and the reasons for exclusion

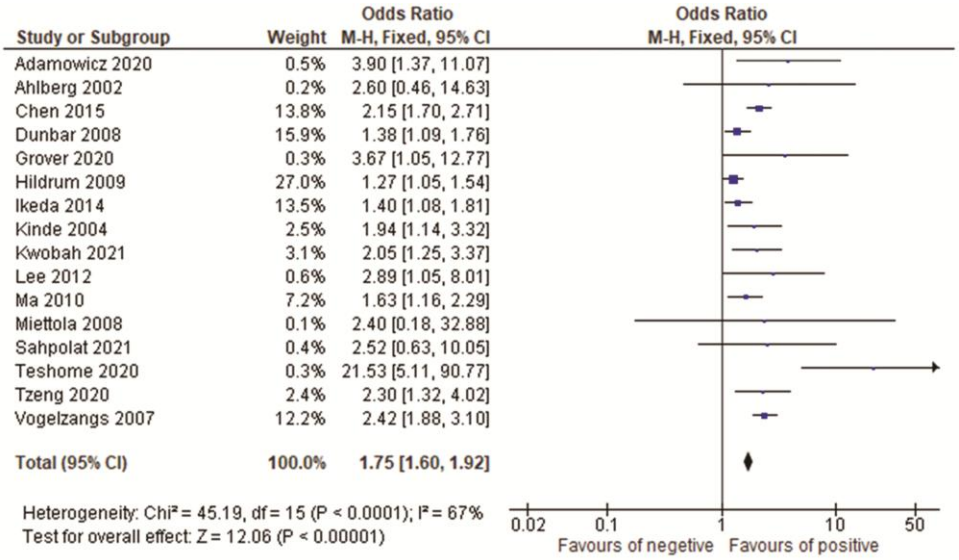

Fig. 3 — Forest plot analysis for the relationship between Mental illness and metabolic syndrome

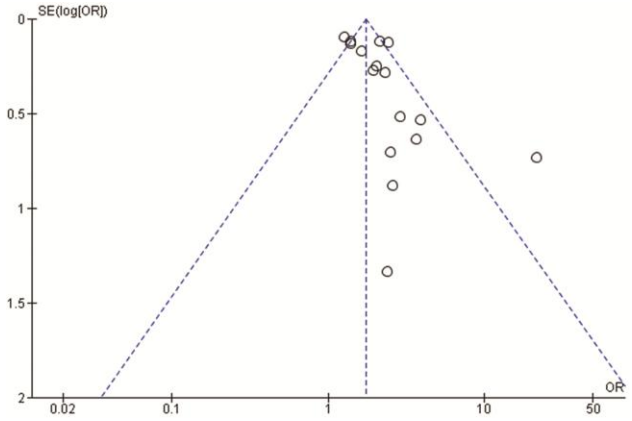

Fig. 4 — Funnel plot analysis of all included studies

criteria of the articles and characteristics of each paper for Mets and Mental illness were clearly described in (Table 4). However, we included 16 cross-sectional studies. Among these studies, five were conducted in Europe, five were conducted in the United States of America, four were conducted in Asia, and two were conducted in Africa seen in (Fig. 2). The studies were structurally diagnostic through different scales like clinical criteria for Manual diagnostics, Mental disorders, National Cholesterol Education Program's Adult Treatment Panel III, International Diabetes Federation, and Joint Interim Societies.

Association between Mets and Mental illness

The study of Mental illness relationship with Mets was composed of 16 cross-sectional studies of 29,147 participants. The age range was 18-86 years (M: 52), where 58% of females. Table 4 shows the quality evaluation of these investigations. The random-effects model has been chosen as the heterogeneity of the study was considerably significant (P <0.0001; I^2= 67%). The result of these studies indicated that Mets has a substantial positive correlation with Mental illness (OR 1.75; 95% CI 1.60, 1.92) with moderate heterogenicity detected (I^2= 67%) (Fig. 3). The funnel plot visual assessment did not detect any significant asymmetry (Fig. 4), which did not suggest a publication bias. (Table 5 & 6)

Discussion

Today's generation, with varied activities and communities, often modifies the daily pattern and circadian malalignment of many people in modern civilizations[26]. This is one of the crucial meta-analysis studies which found a direct association between mental illness and meta-analysis by using data from a cross-sectional study which the concept of Mets has proved would have a combined influence on the development of mental illness by summoning the common effects of all of its components, is based on several literature data on individual components of Mets[27], among this there is particular relationship found between new-onset Mental illness and any Mets component, like Blood glucose, systolic blood pressure, *etc*. After we began looking for a direct link between Mets and mental illness, for several reasons, we could not identify the relationship between mental illness and Mets the many possible explanations: first, we may have found no evidence to support a link as a

Table 5 — List of the herbs used to treat Mets and Mental illness.

Medicaments used	Effect of herbs on medical condition	Clinical Trial Information								
		Participants characteristics	Age (years)	Intervention				Outcome		
				N. Sativa group	Comparison group	Time of study	Specific areas to treat	Main result	Before	After
Resveratrol	DM	66 with type 2 diabetes	46 to 67	1 g/d	Placebo	45 days	Type-2DM	Significantly decreased fasting blood glucose, HbA1c, insulin, and insulin resistance	SBP- 129.03 ± 14.91 mmHg	121.45 ± 10.26 mmHg
									FG-175.74 ± 49.63 mg/dL	FG-140.80 ± 39.74 mg/dL
									TC- 203.61 ± 52.70 mg/dL	TC-192.28 ± 53.13 mg/dL
(cinnamaldehyde, cinnamic acid, eugenol, and coumarin)	Mets	116 individuals with metabolic syndrome	25-45	6 capsules (2.5 g) daily	Placebo	16 weeks	Mets, BP	Significantly control TG, BP, Mets	HbA1c-42.5 ± 6.8	HbA1c-39.6 ± 5.01
N. Sativa oil	hypertension	70 healthy volunteers	34 to 63	2.5 mL *N. Sativa* oil/ two times a day for eight weeks	placebo	Eight weeks	Hypertension	Significant control of blood pressure without any adverse effects	BP-129.7/127.mmHg	BP-119/126 mmHg
N. Sativa	HbA1c	Metabolic syndrome (n = 80)	20-70	Standard treatment +0.5 g/day (powder) for 8 weeks	Standard treatment	Eight weeks	FPG, PPBG, HbA1c	Significantly control in FPG, PPBG, and HbA1c	FBG-165.5823 ± 32.57	144.3411 ± 12.91
Nigella sativa (NS). L seeds	mood, anxiety, and cognition	48 healthy adolescent human males	14 to 17	500 mg NS respectively once daily for four weeks.	one capsule of 500 mg placebo	Four weeks	mood, anxiety, and cognition	Significantly decrease anxiety and modulate cognition positively	134 ±2.60	134.48± 2.9
polyherbal combination of*Soblonga* G-400	Type-2 diabetes	89 patients (50 males and 39 females) with type-2 DM	35-60	polyherbal combination of G-400 (1000mg/d) for 8wk	Placebo	8 weeks	HDL, LDL, DM	significantly lower the diabetes	FBG- 184.84 mg/dl	127 mg/dl
									PP- 277.53 mg/dl	176.92 mg/dl

(*Contd*.)

Table 5 — List of the herbs used to treat Mets and Mental illness (*Contd*.)

Medicaments used	Effect of herbs on medical condition	Clinical Trial Information								
		Participants characteristics	Age (years)	Intervention		Time of study	Specific areas to treat	Outcome		
				N. Sativa group	Comparison group			Main result	Before	After
Gymnemasylvestre Power form	MetS,	24 patients	30-60	600 mg capsule of G. sylvestre /2 times	Placebo	12 weeks	BMI, HDL, LDL, BP	Significantly decrease decreased BWt, BMI, and VLDL levels in subjects with MetS, without changes in insulin secretion and insulin sensitivity	BMI, kg/m^2-31±2.5	BMI, kg/m^2-30.4±2.2
									TG, mmol/L-2.4±1.0	TG, mmol/L-1.7±0.7
									HDL-C, mmol/L-1.1±0.2	HDL-C, mmol/L-1.1±0.3
Blueberries	Mets	44 adults (blueberry; and placebo, (n = 21)	Adults	*Blueberries*2times/ day, (n = 23)	Placebo, (n = 21)	6 weeks	BP, insulin sensitivity	It did not improve BP, but it improved endothelial function	BMI, kg/m^2-36±1.1	BMI, kg/m^2-35.2±0.8
									Fat mass, kg-42.7±2.3	Fat mass, kg-38.5±2

Table 6 — Medicinal plants and effects of herbs on medicinal conditions

Medicinal Plant name	Effect of herbs on medical conditions	Action
Allium sativum	Mental illness	Reduced the oxidative stress
		Potent neuroprotective agent against pollutant-induced nervous tissue damage
	Mets	Reduce the Cholesterol level
		Heart tissue in type 2 DM
Aloe vera	Mental illness	neuronal viability in the hippocampus of streptozotocin (STZ)-induced
	Mets	Useful in the treatment of diabetes mellitus
Brassica oleracea	Mental illness	Influenced the dopamine level, which triggered the photosynthetic reduction of oxygen
	Mets	Successfully treat type 2 DM; Hypertension
Matricaria chamomilla	Mental illness	Used as a mild tranquillizer to reduce anxiety
	Mets	Effective anti-obesity agent
Hypericum perforatum	Mental illness	Useful in the treatment of depression
	Mets	Useful in the treatment of diabetes mellitus.

result of the null-effect compensating Met risk for mental health and the protection effect. Second, many distinct biases might have occurred since participants had varied participation, drop-outs, and survival rates with and without Mets. However, not all the articles included in this meta-analysis have recorded such detailed information, which prevented us from having control of possible confuses. The missing relationship between Mets and mental illness includes the baseline participants' age and heterogeneity in defining Mets criteria, which were previously well disregarded as a probable source of differences in research[28-30]. At that time, we started to find the relationship between these two factors differently. We took possible parameters of the Mets with mental illness and merged them to find the literature with a strong relationship. First, depression which is a part of the mental illness that has been strongly associated with central obesity, chronic

inflammation, and insulin resistance, is a common etiological mechanism that causes Mets. Second, depression is also defined as neuroendocrine effects which play a crucial role in the activation of the sympathetic nervous system and also dysregulation of the hypothalamic-pituitary-adrenocortical axis, which may have an impact on Mets risk by influencing abnormal fat formation, glucose metabolism, and blood pressure control. Third, those peoples are suffered from mental illness that has a poor diet, sleep disturbances, which ultimately participate in less physical activity. These characteristics have been linked to the development of Mets. Fourth, antipsychotic and antidepressant medication may directly impact several components of Mets, which might help explain the observed link between mental illness and Mets. Alternatively, it observed that the opposite side as well, then we can prove that it is a case of vice-versa where people with Mets have a higher level of inflammatory cytokines, including C-reactive protein, interleukin, and also leptin resistance, both of which may have a role in mental disorder including depressive mood disorder[31-39].

In contrast, the pathophysiological of depression and progressive neuro disorders are linked to metabolic disturbances such as insulin-glucose homeostasis, mitochondrial respiration and high-density lipoprotein cholesterol, apolipoprotein A and paraoxonase-1. Mets, as a mixture of vascular risk factors, have the potential to cause subclinical vascular damage, which can cause mental illness that contributes to depressive symptoms. At the same time if you can see one interesting accountable mechanism for cerebrovascular disease where we found that risk of recurrent stroke is known to have increased Mets, and the volume of stroke is a substantial predictor of post-stroke dementia and this dementia leads to mood changes like depression or anxiety[40-45].

Although the relationship was not fully statistically significant, the cohort results suggested a greater risk of Mets in combination with Mental illness; on the other hand, some studies reported higher mental illness in Mets participants than the non-Mets participants. However, the methodologies utilized for Mental illness evaluation differed considerably in further research. Our final cross-sectionally pooled OR was 1.75 (95% CI 1.60, 1.92), which indicates that Mets and Mental illness are closely linked. In stratifying research utilizing mental illness measures, we found that mental illness was shown to be somewhat more strongly associated with the clinically diagnostic report than the self-reported measure scale in cross-sectional studies. More and more data revealed the significant association of symptoms of anxiety subthreshold, such as clinical syndromes with a disease, decrease in life quality and functional impairment.

Conclusion

In this meta-analysis, we are aware that the primary intention of the Mets' impact on mental illness is to evaluate the comorbidity between Mets and mental illness has been established in recent hospital-based research studies. Most research has focused on signalling pathways, cytokines, neurotransmitter content, and antioxidant enzyme activity as the primary mechanisms of action. The potential mechanisms are complex and may involve several shared physiological pathways, such as obesity and inflammation. Mets are considerably linked with Mental illness in this meta-analysis study. Mental illness should be identified and controlled for the people with Mets. Overall, this review gives an essential theoretical foundation for therapeutic options, prospective intervention methods for comorbid Mets and mental illness, and some herbs that have a relevant effect in terms of treating both the cases is given in this review, which also broadens the breadth of knowledge to guide future research on this issue. Although, more studies are needed to explore the mechanisms underlying this reciprocal relation, which will be crucial for the prevention and treatment of both conditions and to find bidirectional association between mental illness and Mets.

Conflicts of interest

All authors declare no conflicts of interest.

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