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REVIEW ARTICLE

The healthy Nordic diet for blood glucose control: a systematic review and meta-analysis of randomized controlled clinical trials

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Abstract

Aims Investigations on the possible effect of the Nordic diet (ND) on the glycemic control and the risk of diabetes have led to inconsistent results. The present study tried to determine the effect of the ND on the markers of blood glucose control using a systematic review and meta-analysis of randomized controlled clinical trials (RCTs).

Methods Predefined keywords were used to search PubMed, ISI Web of Science, Scopus and Google Scholar up to April 2019. The random effects model was used to compute the overall estimates.

Results In total, six RCTs with 618 participants (6–26 weeks of follow-up period) were included in the present study. The meta-analysis revealed that the ND might not have a considerable effect on fasting blood glucose levels [weighted mean difference (WMD) = −0.05 mmol/l, 95% CI − 0.13, 0.01, $P = 0.112$]. In contrast, the analyses showed that the ND significantly reduces serum insulin concentrations (WMD = −1.12 mU/l, 95% CI − 1.84, − 0.39, $P = 0.002$) and the homeostasis model assessment for insulin resistance (HOMA-IR) (WMD = − 0.34, 95% CI − 0.53, − 0.14, $P = 0.001$) compared to control diets. The effect on serum insulin levels was sensitive to one of the included studies. This dietary pattern did not significantly affect 2-h post-prandial blood glucose and Matsuda index.

Conclusions Adherence to the ND might improve serum insulin and HOMA-IR levels; however, this effect was not confirmed for other markers of blood glucose control. Future well-designed and long-term clinical trials are highly recommended.

Keywords Nordic diet · Baltic sea diet · Fasting blood sugar · Insulin · HOMA-IR · Meta-analysis

Introduction

It is estimated that about 415 million adults (8.8%) are affected by type 2 diabetes mellitus (T2DM) globally, and according to the prediction of international diabetes federation (IDF), it would increase up to 642 million in 2040 [1]. T2DM is associated with an increased risk of micro- and macro-vascular complications such as cardiovascular disease, retinopathy, nephropathy, and neuropathy [2]. Therefore, because of its fast growth in prevalence, complications, and burden on the economy, T2DM has become a major public health concern in different countries around the world [3].

Several genetic, environmental, and lifestyle-related factors (e.g., dietary intake, smoking, and physical activity) might directly or indirectly play a role in the pathogenesis of T2DM [4, 5]. Lifestyle modification particularly adherence to a healthy diet and physical activity is regarded as important not only for the prevention but also for the treatment of the disease [6–8]. It is revealed that adherence to healthy dietary patterns which contain high amounts of healthy food groups like fruits, vegetables, whole grains, nuts, and legumes, and less amounts of unhealthy foods like processed meats, saturated and trans fats and sugar-sweetened beverages like the dietary approaches to stop hypertension, and the Mediterranean diet might improve blood glucose control [9, 10].

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The Nordic diet is another dietary pattern which is regarded as healthy. This diet is characterized by a decreased intake of meat and sugar-sweetened beverages and increased consumption of fruits (berries), vegetables, potatoes, whole grains, nuts, seafood (fish and shellfish), organic foods from the wild countryside (typically used for northern European regions). This diet also emphasizes the consumption of low-fat dairy products [11, 12]. It is proposed by a number of researchers that this dietary pattern might beneficially affect human health [13–15]. Recent systematic reviews and meta-analyses revealed that this diet significantly improves total and LDL cholesterol, as well as, systolic and diastolic blood pressure [16]; however, the diet might not affect inflammatory markers including C-reactive protein (CRP), tumor necrosis factor α (TNF-α) and interleukin-6 (IL-6) [17]. The Nordic diet contains high amounts of anti-oxidants, vitamins, polyphenols, unsaturated fatty acids, and fiber; therefore, a number of studies suggested that this diet might beneficially affect the markers of blood glucose control [18, 19]; however, other publications could not replicate the same results [12, 20]. Although the previous studies have led to inconsistent results, we are not aware of any systematic review trying to summarize the evidence in this regard. Therefore, the present systematic review and meta-analysis aimed to summarize the randomized controlled clinical trials (RCTs) which examined the effect of adherence to the Nordic dietary pattern on the markers of blood glucose control and if possible, to quantify the overall effects, using meta-analysis.

Materials and method

The study protocol was registered in PROSPERO database (http://www.crd.york.ac.uk/PROSPERO, registration no: CRD42017058954) [21]. We followed the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines to report the present study [22].

Search strategy

The online search was accomplished using PubMed, ISI Web of Science, Scopus, and Google Scholar. The international registry of clinical trials (clinicaltrials.gov) was also searched to find any additional study related to the subject. No restrictions on the language, publication date or other filters were applied. The following strategies were used to find the related evidence: (nordic AND diet*) OR (nordiet) OR ("baltic sea" AND diet*). Full details on our search strategy for all databases are shown in Supplementary Table 1. The search was updated up to April 2019.

Eligibility criteria

We included parallel or crossover RCTs which examined the effect of the Nordic diet on the markers of blood glucose control in adults (aged 18 years or more). We excluded the studies if: RCTs reported duplicated data, examined the effect of only one component of the Nordic diet (not the whole dietary pattern), did not report sufficient data on glycemic control indices. To find the eligible studies, all titles and abstracts were independently screened by two authors (MM, NRJ) and when the titles/abstracts were inconclusive, the full-texts were evaluated. Furthermore, studies identified from reference lists of the related pieces of literature were added. A third reviewer (ASA) rechecked the retrieved articles to ensure that they meet the inclusion criteria.

Data extraction

The following data were extracted from studies included in the present review: surname of the first author, publication year, the country in which the study was performed, study design, sample size, sex and age of the participants, follow-up duration, details of the dietary strategy administered to the intervention and the control groups, and the study results. The data were independently extracted by two investigators (MM, NRJ) and rechecked by (AZ) to diminish possible errors, and the lead author (ASA) made the final decision in case of disagreements.

Risk of bias assessment

The risk of bias in the individual RCTs was assessed using the Cochrane collaboration's tool, by two reviewers (AZ, MM). Random sequence generation, allocation concealment, blinding of the participants and outcome data, incomplete outcome data, and selective reporting were considered to evaluate the quality of studies [23]. As blinding of the participants is almost impossible in the trials which assess the effect of dietary patterns, the other five domains were considered to assess the overall quality of the included RCTs. These domains were classified as low risk of bias, high risk of bias and unclear [23]. The overall quality of the investigations was stratified as good if they were low risk of bias in more than two domains, fair when they were low risk of bias in two domains and weak when they were low risk of bias in less than two domains.

Statistical analysis

The mean change [and standard deviation (SD)] in outcome variables including fasting blood glucose (FBG), circulating

insulin, 2-h post-prandial blood glucose (2 h-PBG), homeostasis model assessment for insulin resistance (HOMA-IR), and Matsuda index for the Nordic diet and control groups were extracted from the included studies. We considered the correlation coefficient of 0.5 to compute the SD for mean change values. All analyses were replicated assuming 0.1 and 0.9 as correlation coefficients for calculating the change values, to check the sensitivity of meta-analyses to selected correlation coefficient ($r = 0.5$). The raw difference in mean and its standard error (SE) was calculated using the change values calculated for the Nordic diet and control groups and then used as effect sizes for meta-analysis.

The random effects model was used to compute the weighted mean differences (WMD) and their corresponding 95% confidence intervals (CI) [24]. The between-study heterogeneity was assessed using Cochran's Q test and I-squared (I^2) [25]. Subgroup analyses based on the type of control diet (typical diet/average Danish diet) and duration of the intervention (≤ 3 months/> 3 months) were done to evaluate the potential sources of heterogeneity [26]. Sensitivity analysis was done by omitting included studies one by one from the meta-analyses to assess if a study might affect the overall estimates. To check the publication bias, funnel plots were visually inspected [27]. We performed all analysis using STATA, version 11.2 (Stata Corp, College Station, TX) and considered P values < 0.05 as statistically significant.

Results

Study selection and characteristics

In total, 2859 articles were retrieved using electronic database search and 2288 publications remained after the duplicates were removed. These studies were screened by reading their title and abstract and 47 relevant full-texts were selected for further consideration. Finally 41 full-texts were excluded because of the following reasons: 10 studies were performed in children [28–37]; 18 studies did not consider the outcomes of interest [38–55]; 6 studies did not prescribe the Nordic diet and only provided advice to the participants for following the Nordic nutrition recommendations [56–61]; 4 studies evaluated the effect of a single food item rather than the whole dietary pattern [62–65]; 2 studies represented duplicate reports [19, 66]; and 1 study was before-after in design [67]. Therefore, six RCTs met the eligibility criteria and were included in the present systematic review [12, 18, 20, 68–70]. We had two papers that originated [68, 69] from two main studies [12, 70]. We included all of the studies in the systematic review because different outcomes were reported in these papers and the data were extracted from all of them. It should be noted that we considered these studies in the systematic review but we included one effect size from each paper in the meta-analysis. Figure 1 shows the flow diagram of the study selection process.

The publication date of eligible articles ranged from 2011 to 2017. Three included studies were carried out in Finland [68–70], one in Denmark [18], one in Sweden [20], and one in different regions in Europe [12]. The Nordic diet was provided for the intervention groups, and other diets (e.g., typical diets or average Danish diet) had been also recommended for control individuals. In all of the included studies, the Nordic diets provided 46–52% of the total calorie intake from carbohydrate, 27–32% from fat and 17–19% from protein, and there was no considerable difference in energy intake between prescribed diets (1968–2186 kcal/day). Altogether, the total intake of whole grains, fatty fishes, bilberries and salt are the main differences between the Nordic diets in comparison with the control diets (Table 1).

All studies used a parallel design [12, 18, 20, 68–70], and the participants aged 20–70 years. Duration of the studies ranged from 42 to 182 days and all of included studies were conducted in both genders. Moreover, the baseline health status of participants was as follows: patients with metabolic syndrome [68–70], individuals with mild hypercholesterolemia [20], and subjects with obesity [12, 18]. The characteristics of the included studies are demonstrated in Table 1.

Assessment of the risk of bias

All studies were low risk in at least three domains of the Cochrane collaboration's tool for assessing the risk of bias and were classified as good quality [12, 18, 20, 68–70]. All studies except one [18] did not report the allocation concealment, all of the included studies were low risk in incomplete outcome data and selective reporting, and three of them explained the method of random sequence generation [18, 20, 68]. Blinding of outcome assessors was explained in the included studies [12, 69, 70]. None of the eligible studies described the blinding of participants or personnel. The detailed results for the risk of bias assessment are provided in Supplementary Table 2.

Meta-analysis

Fasting blood glucose (FBG)

Four studies with 492 participants assessed the effect of the Nordic dietary pattern on FBG levels [12, 18, 20, 68]. The overall results demonstrated that adherence to the Nordic diet had no significant effect on FBG levels (WMD = −0.05 mmol/l, 95% CI − 0.13, 0.01, $P = 0.112$; Fig. 2), and there was no evidence of between-study heterogeneity (Cochran's Q test, Q statistic = 1.32, $P = 0.726$, $I^2 = 0\%$). The subgroup analysis revealed that the Nordic diet

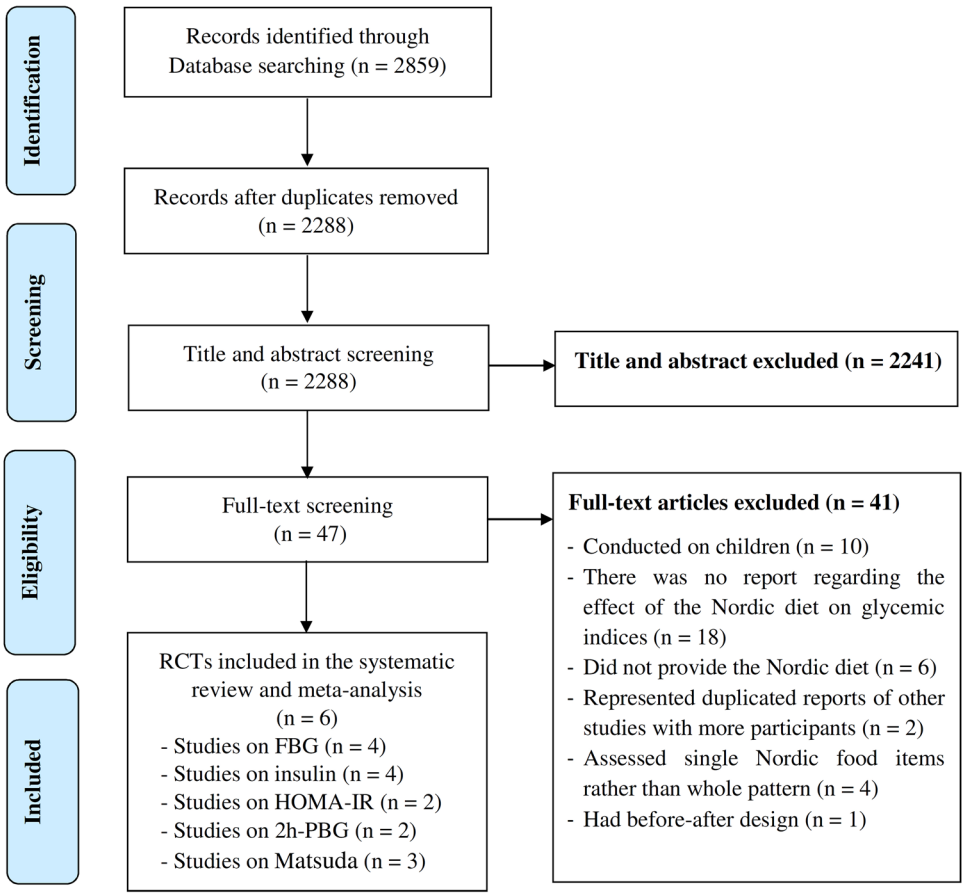

Fig. 1 Flow diagram for the study selection process

does not significantly reduce FBG levels in all subgroups. The overall effect of the Nordic diet on FPG levels and the effect based on several subgroup analyses are presented in Table 2.

Serum insulin levels

Four studies (including 359 participants) evaluated the effect of the Nordic diet on serum insulin concentrations and were included in the meta-analysis [18, 20, 68, 69]. The analysis showed that serum insulin levels were significantly reduced in participants who followed the Nordic diet when compared to the control diets (WMD = −1.12 mU/l, 95% CI − 1.84, − 0.39, $P = 0.002$; Fig. 3) and no heterogeneity was observed between included studies (Cochran's Q test, Q statistic = 1.92, $P = 0.589$, $I^2 = 0\%$).

Subgroup analysis also demonstrated that the reducing effect was significant when the Nordic diet was compared with either typical diets (WMD = −1.04 mU/l, 95% CI − 1.93, − 0.15, $P = 0.022$) or the average Danish diet (WMD = −1.28 mU/l, 95% CI − 2.51, − 0.04, $P = 0.043$). Moreover, the reduction of insulin levels was observed in studies with more than 3 months of intervention (WMD = −1.07 mU/l, 95% CI − 2.10, − 0.05, $P = 0.039$), while the effect was not significant when the studies with lower than 3 months of follow-up duration were separately analyzed (WMD = −0.88 mU/l, 95% CI − 2.61, 0.84, $P = 0.315$) (Table 2).

The effect of Nordic diet on other markers of blood glucose control

Two eligible studies reported data on HOMA-IR levels [18, 20]. The meta-analysis revealed that adherence to the Nordic dietary pattern significantly reduces the HOMA-IR levels [WMD = −0.34, 95% CI − 0.53, − 0.14, $P = 0.001$]. However, the meta-analyses of the two studies which examined the effect of the Nordic diet on 2 h-PBG levels [12, 68] and the three studies which provided data for Matsuda index [12, 18, 70] did not show a significant effect (WMD = −0.03, 95% CI − 0.96, 0.88, $P = 0.936$, for 2 h-PBG levels and WMD = 0.006, 95% CI − 0.57, 0.58, $P = 0.984$, for Matsuda index).

Sensitivity analysis and publication bias

The results of sensitivity analysis showed that the meta-analysis of serum insulin levels was sensitive to one study

Table 1 Characteristic of randomized clinical trials evaluating the effect of adherence to the Nordic diet on glycemic indices that were included in the systematic review

First author (references)	Country	Sample size (Int)	Gender (% female)	Mean age (year)	Design	Duration (day)	Intervention diet	Control diet	Outcomes	Notes about participants	Quality score
Kolehmainen [69]	Finland	56 (31)	Both (66%)	Int: 55.2 Cont: 55.4	Parallel	168	Nordic diet CHO: 46.1% Fat: 32% Pro: 16.9	Typical diet CHO: 42.7% Pro: 17.1% Fat: 36.7%	Insulin	Subjects with two IDF's criteria for MetS (BMI = 27–38 kg/m^2)	3 (good)
Lankinen [68]	Finland	71 (37)	Both (51%)	Int: 58 Cont: 59	Parallel	84	Healthy Nordic food pattern CHO: 48.1% Fat: 30.5% Pro: 18.5%	Typical diet CHO: 47.3% Fat: 31.9% Pro: 18.3%	FBG 2 h-PBG Insulin	Subjects with impaired glucose metabolism and features of the MetS (BMI = 26–39 kg/m^2)	3 (good)
Poulsen [18]	Denmark	147 (91)	Both (71%)	Int: 42.7 Cont: 41	Parallel	182	Nordic Diet CHO: 52% Fat: 30% Pro: 18%	Average Danish diet CHO: 50% Fat: 35% Pro: 15%	HOMA-IR Insulin Matsuda	Subjects with one or more IDF's criteria for MetS, centrally obese (BMI ~ 30.2 kg/m^2, 22.6–47.3)	4 (good)
Uusitupa [12]	Multicenter (Finland, Sweden, Denmark, Iceland)	189 (99)	Both (67%)	Int: 54 Cont: 54.9	Parallel	168	Healthy Nordic diet CHO: 46.8% Fat: 31.7% Pro: 17.5%	Typical diet CHO: 44.6% Fat: 35.2% Pro: 16.2%	FBG 2 h-PBG Matsuda	Subjects with two IDF's criteria for MetS (BMI = 27–38 kg/m^2)	3 (good)
Adamsson [20]	Sweden	86 (44)	Both (63%)	Int: 52.6 Cont: 53.4	Parallel	42	Nordic diet CHO: 52% Fat: 27% Pro: 19%	Control diet CHO: 46% Fat: 34% Pro: 17%	FBG HOMA-IR Insulin	Mildly hypercholesterolaemic (BMI ≥ 20 and ≤ 31)	3 (good)

Table 1 (continued)

First author (references)	Country	Sample size (Int)	Gender (% female)	Mean age (year)	Design	Duration (day)	Intervention diet	Control diet	Outcomes	Notes about participants	Quality score
Mello [70]	Finland	70 (36)	Both (51%)	Int: 59 Cont: 59	Parallel	84	Healthy Nordic food pattern (fatty fish, vegetable oil and vegetable oil-based products in fish preparation, bilberries)	Control diet (avoid whole grain cereals, replace the bread usually consumed with refined wheat bread and other cereal products, avoid bilberries, consumption of fatty fish once a week only)	Matsuda	Subjects with impaired glucose metabolism and features of the MetS (BMI = 26–39 kg/m^2)	3 (good)

Int intervention, *Cont* control, *CHO* carbohydrate, *Pro* protein, *FBG* fasting blood glucose, *2 h-PBG* 2-h post-prandial blood glucose, *HOMA-IR* homeostasis model assessment for insulin resistance, *MetS* metabolic syndrome, *IDF* International Diabetes Federation, *BMI* body mass index

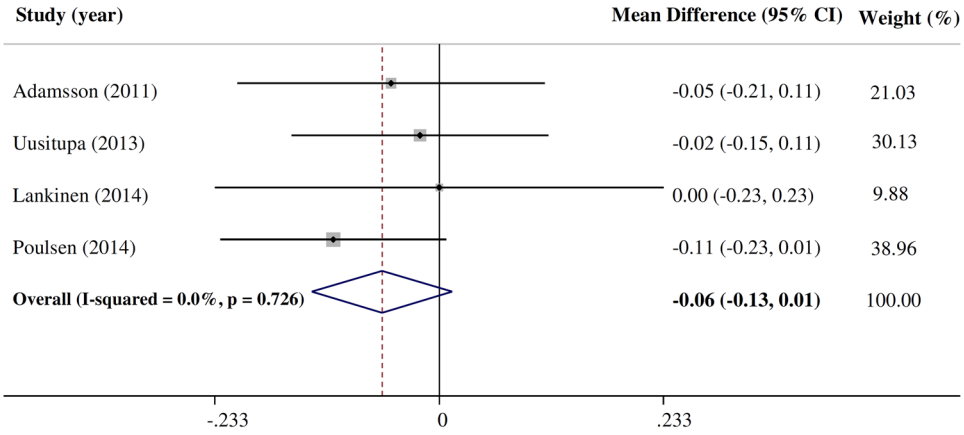

Fig. 2 Forest plot demonstrating the effect of the Nordic diet on fasting blood glucose levels; the analysis was conducted using random effects model

Table 2 Meta-analysis showing the effect of the Nordic diet on levels of FBG and insulin based on several subgroups (all analyses were conducted using random effects model)

			Meta-analysis		Heterogeneity			
Study group	No. of studies	No. of subjects	WMD (95% CI)	*P* effect	*Q* statistic	*P* within group	I^2 (%)	*P* between group
FBG (mmol/L)								
Duration								
≤ 3 months	2	157	− 0.03 (− 0.16, 0.09)	0.612	0.12	0.728	0	0.649
> 3 months	2	335	− 0.07 (− 0.15, 0.01)	0.115	0.99	0.320	0	
Control diet								
Other diets	3	346	− 0.02 (− 0.12, 0.06)	0.571	0.14	0.931	0	0.279
Average Danish diet	1	146	− 0.11 (− 0.22, 0.007)	0.066	0.00	–	–	
Overall	4	492	− 0.05 (− 0.13, 0.01)	0.112	1.32	0.726	0	–
Serum insulin (mU/L)								
Duration								
≤ 3 months	2	157	− 0.88 (− 2.61, 0.84)	0.315	1.58	0.208	36.8	0.905
> 3 months	2	202	− 1.07 (− 2.10, − 0.05)	0.039	0.32	0.570	0	
Control diet								
Other diets	3	213	− 1.04 (− 1.93, − 0.15)	0.022	1.83	0.401	0	0.759
Average Danish diet	1	146	− 1.28 (− 2.51, − 0.04)	0.043	0.00	–	–	
Overall	4	359	− 1.12 (− 1.84, − 0.39)	0.002	1.92	0.589	0	–

FBG fasting blood glucose, *WMD* weighted mean difference

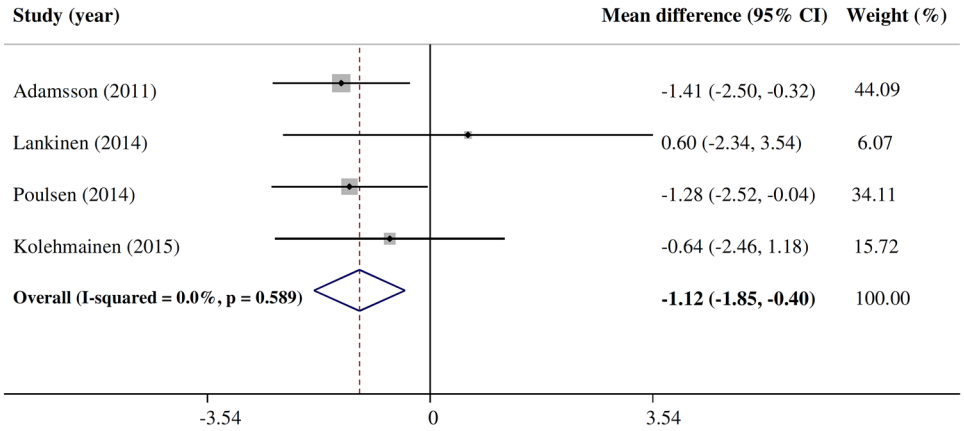

Fig. 3 Forest plot demonstrating the effect of the Nordic diet on serum insulin levels. The analysis was conducted using random effects model

carried out by Adamsson et al. [20] which its removal changed the overall effect to nonsignificant (WMD = −0.89, 95% CI − 1.86, 0.07) (Supplementary Figure 1A). The omission of any individual studies did not alter the other observed pooled effects.

Moreover, the overall effect of the Nordic diet on serum insulin levels changed to nonsignificant when the meta-analysis was conducted on effect estimates calculated based on correlation *r* of 0.9. Other meta-analyses were not sensitive to the correlation coefficients selected for meta-analysis.

No evidence of asymmetry was detected after inspecting Begg's funnel plots for the meta-analysis of FBG (Fig. 4a) and serum insulin (Fig. 4b) levels.

Discussion

This was the first comprehensive review and meta-analysis which considered the effect of the Nordic dietary pattern on blood glucose control. The results demonstrated that adherence to the Nordic diet could significantly decrease serum insulin levels and HOMA-IR index. However, the diet might not affect the FBG, 2 h-PBG, and Matsuda index.

The present study also revealed that serum insulin levels significantly decreased in trials with 3 months of follow-up or more. The previous investigations also proposed that the effects of lifestyle interventions on health status can be achieved in long-term interventions; this is especially true in chronic diseases [71, 72].

The Nordic diet focuses on the intake of dietary fiber, anti-oxidants, polyphenols, and polyunsaturated fatty acids which are provided by the consumption of whole grains, fruits, vegetables, berries, fish and other seafoods. It also recommends decreased consumption of sugar-sweetened beverages and meat products simultaneously and choosing low-fat dairy products [11].

The high content of dietary fiber of the Nordic diet might improve insulin sensitivity and capacity of pancreatic β-cell secretion, and also might decrease glucose and cholesterol absorption to promote weight reduction, which results to a reduced risk of T2DM [73]. Indeed, weight reduction plays a major role in the improvement of glycemic control [74, 75], and it has been observed that the Nordic diet might improve weight loss. Fiber-rich foods have a large amount of water which results in gastric distention enhancement which is associated with satiety [76]. Moreover, consuming nuts which are high in dietary fiber, fat and protein are associated with satiety and also a reduced risk of T2DM especially in individuals with overweight and impaired glucose tolerance [77–79]. Notably, a high amount of proteins in the Nordic diet might change the appetite-regulating hormones which in turn results in better weight control [80, 81]. On the other hand, seafoods which contain polyunsaturated fatty acids (PUFAs) are associated with improved glucose metabolism and stimulating G-protein-coupled receptors (GPCR) such as GPR40 and GPR120 [82–84]. GPR40 is especially expressed in pancreatic β-cells which has a direct effect on insulin secretion. In addition, GPR120 is expressed in adipose tissue, gastrointestinal tract and pro-inflammatory macrophages [82]. When omega 3-PUFAs are bonded to these receptors, insulin secretion will be stimulated by enhancing glucagon-like peptide-1 (GLP-1) release [82, 83]. In addition, glucose transporter type 4 (GLUT-4) concentrations are reduced in T2DM individuals [85]. When PUFAs bind to GPR120, increased translocation of GLUT-4 might lead to improved uptake of glucose in adipocytes [83]. Expression of GLUT-4 in the muscle cells plasma membrane and translocation of intracellular vesicles, containing GLUT-4, can be promoted by insulin [85]. Therefore, glucose uptake via GLUT-4 in adipocytes and insulin secretion, directly and indirectly, can be increased following consumption of PUFAs [83].

Berries are also another component of the Nordic diet and contain high amounts of anti-oxidants and polyphenols which might have beneficial effects on insulin resistance by reducing oxidative stress [86]. Polyphenols, in particular flavonoids, have been inversely associated not only with the risk of diabetes [87] but also mortality [88], cardiovascular disease [89] and several cancers [90]. Indeed, flavonoids have various beneficial effects such as modulation of the enzymatic activity, inhibition of cellular proliferation, and anti-oxidant or anti-inflammatory features [91–93]. Also,

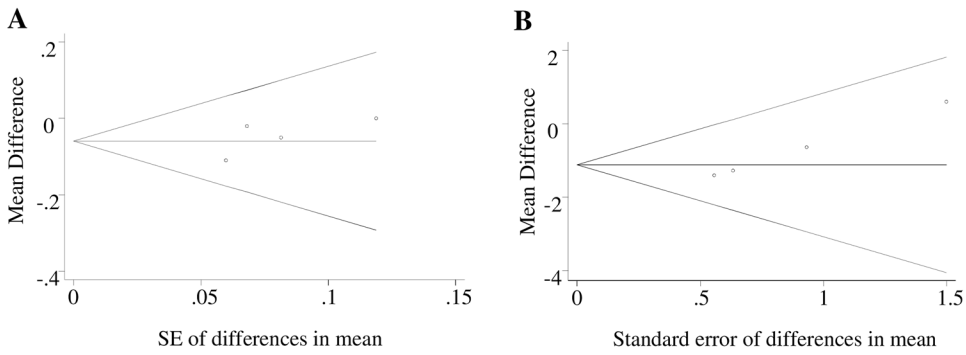

Fig. 4 (**a**) Funnel plot with pseudo 95% confidence limits for the meta-analysis of the effect of the Nordic diet on fasting blood glucose. (**b**) Funnel plot with pseudo 95% confidence limits for the meta-analysis of the effect of the Nordic diet on serum insulin levels

increased magnesium intake by consuming vegetables, nuts and legumes might have favorable effects on insulin sensitivity [94]. Indeed, it has been observed that either dietary or plasma magnesium insufficiency, are contributed to the development of glucose intolerance and diabetes [95–97], and also magnesium intake has an inverse association with insulin resistance and incidence of T2DM [98].

Previous meta-analyses have also shown that the adherence to the DASH and the Mediterranean diets were associated with improvement in insulin sensitivity and glycemic control in a long-term intervention. Indeed, the Nordic diet has some similar features with other healthy dietary patterns like Mediterranean and DASH diets including recommendations for a higher intake of whole grains, vegetables, fruits, nuts and low intake of red meat and sweets [9, 99].

The previous population-based studies have led to inconsistent results regarding the association between the healthy Nordic diet and the development of T2DM [100, 101]. One study indicated an inverse relationship between the Nordic diet score and its components such as oatmeal and root vegetables and the development of T2DM [100]. However, the other study could not support the reducing effects of adherence to the Nordic diet on the risk of T2DM [101].

The current meta-analysis has some limitations. A limited number of studies were included in the meta-analyses. In addition, although we found that the Nordic diet has a significant reducing effect on serum insulin, this effect was sensitive to one of the included studies and the correlation coefficient selected to calculate the effect sizes. These two limitations show that more high-quality trials still are needed to confirm these results. All of the included studies were performed in north European countries which might limit the generalizability of the results to other populations. The included studies had diverse methodologies; however, there was no heterogeneity among studies.

In conclusion, the present systematic review and meta-analysis revealed that following the Nordic diet might lead to an improvement in serum insulin and HOMA-IR levels. Future high-quality long-term intervention studies should be carried out to confirm our results. Also, interventions in other countries can be done to recognize the possible effects of the Nordic diet on other populations.

Authors' contribution The authors' contribution was as follows: ASA, MM, and NRJ conceived and designed the research; MM and NRJ conducted the systematic research and study selection; MM, NRJ, and AZ extracted data; ASA and MM analyzed data; AZ, MM and ASA wrote and edited the manuscript. All authors read and approved the final manuscript.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest to report for the present study.

Ethical standard This article does not contain any studies with human participants performed by any of the authors.

Informed consent Not applicable.

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