SUPPLEMENTARY INFORMATION

Gender-specific accuracy of lipid accumulation product index for the screening of metabolic syndrome in general adults: A meta-analysis and comparative analysis with other adiposity indicators

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Supplementary Table 1. PRISMA 2020 Checklist [1].

Section and Topic	Item #	Checklist item	Location where item is reported[a]
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4–5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 6–7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 6
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6 & Suppl. Table 2
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 7
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 7–8
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 7–8
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 8–9 & Suppl. Table 3
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 9–10
Synthesis	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention	Page 7–

Section and Topic	Item #	Checklist item	Location where item is reported[a]
methods		characteristics and comparing against the planned groups for each synthesis (item #5)).	11
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 7 & 9–10
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 9–11
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 9–10
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 11
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 10–11
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 11–12 & Fig. 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 11–12
Study characteristics	17	Cite each included study and present its characteristics.	Page 12–13 & Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 13, Table 1, & Suppl. Fig. 1
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Suppl. Table 4
Results of	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	N/A

Section and Topic	Item #	Checklist item	Location where item is reported[a]
syntheses	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Page 13–15, Page 18, Table 3, Figs. 2–3, & Suppl. Figs. 2–6
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Page 18 & Table 2
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Page 14–15, Page 17–18, Suppl. Tables 5–7, & Suppl. Fig. 7
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 18–22
	23b	Discuss any limitations of the evidence included in the review.	Page 22–23
	23c	Discuss any limitations of the review processes used.	Page 22–23
	23d	Discuss implications of the results for practice, policy, and future research.	Page 20–24
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 5

Section and Topic	Item #	Checklist item	Location where item is reported[a]
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 26
Competing interests	26	Declare any competing interests of review authors.	Page 26
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 26

[a]Locations were based on the submitted manuscript file.

N/A, not applicable or not available; **PRISMA**, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Supplementary Table 2. PICO framework [2].

Components of PICO	Definition
Population	Adults aged 18 years or older
Index Test	LAP
Comparator	MetS diagnostic criteria
Outcome	Diagnostic accuracy (AUC, sensitivity, and specificity)

AUC, area under curve; **LAP**, lipid accumulation product; **MetS**, metabolic syndrome; **PICO**, Population, Index Test, Comparator, and Outcome.

Supplementary Table 3. Modified QUADAS-2 tool signaling questions for risk of bias [3].

No.	Signaling Questions	Yes	Unclear	No
		Patient Selection		
#1	**Was a consecutive or random sample of patients enrolled?**	A consecutive or random sample of patients was enrolled.	It is unclear whether a consecutive or random sample of patients was enrolled.	There was no consecutive or random sample of patients enrolled.
#2	**Was a case-control design avoided?**	A case-control design was avoided.	It is unclear if a case-control design was avoided.	The study used a case-control design.
#3	**Did the study avoid inappropriate exclusions?**	There were no inappropriate exclusions of patients.	It is unclear if there were inappropriate exclusions of patients.	There were inappropriate exclusions of patients (e.g., patients with any physical and postural limitations precluding anthropometric measurements, patients with history of weight loss surgeries or any other procedures that caused WC reduction, such as liposuction, lipolysis, and abdominoplasty).
		Index Test		
#4	**Were the index test results interpreted without knowledge of the results of the reference standard?**	This item was omitted since blinding LAP interpreter was considered to be irrelevant to the current study. LAP is an objective index test as it involves an objective measurement of TG using machine analyzers and a specific formula to obtain the final value.		
#5	**If a threshold was used, was it pre-specified?**	This item was omitted as the specific threshold of LAP for MetS has not been determined to date; hence, each study analyzed its own population optimal cut-off value.		
#6	**If a threshold was used, was the sample size included in the diagnostic analysis ≥ 300?[a]**	A threshold was used and the sample size included in the LAP accuracy analysis was ≥ 300.	It is unclear whether a threshold was used or the sample size included in the LAP accuracy analysis was ≥ 300.	A threshold was used and the sample size included in the LAP accuracy analysis was < 300.
#7	**Was the calculation to determine the index test clearly described?[b]**	The calculation including formula and units of LAP was clearly described.	One of the calculation components of LAP (formula or units) was not clearly described.	The calculation including formula and units of LAP was not clearly described.
#8	**Were the methods used to determine the index test consistently applied across study subjects?[b]**	The methods used to determine LAP were consistently applied across study subjects.	It is unclear if the methods used to determine LAP were consistently applied across study subjects.	The methods used to determine LAP were not consistently applied across study subjects.
		Reference Standard		
#9	**Is the reference standard likely to correctly classify the target condition?**	The study used published and established criteria to define MetS.	It is unclear what criteria were used to define MetS.	The study did not use any published and established criteria to define MetS.
#10	**Were the reference standard results interpreted without knowledge of the results of the index test?**	This item was omitted as blinding the MetS diagnostic criteria interpreter was considered to be irrelevant to the current study. Since the threshold of LAP for MetS has not been determined to date, the MetS diagnostic criteria results would always be interpreted without the knowledge of the results of LAP.		
#11	**Was the reference standard and its definition clearly described?[b]**	The type of MetS diagnostic criteria and all of the MetS components definitions were clearly described.	The type of MetS diagnostic criteria was clearly described without complete description of the MetS components.	Either the type of MetS diagnostic criteria or all of the MetS components definitions was not clearly described.

#12	**Were the methods used to determine the reference standard consistently applied across study subjects?[b]**	The methods used to determine MetS were consistently applied across study subjects.	It is unclear if the methods used to determine MetS were consistently applied across study subjects.	The methods used to determine MetS were not consistently applied across study subjects.
			Flow and Timing	
#13	**Was there an appropriate interval between index test(s) and reference standard?**	There was an appropriate interval between the result collection of LAP and MetS.	It is not clear whether the interval between the result collection of LAP and MetS was appropriate.	There was no appropriate interval between the result collection of LAP and MetS.
#14	**Did all patients receive a reference standard?**	All patients received the definition criteria of MetS.	It is unclear if all patients received the definition criteria of MetS.	Some patients did not receive the definition criteria of MetS.
#15	**Did patients receive the same reference standard?**	All patients received the same definition criteria of MetS.	It is not clear if all patients received the same definition criteria of MetS.	Some patients received different definition criteria of MetS.
#16	**Were all patients included in the analysis?**	All patients were included in the LAP accuracy analysis.	It is not clear whether all patients were included in the LAP accuracy analysis.	Some patients were not included in the LAP accuracy analysis.

[a]This additional item is formulated from a rule-of-thumb suggested by Bujang et al. [4], where a sample of minimum 300 subjects can often be considered sufficient in obtaining a reliable estimate of the sensitivity and specificity of most screening and diagnostic tests.
[b]These additional items are adopted and formulated from the QUADAS-2 signaling questions in McCrea et al. [5] and Munthali et al. [6].
LAP, lipid accumulation product; **MetS**, metabolic syndrome; **QUADAS-2**, Quality Assessment of Diagnostic Accuracy Studies 2; **WC**, waist circumference.

Supplementary Table 4. Outcomes of the included studies.

Author, Year	Gender	Value of LAP[a]		Association of LAP and MetS			Diagnostic Accuracy Parameters of LAP for MetS						
		MetS	Non-MetS	OR (95% CI)	*p*-value	Model	AUC (95% CI)	Optimal Cut-Off	% Sn	% Sp	TP	FP	FN	TN
Adejumo et al., 2019 [7]	Male	42.17 ± 24.72	21.77 ± 20.02	N/A	N/A	N/A	0.773 (0.693–0.852)	22.94	88	66.1	20	42	3	81
	Female	53.95 ± 34.90	27.01 ± 18.40	N/A	N/A	N/A	0.801 (0.748–0.853)	28.29	81.8	61.4	82	112	18	177
Alfawaz et al., 2023 [8]	Male	78.6 (53.3, 121.9)	29.9 (19.3, 46.1)	N/A	N/A	N/A	0.877 (0.840–0.909)	46.2	85.63	76.26	151	47	25	151
	Female	63.9 (44.5, 93.0)	31.0 (19.3, 45.2)	N/A	N/A	N/A	0.840 (0.803–0.872)	49.82	68.53	82.38	159	40	73	187
Alves et al., 2021 [9]	Male	N/A	N/A	N/A	N/A	N/A	0.781 (0.676–0.886)	41.36	86.7	64.7	39	12	6	22
	Female	N/A	N/A	N/A	N/A	N/A	0.933 (0.871–0.994)	46.82	85.9	77.8	61	2	10	7
Anto et al., 2023 [10]	Male	N/A	N/A	N/A	N/A	N/A	0.951 (0.912–0.991)	23.87	95	84	381	224	20	1,176
	Female	N/A	N/A	N/A	N/A	N/A	0.790 (0.718–0.862)	33.32	84	60	1,244	583	237	875
Banik et al., 2021 [11]	Male (age 40–59 years)	N/A	N/A	1.03	< 0.05	Unadjusted	0.72 (0.57–0.87)	58.83	70.8	66.7	17	7	7	14
	Male (age 60–65 years)	N/A	N/A	1.05	NS	Unadjusted	0.88 (0.71–1.00)	36.41	100	72.7	4	3	0	8
	Female (age 20–39 years)	68.7 (53.8, 91.3)	31.6 (20.7, 44.7)	1.02	< 0.05	Unadjusted	0.79 (0.63–0.94)	50.19	66.7	81.8	8	6	4	28
	Female (age 40–59 years)			1.08	< 0.001	Unadjusted	0.87 (0.81–0.94)	54.01	78.3	85.4	47	6	13	35

	Female (age 60–65 years)			1.14	< 0.05	Unadjusted	0.96 (0.89–1.00)	42.06	95	100	19	0	1	6
Chiang et al., 2012 [12]	Male	N/A	N/A	1.10 (1.07–1.13)	< 0.001	Unadjusted	0.916 (0.880–0.953)	31.64	88.46	82.24	46	38	6	176
	Female	N/A	N/A	1.12 (1.08–1.15)	< 0.001	Unadjusted	0.901 (0.855–0.946)	26.97	81.13	87.11	43	25	10	169
Ching et al., 2020 [13]	Male	75.30 ± 35.10	26.78 ± 16.65	N/A	N/A	N/A	0.923 (0.867–0.980)	41.44	85.7	85.3	24	10	4	58
	Female	63.53 ± 52.65	17.38 ± 11.19	N/A	N/A	N/A	0.920 (0.862–0.977)	21.74	94.7	70.5	36	41	2	98
Duan et al., 2013 [14]	Male	68.5 ± 35.9	24.7 ± 19.6	N/A	N/A	N/A	0.91 (0.89–0.92)	39.18	82.6	86	276	169	58	1,036
	Female	72.3 ± 40.5	23.4 ± 16.3	N/A	N/A	N/A	0.93 (0.91–0.94)	37.89	87.6	85.4	212	124	30	723
Duan et al., 2021 [15]	Male	N/A	N/A	N/A	N/A	N/A	0.831 (0.795–0.867)	52.03	77.5	75.4	158	72	46	221
	Female	N/A	N/A	N/A	N/A	N/A	0.887 (0.834–0.940)	54.84	77.8	87.3	35	21	10	145
Duan et al., 2022 [16]	Male	69.12 (53.36, 109.12)	28.71 (17.18, 40.53)	1.063 (1.050–1.075)	< 0.001	Adjusted	0.900 (0.874–0.926)	46.28	87.1	82.7	149	77	22	367
	Female	64.94 (49.14, 87.83)	28.75 (17.29, 41.28)	1.060 (1.048–1.073)	< 0.001	Adjusted	0.882 (0.853–0.911)	47.02	79.1	82.9	106	120	28	583
Ejike, 2011 [17]	Male	60.28 ± 9.26	43.44 ± 6.86	N/A	N/A	N/A	0.937 (0.000–1.000)	49.62	100	81	3	7	0	30
Gao et al., 2019 [18]	Male (Yi Nationality)	N/A	N/A	N/A	N/A	N/A	0.913 (0.884–0.942)	39.69	84.9	86.4	101	58	18	370
	Male (Han Nationality)	N/A	N/A	N/A	N/A	N/A	0.908 (0.885–0.926)	33	91.21	76.71	166	153	16	506
	Female (Yi Nationality)	N/A	N/A	N/A	N/A	N/A	0.854 (0.826–0.879)	37.3	80.17	77.48	93	134	23	461
	Female (Han Nationality)	N/A	N/A	N/A	N/A	N/A	0.889 (0.872–0.905)	35.2	87.57	78.08	148	268	21	956

Gu et al., 2018 [19]	Male	51.71 ± 38.60	18.27 ± 13.53	N/A	N/A	N/A	0.897 (0.885–0.907)	26.35	85.09	79.31	850	430	149	1,648
	Female	55.25 ± 40.15	21.75 ± 13.16	N/A	N/A	N/A	0.875 (0.864–0.886)	31.04	79.17	80.69	1,361	372	358	1,554
Guo et al., 2016 [20]	Male	N/A	N/A	N/A	N/A	N/A	0.853 (0.840–0.867)	34.7	73.93	83.15	797	558	281	2,753
	Female	N/A	N/A	N/A	N/A	N/A	0.817 (0.804–0.829)	27.3	78.88	69.71	1,173	1,258	314	2,895
İlhan et al., 2019 [21]	Female	83.52 ± 30.03	41.05 ± 19.89	N/A	N/A	N/A	0.88 (0.82–0.93)	54.09	84	78	53	30	10	107
Jian et al., 2022 [22]	Male	61.50 ± 47.22	23.09 ± 20.99	N/A	N/A	N/A	0.831 (0.806–0.856)	39.7	66.7	86.3	206	256	103	1,609
	Female	61.08 ± 44.12	22.99 ± 19.82	N/A	N/A	N/A	0.842 (0.820–0.864)	35.065	72.5	82.1	277	315	105	1,444
Lee et al., 2018[b] [23]	Female	50.79 (35.45, 69.63)	17.09 (10.68, 26.58)	1.09 (1.09–1.10)	< 0.001	Unadjusted	0.91 (0.90–0.92)	29.62	83.3	82.02	379	626	76	2,855
Li et al., 2022 [24]	Male	N/A	N/A	1.052 (1.043–1.061)	< 0.001	Adjusted	0.869 (0.850–0.887)	53.3125	80.13	78.52	449	286	111	1,047
	Female	N/A	N/A	1.047 (1.038–1.056)	< 0.001	Adjusted	0.846 (0.827–0.865)	52.4291	81.17	76.77	429	342	100	1,130
Li et al., 2023 [25]	Male	61.21 ± 44.08	17.47 ± 12.57	N/A	N/A	N/A	0.912 (0.903–0.921)	27.895	83.5	83.6	1,111	493	220	2,516
	Female	62.44 ± 39.15	24.09 ± 13.54	N/A	N/A	N/A	0.876 (0.867–0.885)	35.867	75.4	83.4	1,982	413	647	2,075
Liu et al., 2017 [26]	Male	N/A	N/A	N/A	N/A	N/A	0.904 (0.871–0.937)	33.78	92	74.5	117	14	10	41
	Female	N/A	N/A	N/A	N/A	N/A		50.62	71.1	90.6	43	5	18	48
Liu et al., 2021 [27]	Male	N/A	N/A	N/A	N/A	N/A	0.963 (0.912–1.000)	20.1	100	85.2	5	34	0	196
	Female	N/A	N/A	N/A	N/A	N/A	0.931 (0.829–1.000)	13.7	100	75.5	4	51	0	158
Llinás et al., 2017 [28]	Male	118.80 ± 78.58	28.82 ± 24.49	N/A	N/A	N/A	0.946 (0.943–0.950)	36.04	95	75.7	3,035	7,739	160	24,108

	Female	69.86 ± 49.15	15.77 ± 12.62	N/A	N/A	N/A	0.942 (0.935–0.950)	18.4	96	70.1	1,045	7,520	44	17,632
Luo et al., 2019 [29]	Male	N/A	N/A	N/A	N/A	N/A	0.83	47.46	74.3	79.3	613	398	212	1,525
	Female	N/A	N/A	N/A	N/A	N/A	0.86	48.08	80.3	76.2	1,473	1,301	361	4,165
Mosad et al., 2023 [30]	Male	80.3 ± 29.2	28.8 ± 17.6	N/A	N/A	N/A	0.970 (0.948–0.993)	49.42	93.5	90.9	72	7	5	70
	Female	96.9 ± 46.0	32.8 ± 17.9	N/A	N/A	N/A	0.964 (0.945–0.982)	52.23	92.8	85.3	123	20	10	113
Motamed et al., 2016 [31]	Male	N/A	N/A	N/A	N/A	N/A	0.899 (0.888–0.910)	39.89	86	79.6	958	409	156	1,596
	Female	N/A	N/A	N/A	N/A	N/A	0.915 (0.904–0.927)	49.71	85.2	82.3	827	252	144	1,169
Musa et al., 2023 [32]	Male	N/A	N/A	N/A	N/A	N/A	0.908 (0.857–0.960)	50	90.9	80	10	25	1	99
	Female	N/A	N/A	N/A	N/A	N/A	0.721 (0.600–0.842)	41.5	92.9	60	13	20	1	31
Nwankwo et al., 2023[b] [33]	Male	50.75 ± 18.90	17.81 ± 17.71	N/A	N/A	N/A	0.82 (0.80–0.83)	27	73	79	159	531	59	1,999
	Female	51.49 ± 8.77	23.64 ± 8.52	N/A	N/A	N/A	0.76 (0.73–0.78)	38	57	84	271	151	205	793
Omuse et al., 2017 [34]	Male	N/A	N/A	N/A	N/A	N/A	0.949 (0.923–0.976)	42.895	91	84.3	58	30	6	161
	Female	N/A	N/A	N/A	N/A	N/A	0.822 (0.764–0.879)	30.56	77.5	72.8	55	55	16	147
Osman et al., 2020 [35]	Female	103.46 ± 58.22	41.43 ± 23.03	N/A	N/A	N/A	0.895 (0.860–0.930)	56.23	82	80	122	28	27	113
Rabiei et al., 2021 [36]	Male	73.07 ± 36.07	33.45 ± 19.50	N/A	N/A	N/A	0.87 (0.85–0.89)	49.31	74	83.71	336	116	118	596
	Female	82.37 ± 44.08	40.06 ± 19.30	N/A	N/A	N/A	0.85 (0.82–0.87)	52.39	76.09	76.9	646	94	203	313
	Male	65.1 ± 24.7	31.9 ± 18.8	1.078 (1.024–1.136)	0.004	Adjusted	0.882	45.65	80	80	44	19	11	76

Rajendran et al., 2022 [37]	Female	63.3 ± 19.7	29.8 ± 15.6	1.149 (1.016–1.299)	0.027	Adjusted	0.905	46.91	88	88	37	13	5	95
Shabestari et al., 2016 [38]	Female	N/A	N/A	N/A	N/A	N/A	0.827 (0.775–0.879)	47.63	75	77.9	82	34	27	121
Shao et al., 2023 [39]	Male	N/A	N/A	1.074 (1.071–1.077)	< 0.001	Adjusted	0.901 (0.895–0.906)	36.25	81.91	81.6	3,183	1,933	703	8,572
	Female	N/A	N/A	1.097 (1.094–1.100)	< 0.001	Adjusted	0.898 (0.893–0.902)	34.95	80.93	83.04	5,947	2,325	1,401	11,382
Shin et al., 2019 [40]	Male	N/A	N/A	N/A	N/A	N/A	0.899 (0.893–0.906)	40.78	83.6	82.8	1,034	1,463	203	7,043
	Female	N/A	N/A	N/A	N/A	N/A	0.953 (0.946–0.960)	23.85	92.6	85.5	603	739	48	4,357
Soares, 2016 [41]	Male	101.98 ± 93.90	23.84 ± 15.63	N/A	N/A	N/A	0.92 (0.86–0.98)	33.16	89.7	82.9	35	7	4	34
	Female	71.34 ± 50.88	22.95 ± 16.68	N/A	N/A	N/A	0.88 (0.82–0.94)	30.1	85.7	76.4	36	21	6	68
Su et al., 2020 [42]	Male	N/A	N/A	1.099 (1.075–1.123)	< 0.05	Adjusted	0.831 (0.797–0.862)	39.2	69.4	80.1	129	71	57	285
	Female	N/A	N/A	1.107 (1.086–1.129)	< 0.05	Adjusted	0.865 (0.839–0.888)	43.25	80.7	79.7	221	105	53	413
Talavera et al., 2022 [43]	Male	99.15 (77.53, 132.24)	25.32 (14.84, 44.01)	N/A	N/A	N/A	0.929 (0.907–0.952)	59.85	91.6	84.5	98	283	9	1,546
	Female	88.01 (68.72, 116.37)	29.32 (19.78, 43.33)	N/A	N/A	N/A	0.950 (0.940–0.960)	53.06	92.4	86.4	462	211	38	1,344
Taverna et al., 2011 [44]	Male	89.79 ± 46.90	34.65 ± 21.42	N/A	N/A	N/A	0.910 (0.860–0.950)	51.82	85	85	45	45	8	254
	Female	58.79 ± 30.00	21.96 ± 14.17	N/A	N/A	N/A	0.900 (0.860–0.940)	33.28	81	80	52	70	12	282
Tellechea et al., 2009 [45]	Male	N/A	N/A	N/A	N/A	N/A	0.91	53.63	83	83	131	75	27	368

Xiang et al., 2012[b] [46]	Male	N/A	N/A	N/A	N/A	N/A	0.88	44.5	85.3	80.6	189	167	32	694
	Female	N/A	N/A	N/A	N/A	N/A	0.931	37.7	95.8	83	203	206	9	1,004
Yin et al., 2018 [47]	Male	N/A	N/A	N/A	N/A	N/A	0.907 (0.839–0.888)	39.83	88.2	86.2	47	7	6	43
	Female	N/A	N/A	N/A	N/A	N/A		37.16	87.4	85.5	25	7	4	43
Zhang et al., 2017 [48]	Male	N/A	N/A	N/A	N/A	N/A	0.852 (0.805–0.898)	32.8	76.5	80.7	80	42	24	174
	Female	N/A	N/A	N/A	N/A	N/A	0.871 (0.837–0.905)	40.4	74.6	86.6	146	35	50	229
Zhang et al., 2019 [49]	Male	51.71 ± 38.60	18.27 ± 13.53	N/A	N/A	N/A	0.896	26.36	75	84	74	33	25	174
	Female	55.25 ± 40.15	21.75 ± 13.16	N/A	N/A	N/A	0.874	31.05	74	92	127	15	45	176

[a]Data are presented in mean ± SD or median (IQR).

[b]Authors that provided additional data on requests.

AUC, area under curve; **CI**, confidence interval; **FN**, false negative; **FP**, false positive; **IQR**, interquartile range; **LAP**, lipid accumulation product; **MetS**, metabolic syndrome; **N/A**, not applicable or not available; **OR**, odds ratio; **SD**, standard deviation; **Sn**, sensitivity; **Sp**, specificity; **TN**, true negative; **TP**, true positive.

Supplementary Table 5. Sensitivity analyses for MD meta-analyses of LAP in MetS and non-MetS subjects.

Analysis	Male				Female			
	Number of Studies	**MD (95% CI)**	***p*-value**	I^2	**Number of Studies**	**MD (95% CI)**	***p*-value**	I^2
Main analysis	18	45.92 (36.11–55.72)	< 0.001	99%	21	41.70 (37.16–46.24)	< 0.001	97%
Sensitivity analyses								
Without outliers	12	44.02 (40.53–47.51)	< 0.001	74%	13	39.28 (36.98–41.58)	< 0.001	58%
Low risk of bias	9	48.32 (33.59–63.05)	< 0.001	99%	9	40.73 (33.65–47.81)	< 0.001	99%
Sample size ≥ 100	15	46.19 (35.60–56.78)	< 0.001	99%	21	41.70 (37.16–46.24)	< 0.001	97%

CI, confidence interval; **LAP**, lipid accumulation product; **MD**, mean difference; **MetS**, metabolic syndrome.

Supplementary Table 6. Sensitivity analyses for OR meta-analyses between LAP and MetS.

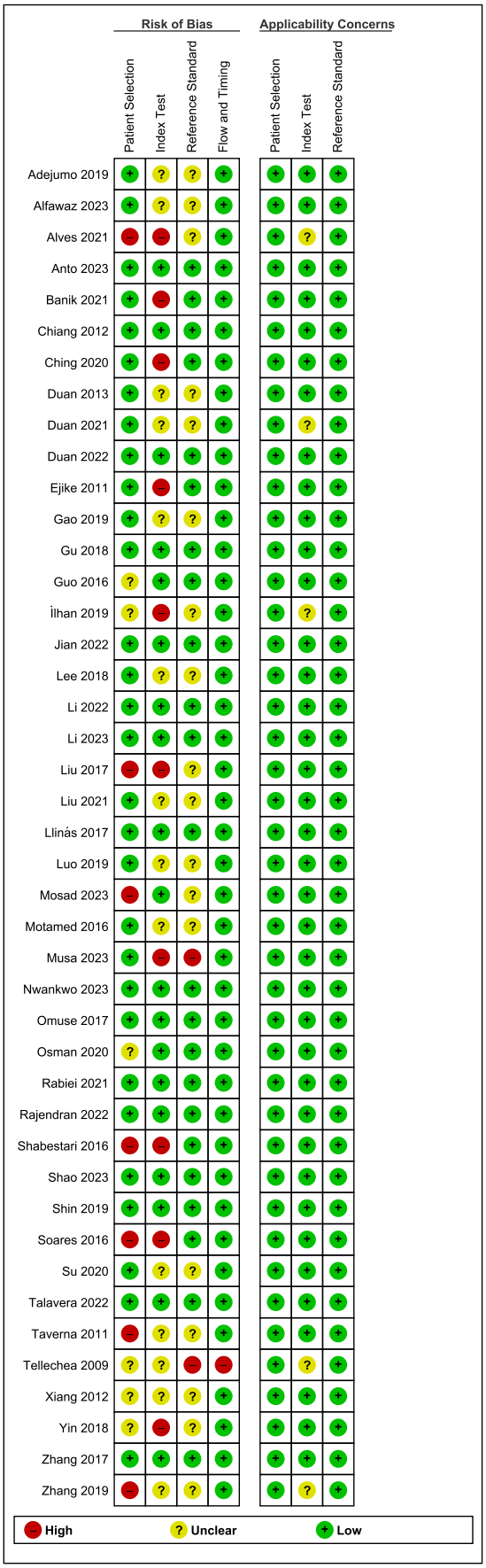
Analysis	Male				Female			
	Number of Studies	**OR (95% CI)**	***p*-value**	I^2	**Number of Studies**	**OR (95% CI)**	***p*-value**	I^2
Main analysis	6	1.07 (1.06–1.09)	< 0.001	83%	7	1.08 (1.07–1.10)	< 0.001	95%
Sensitivity analyses								
Without outliers	6	1.07 (1.06–1.09)	< 0.001	83%	6	1.09 (1.08–1.10)	< 0.001	87%
Low risk of bias	5	1.07 (1.06–1.08)	< 0.001	84%	5	1.08 (1.05–1.11)	< 0.001	97%
Sample size ≥ 100	6	1.07 (1.06–1.09)	< 0.001	83%	7	1.08 (1.07–1.10)	< 0.001	95%

CI, confidence interval; **LAP**, lipid accumulation product; **MetS**, metabolic syndrome; **OR**, odds ratio.

Supplementary Table 7. Sensitivity analyses for diagnostic accuracy meta-analyses of LAP as a screening tool for MetS.

Analysis	Male						Female					
	Number of Studies	AUSROC Curve (95% CI)	% Sn (95% CI)	% Sp (95% CI)	I^2 of Sn	I^2 of Sp	Number of Studies	AUSROC Curve (95% CI)	% Sn (95% CI)	% Sp (95% CI)	I^2 of Sn	I^2 of Sp
Main analysis	39	0.88 (0.85–0.90)	85 (82–87)	81 (80–83)	95%	95%	41	0.88 (0.85–0.91)	83 (80–86)	80 (78–82)	94%	98%
Sensitivity analyses												
Without outliers	33	0.87 (0.84–0.90)	84 (81–86)	82 (81–83)	87%	76%	31	0.88 (0.85–0.91)	82 (80–84)	81 (80–83)	88%	95%
Low risk of bias	16	0.87 (0.84–0.90)	85 (80–88)	82 (80–83)	97%	98%	16	0.88 (0.85–0.91)	82 (77–87)	81 (78–84)	97%	99%
Sample size ≥ 100	34	0.88 (0.85–0.90)	84 (82–87)	82 (80–83)	95%	96%	37	0.88 (0.85–0.91)	83 (80–85)	81 (78–83)	94%	98%

AUSROC, area under the summary receiver operating characteristic; **CI**, confidence interval; **LAP**, lipid accumulation product; **MetS**, metabolic syndrome; **Sn**, sensitivity; **Sp**, specificity.

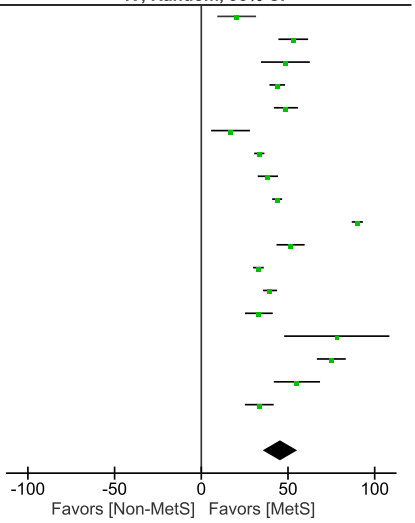


Supplementary Fig. 1. Domain-specific quality assessment results of included studies using the QUADAS-2 tool [3]. **QUADAS-2**, Quality Assessment of Diagnostic Accuracy Studies 2.

A

Study or Subgroup	MetS Mean	MetS SD	MetS Total	Non-MetS Mean	Non-MetS SD	Non-MetS Total	Weight	Mean Difference IV, Random, 95% CI
Adejumo 2019	42.17	24.72	23	21.77	20.02	123	5.5%	20.40 [9.70, 31.10]
Alfawaz 2023	84.92	51.28	176	31.87	20.01	198	5.6%	53.05 [44.98, 61.12]
Ching 2020	75.3	35.1	28	26.78	16.65	68	5.3%	48.52 [34.93, 62.11]
Duan 2013	68.5	35.9	334	24.7	19.6	1205	5.8%	43.80 [39.79, 47.81]
Duan 2022	77.63	41.69	171	28.81	17.37	444	5.7%	48.82 [42.37, 55.27]
Ejike 2011	60.28	9.26	3	43.44	6.86	37	5.5%	16.84 [6.13, 27.55]
Gu 2018	51.71	38.6	999	18.27	13.53	2078	5.8%	33.44 [30.98, 35.90]
Jian 2022	61.5	47.22	309	23.09	20.99	1865	5.8%	38.41 [33.06, 43.76]
Li 2023	61.21	44.08	1331	17.47	12.57	3009	5.8%	43.74 [41.33, 46.15]
Llinás 2017	118.8	78.58	3195	28.82	24.49	31847	5.8%	89.98 [87.24, 92.72]
Mosad 2023	80.3	29.2	77	28.8	17.6	77	5.7%	51.50 [43.88, 59.12]
Nwankwo 2023	50.75	18.9	218	17.81	17.71	2530	5.8%	32.94 [30.34, 35.54]
Rabiei 2021	73.07	36.07	454	33.45	19.5	712	5.8%	39.62 [36.01, 43.23]
Rajendran 2022	65.1	24.7	55	31.9	18.8	95	5.7%	33.20 [25.66, 40.74]
Soares 2016	101.98	93.9	39	23.84	15.63	41	3.8%	78.14 [48.28, 108.00]
Talavera 2022	103.19	41.11	107	28.19	21.64	1829	5.6%	75.00 [67.15, 82.85]
Taverna 2011	89.79	46.9	53	34.65	21.42	299	5.3%	55.14 [42.28, 68.00]
Zhang 2019	51.71	38.6	99	18.27	13.53	207	5.6%	33.44 [25.62, 41.26]
Total (95% CI)			**7671**			**46664**	**100.0%**	**45.92 [36.11, 55.72]**

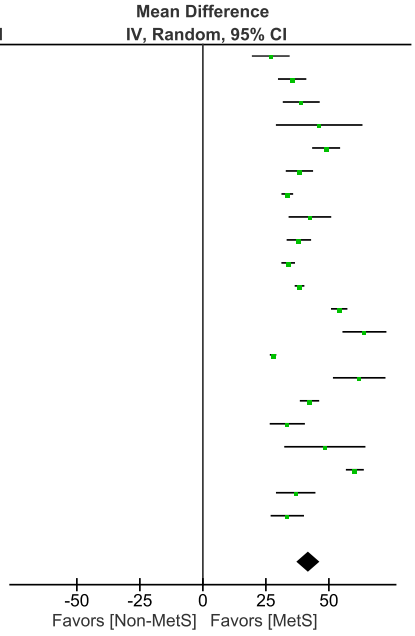
Heterogeneity: Tau² = 427.07; Chi² = 1346.90, df = 17 (P < 0.00001); I² = 99%
Test for overall effect: Z = 9.18 (P < 0.00001)



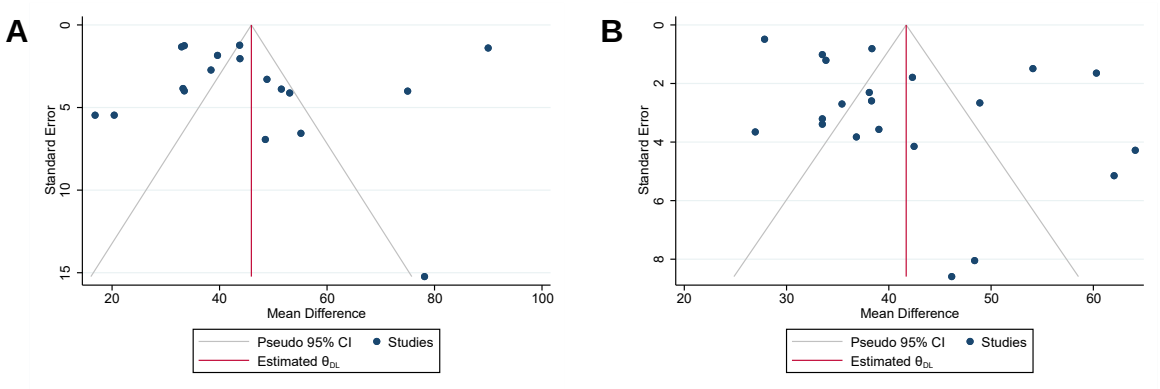
B

Study or Subgroup	MetS Mean	MetS SD	MetS Total	Non-MetS Mean	Non-MetS SD	Non-MetS Total	Weight	Mean Difference IV, Random, 95% CI
Adejumo 2019	53.95	34.9	100	27.01	18.4	289	4.7%	26.94 [19.78, 34.10]
Alfawaz 2023	67.3	36.18	232	31.88	19.32	227	5.0%	35.42 [30.13, 40.71]
Banik 2021	71.41	28.24	92	32.38	18.12	81	4.7%	39.03 [32.04, 46.02]
Ching 2020	63.53	52.65	38	17.38	11.19	139	3.1%	46.15 [29.31, 62.99]
Duan 2013	72.3	40.5	242	23.4	16.3	847	5.0%	48.90 [43.68, 54.12]
Duan 2022	67.43	29	134	29.12	17.82	703	5.0%	38.31 [33.23, 43.39]
Gu 2018	55.25	40.15	1719	21.75	13.16	1926	5.3%	33.50 [31.51, 35.49]
İlhan 2019	83.52	30.03	63	41.05	19.89	137	4.6%	42.47 [34.34, 50.60]
Jian 2022	61.08	44.12	382	22.99	19.82	1759	5.1%	38.09 [33.57, 42.61]
Lee 2018	52.02	25.42	455	18.17	11.79	3481	5.3%	33.85 [31.48, 36.22]
Li 2023	62.44	39.15	2629	24.09	13.54	2488	5.3%	38.35 [36.76, 39.94]
Llinás 2017	69.86	49.15	1089	15.77	12.62	25152	5.2%	54.09 [51.17, 57.01]
Mosad 2023	96.9	46	133	32.8	17.9	133	4.5%	64.10 [55.71, 72.49]
Nwankwo 2023	51.49	8.77	476	23.64	8.52	944	5.3%	27.85 [26.89, 28.81]
Osman 2020	103.46	58.22	149	41.43	23.03	141	4.2%	62.03 [51.94, 72.12]
Rabiei 2021	82.37	44.08	849	40.06	19.3	407	5.2%	42.31 [38.80, 45.82]
Rajendran 2022	63.3	19.7	42	29.8	15.6	108	4.8%	33.50 [26.86, 40.14]
Soares 2016	71.34	50.88	42	22.95	16.68	89	3.2%	48.39 [32.62, 64.16]
Talavera 2022	91.19	35.43	500	30.89	17.47	1555	5.2%	60.30 [57.08, 63.52]
Taverna 2011	58.79	30	64	21.96	14.17	352	4.7%	36.83 [29.33, 44.33]
Zhang 2019	55.25	40.15	172	21.75	13.16	191	4.8%	33.50 [27.22, 39.78]
Total (95% CI)			**9602**			**41149**	**100.0%**	**41.70 [37.16, 46.24]**

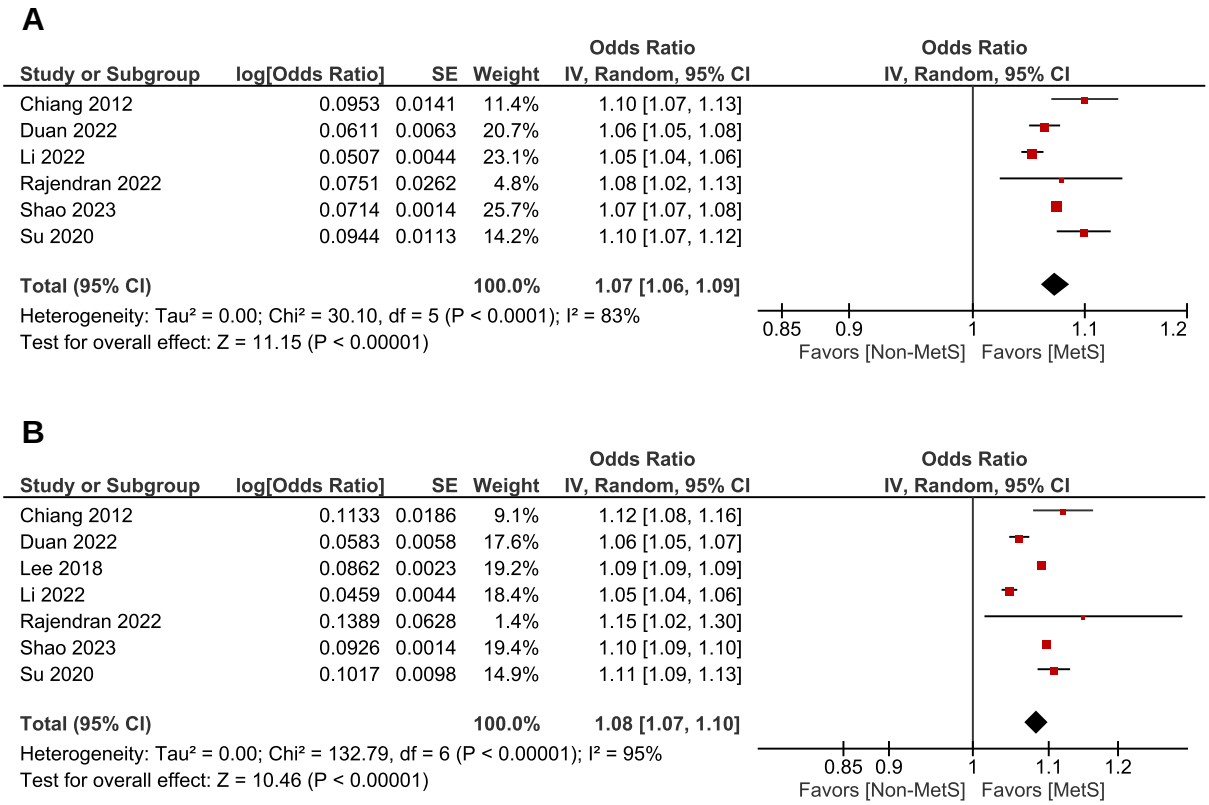
Heterogeneity: Tau² = 100.73; Chi² = 770.40, df = 20 (P < 0.00001); I² = 97%
Test for overall effect: Z = 18.00 (P < 0.00001)



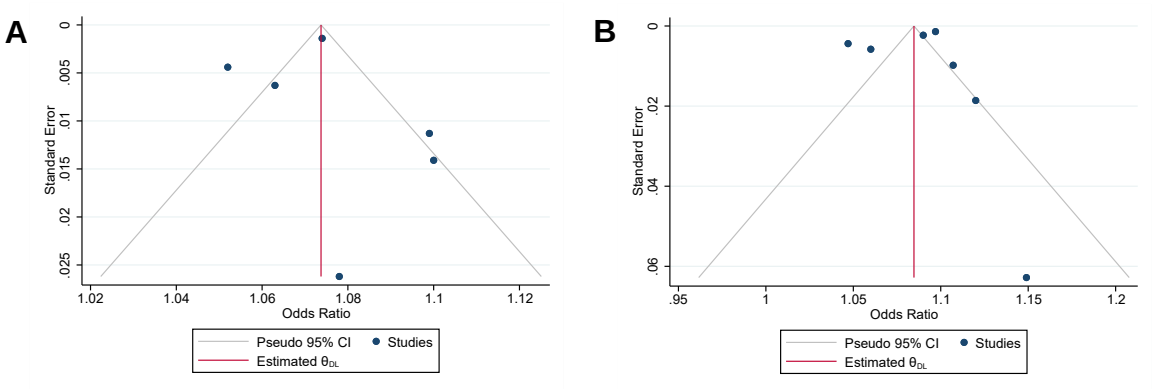
Supplementary Fig. 2. Forest plots of MD meta-analyses of LAP in (**A**) men and (**B**) women with and without MetS. **CI**, confidence interval; **IV**, inverse variance; **LAP**, lipid accumulation product; **MD**, mean difference; **MetS**, metabolic syndrome; **SD**, standard deviation.



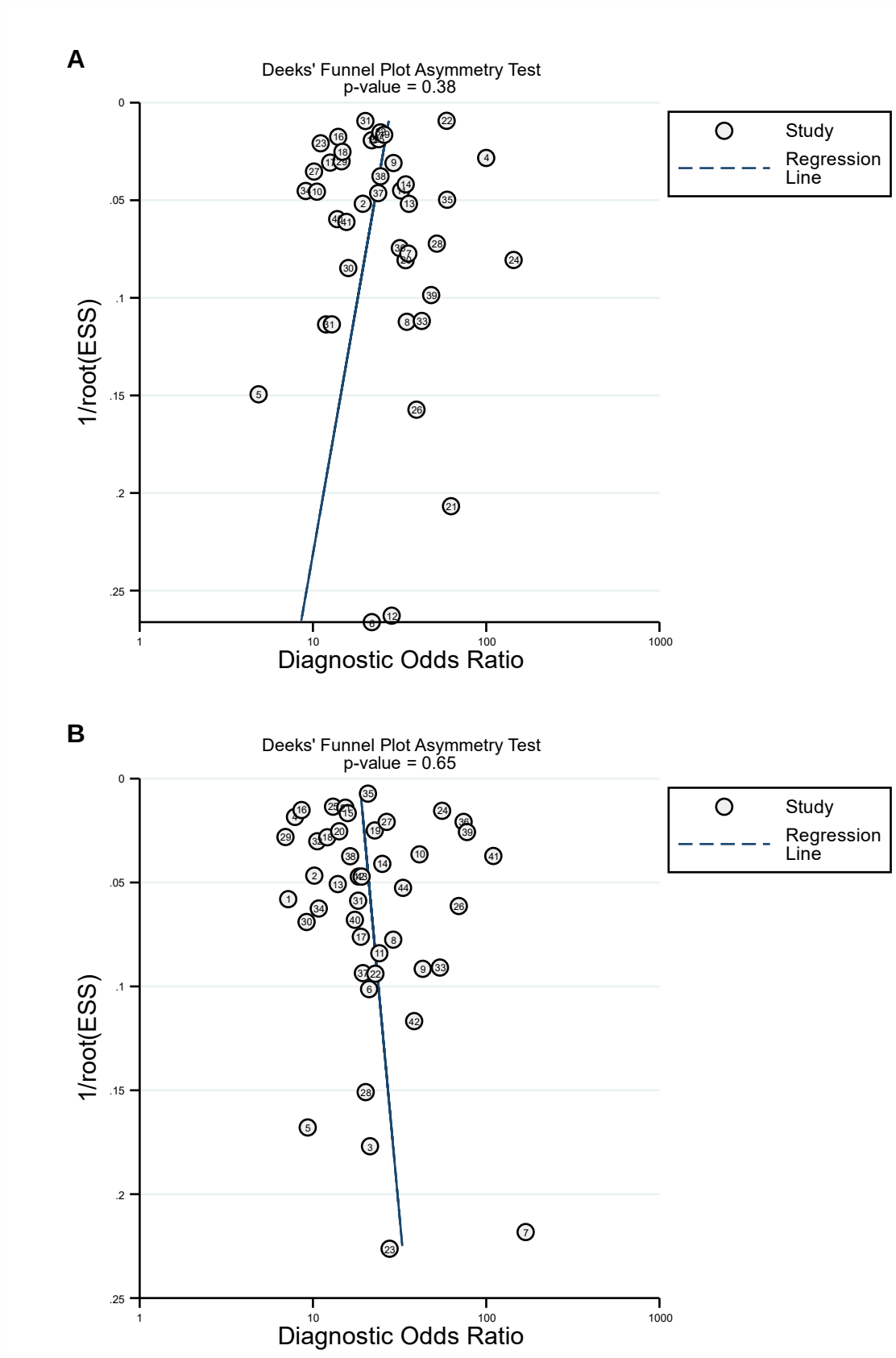
Supplementary Fig. 3. Funnel plots of MD meta-analyses of LAP in (**A**) men and (**B**) women with and without MetS. **CI**, confidence interval; **LAP**, lipid accumulation product; **MD**, mean difference; **MetS**, metabolic syndrome.



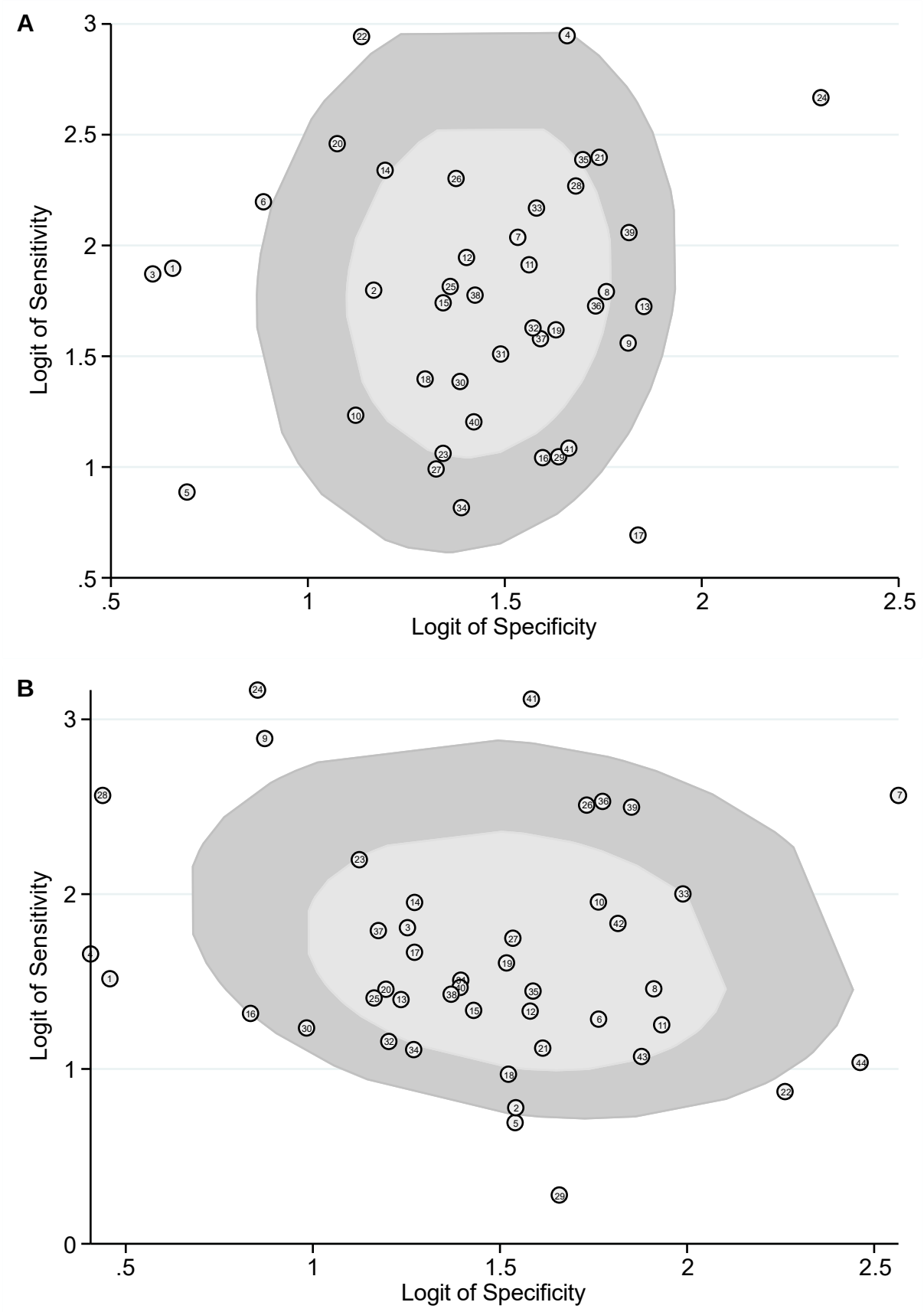
Supplementary Fig. 4. Forest plots of OR meta-analyses between LAP and MetS in (**A**) men and (**B**) women. **CI**, confidence interval; **IV**, inverse variance; **LAP**, lipid accumulation product; **MetS**, metabolic syndrome; **OR**, odds ratio; **SE**, standard error.



Supplementary Fig. 5. Funnel plots of OR meta-analyses between LAP and MetS in (**A**) men and (**B**) women. **CI**, confidence interval; **LAP**, lipid accumulation product; **MetS**, metabolic syndrome; **OR**, odds ratio.



Supplementary Fig. 6. Deeks' funnel plots of diagnostic accuracy meta-analyses of LAP for detecting MetS in (**A**) men and (**B**) women. **ESS**, effective sample size; **LAP**, lipid accumulation product; **MetS**, metabolic syndrome.



Supplementary Fig. 7. Bivariate boxplots of diagnostic accuracy meta-analyses of LAP for detecting MetS in (**A**) men and (**B**) women. **LAP**, lipid accumulation product; **MetS**, metabolic syndrome.

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