

評価対象論文リスト(要因:身体活動、アウトカム:糖尿病)

評価判定日:2023/8/31

①既存の系統的レビュー・メタ解析・統合解析

1	Cloostermans L, Wendel-Vos W, Doornbos G, et al. Independent and combined effects of physical activity and body mass index on the development of Type 2 Diabetes - a meta-analysis of 9 prospective cohort studies. <i>Int J Behav Nutr Phys Act</i> . 2015;12:147. Published 2015 Dec 1. doi:10.1186/s12966-015-0304-3
2	Patterson R, McNamara E, Tainio M, et al. Sedentary behaviour and risk of all-cause, cardiovascular and cancer mortality, and incident type 2 diabetes: a systematic review and dose response meta-analysis. <i>Eur J Epidemiol</i> . 2018;33(9):811-829. doi:10.1007/s10654-018-0380-1
3	Kyu HH, Bachman VF, Alexander LT, et al. Physical activity and risk of breast cancer, colon cancer, diabetes, ischemic heart disease, and ischemic stroke events: systematic review and dose-response meta-analysis for the Global Burden of Disease Study 2013. <i>BMJ</i> . August 2016:i3857. doi:10.1136/bmj.i3857
4	Wahid A, Manek N, Nichols M, et al. Quantifying the association between physical activity and cardiovascular disease and diabetes: a systematic review and meta analysis. <i>JAHA</i> . 2016;5(9):e002495. doi:10.1161/JAHA.115.002495
5	Aune D, Norat T, Leitzmann M, Tonstad S, Vatten LJ. Physical activity and the risk of type 2 diabetes: a systematic review and dose-response meta-analysis. <i>Eur J Epidemiol</i> . 2015;30(7):529-542. doi:10.1007/s10654-015-0056-z
6	Wilmot EG, Edwardson CL, Achana FA, et al. Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis. <i>Diabetologia</i> . 2012;55(11):2895-2905. doi:10.1007/s00125-012-
7	Smith, AD., et al. Physical activity and incident type 2 diabetes mellitus: a systematic review and dose-response meta-analysis of prospective cohort studies
8	Jeon CY, Lokken RP, Hu FB, Van Dam RM. Physical activity of moderate intensity and risk of type 2 diabetes. <i>Diabetes Care</i> . 2007;30(3):744-752. doi:10.2337/dc06-1842
9	Huai P, Han H, Reilly KH, Guo X, Zhang J, Xu A. Leisure-time physical activity and risk of type 2 diabetes: a meta-analysis of prospective cohort studies. <i>Endocrine</i> . 2016;52(2):226-230. doi:10.1007/s12020-015-0769-5
10	Guo C, Zhou Q, Zhang D, et al. Association of total sedentary behaviour and television viewing with risk of overweight/obesity, type 2 diabetes and hypertension: A dose-response meta analysis. <i>Diabetes Obesity Metabolism</i> .

②日本人集団の個別疫学研究

11	Okada K, Hayashi T, Tsumura K, Suematsu C, Endo G, Fujii S. Leisure-time physical activity at weekends and the risk of Type 2 diabetes mellitus in Japanese men: the Osaka Health Survey. <i>Diabetic Medicine</i> . 2000;17(1):53-58. doi:10.1046/j.1464-5491.2000.00229.x
12	Ikehara S, Iso H, Maruyama K, Ukawa S, Tamakoshi A. Television viewing time, walking time, and risk of type 2 diabetes in Japanese men and women: The Japan Collaborative Cohort Study. <i>Preventive Medicine</i> . 2019;118:220-225.
13	Kabeya Y, Goto A, Kato M, et al. Time spent walking and risk of diabetes in Japanese adults: the Japan public health center-based prospective diabetes study. <i>Journal of Epidemiology</i> . 2016;26(4):224-232. doi:10.2188/jea.JE20150059
14	Iwasaki M, Kudo A, Asahi K, et al. Fast walking is a preventive factor against new-onset diabetes mellitus in a large cohort from a Japanese general population. <i>Sci Rep</i> . 2021;11(1):716. doi:10.1038/s41598-020-80572-y
15	Honda T, Kuwahara K, Nakagawa T, Yamamoto S, Hayashi T, Mizoue T. Leisure-time, occupational, and commuting physical activity and risk of type 2 diabetes in Japanese workers: a cohort study. <i>BMC Public Health</i> . 2015;15(1):1004.
16	Sato KK, Hayashi T, Kambe H, et al. Walking to work is an independent predictor of incidence of type 2 diabetes in Japanese men. <i>Diabetes Care</i> . 2007;30(9):2296-2298. doi:10.2337/dc07-0090
17	Nakanishi N, Takatorige T, Suzuki K. Daily life activity and risk of developing impaired fasting glucose or Type 2 diabetes in middle-aged Japanese men. <i>Diabetologia</i> . 2004;47(10):1768-1775. doi:10.1007/s00125-004-1528-y
18	Waki K, Noda M, Sasaki S, et al. Alcohol consumption and other risk factors for self-reported diabetes among middle-aged Japanese: a population-based prospective study in the JPHC study cohort I. <i>Diabetic Medicine</i> . 2005;22(3):323-331. doi:10.1111/j.1464-5491.2004.01403.x
19	Wang L, Yamaguchi T, Yoshimine T, et al. A case-control study of risk factors for development of type 2 diabetes: emphasis on physical activity. <i>J Epidemiol</i> . 2002;12(6):424-30. doi: 10.2188/jea.12.424.

■ 系統的レビュー・メタ解析・統合解析

No	Author	Title	Year	Category	Relative risk (95% CI)	Magnitude of association
1	Cloostermans, L., et al	Independent and combined effects of physical activity and body mass index on the development of Type 2 Diabetes - a meta-analysis of 9 prospective cohort studies	2015	High physical activity Medium physical activity Low physical activity	Ref. 1.08 (1.04–1.13) 1.23 (1.09–1.39)	↑ ↑
2	Patterson, R., et al	Sedentary behaviour and risk of all-cause, cardiovascular and cancer mortality, and incident type 2 diabetes: a systematic review and dose response meta-analysis	2018	Total sedentary behaviour TV viewing	1.01 (1.00, 1.01) 1.09 (1.07, 1.12)	↑ ↑
3	Kyu, HH., et al	Physical activity and risk of breast cancer, colon cancer, diabetes, ischemic heart disease, and ischemic stroke events: systematic review and dose-response meta-analysis for the Global Burden of Disease Study 2013	2016	<600 600-3999 4000-7999 >=8000	Ref. 0.890 (0.808–0.968) 0.827 (0.724–0.930) 0.798 (0.702–0.891)	↓ ↓ ↓
4	Wahid, A., et al	Quantifying the Association Between Physical Activity and Cardiovascular Disease and Diabetes: A Systematic Review and Meta-Analysis	2016	Being inactive to achieving recommended PA levels (150 minutes of moderate-intensity aerobic activity per week)	0.74 (0.72–0.77)	↓
5	Aune, D., et al	Physical activity and the risk of type 2 diabetes: a systematic review and dose-response meta-analysis	2015	For physical activity and type 2 diabetes For vigorous physical activity and type 2 diabetes For low intensity physical activity and type 2 diabetes For moderate physical activity and type 2 diabetes Working and type 2 diabetes Leisure-time physical activity and type 2 diabetes (per 20 MET-hours/week) Leisure-time physical activity and type 2 diabetes (per 5 hours/week)	0.74 (0.70–0.79) 0.61 (0.51–0.74) 0.66 (0.47–0.94) 0.68 (0.52–0.90) 0.85 (0.79–0.91) 0.85 (0.81–0.89) 0.75 (0.67–0.85)	↓ ↓↓ ↓↓ ↓ ↓ ↓ ↓

6	Wilmot, EG., et al	Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis	2012	For sedentary time and diabetes (reference group was lowest sedentary time) For sedentary time and diabetes adjusted for physical activity (reference group was lowest sedentary time)	2.12 (1.61–2.78) 2.47 (1.49–3.95)	↑↑↑ ↑↑↑
7	Smith, AD., et al	Physical activity and incident type 2 diabetes mellitus: a systematic review and dose-response meta-analysis of prospective cohort studies	2016	For type 2 diabetes for every 10 MET h/week exposure of physical activity	0.87 (0.84–0.89)	↓
8	Jeon, CY., et al	Physical activity of moderate intensity and risk of type 2 diabetes: a systematic review	2007	For moderately intense physical activity and risk of type 2 diabetes BMI-unadjusted For moderately intense physical activity and risk of type 2 diabetes BMI-adjusted For walking and type 2 diabetes BMI-unadjusted For walking and type 2 diabetes BMI-adjusted	0.69 (0.58–0.83) 0.83 (0.76–0.90) 0.70 (0.58–0.84) 0.83 (0.75–0.91)	↓ ↓ ↓ ↓
9	Huai, P., et al	Leisure-time physical activity and risk of type 2 diabetes: a meta-analysis of prospective cohort studies	2016	Moderate vs. low physical activity High vs. low physical activity	0.79 (0.70–0.89) 0.69 (0.61–0.78)	↓ ↓
10	Guo, C., et al	Association of total sedentary behaviour and television viewing with risk of overweight/obesity, type 2 diabetes and hypertension: A dose-response meta-	2020	Dose-response association between total sedentary behaviour and type 2 diabetes	1.05 (1.04–1.07)	↑

■日本人集団の個別疫学研究

No	Author	Title	Year	Study period	Number of subjects for analysis	Source of subjects	Event followed	Definitions	Number of incident cases or deaths	Participant's race	Category	Number among cases	Relative risk (95%CI)	p for trend	Confounding variables considered	Magnitude of association
11	Okada, K., et al	Leisure-time physical activity at weekends and the risk of Type 2 diabetes mellitus in Japanese men: the Osaka Health Survey	2000	1981-1990	6013 men	The Osaka Health Survey	Incidence	Type 2 DM was defined by the new WHO criterion of a fasting plasma glucose level ≥ 7.0 mmol/l or an oral glucose tolerance test with 2-h post-load plasma glucose level ≥ 11.1 mmol/l.	444	Japanese	Overall leisure-time physical activity. At least once a week (weekdays and weekends) No Yes Frequency 0 1-2 ≥ 3 Leisure-time physical activity at weekends Sedentary activity Moderate activity Vigorous activity Leisure-time physical activity at weekends (Vigorous activity only) Sedentary activity Moderate activity Vigorous activity	313 131 313 110 21 156 245 43 136 177 22	Ref. 0.75 (0.61-0.93) Ref. 0.80 (0.64-0.99) 0.55 (0.34-0.87) Ref. 1.06 (0.86-1.31) 0.67 (0.47-0.94) Ref. 0.98 (0.78-1.24) 0.55 (0.35-0.88)	NA	age, BMI, alcohol consumption, smoking habits, blood pressure levels, and a parental history of type 2 diabetes mellitus age, BMI, alcohol consumption, smoking habits, blood pressure levels, regular physical exercise on weekdays, and a parental history of type 2 diabetes mellitus age, BMI, alcohol consumption, smoking habits, blood pressure levels, and a parental history of type 2 diabetes mellitus	\downarrow \downarrow $\downarrow\downarrow$ - \downarrow - $\downarrow\downarrow$
12	Ikehara, S., et al	Television viewing time, walking time, and risk of type 2 diabetes in Japanese men and women: The Japan Collaborative Cohort Study	2019	1988/1990 5-year follow-up	25,240	community-dwelling	Incidence	self-reported physician-diagnosed diabetes at the 5-year follow-up survey	778	Japanese	Walking time (hours/day) < 0.5 0.5 $0.6-0.9$ ≥ 1.0	94 146 162 376	1.13 (0.86-1.49) Ref. 0.97 (0.77-1.22) 0.87 (0.71-1.06)	0.02	age, sex (excluded for sex-specific analysis), alcohol consumption, history of hypertension, smoking, hours of exercise, stress, educational level, unemployed, sleep duration, television viewing time, and body mass index, unemployed and sleep duration	- - -
13	Kabeya, Y., et al	Time Spent Walking and Risk of Diabetes in Japanese Adults: The Japan Public Health Center-Based Prospective Diabetes Study	2016	1990-2005	11,101	JPHC study	Incidence	they reported having diabetes in the questionnaire (presence of self-reported diabetes), or they had an FPG value of ≥ 126 mg/dL or more.	612	Japanese	Time spent walking per day < 30 min Time spent walking per day 30min--1h Time spent walking per day 30h--2h Time spent walking per day ≥ 2 h	87 139 141 245	1.10 (0.82-1.48) 1.12 (0.88-1.44) 1.10 (0.87-1.41) Ref.	0.384	public health center area, age, sex, HbA1c levels and family history of diabetes, systolic BP and BMI	- - -
14	Iwasaki, M., et al	Fast walking is a preventive factor against new-onset diabetes mellitus in a large cohort from a Japanese general population	2021	2008 to 2011	167684 men and women	Data of the annual health check program, "The Specific Health Check and Guidance System" (SHCG), of 27 Prefectures	Incidence	DM was defined as fasting plasma glucose level ≥ 126 mg/dL, or the HbA1c level $\geq 6.5\%$ (48 mmol/mol), or the participant had a regular use of anti-hyperglycemic drugs	6229	Japanese	Exercise to sweat lightly Walking > 1 hour/day Fast walking		1.07 (1.01-1.14) 1.05 (0.99-1.11) 0.93 (0.88-0.98)	< 0.05 0.13 < 0.05	sex, age, BMI, SBP, current smoking, drink, weight gain over 10 kg from 20-years, weight change of 3 kg within 1 year, exercise to sweat lightly, walking > 1 h/day and fast walking	\uparrow - \downarrow
15	Honda, T., et al	Leisure-time, occupational, and commuting physical activity and risk of type 2 diabetes in Japanese workers: a cohort study	2015	2006/2007 6 years after	26,628	men and female employees of a company (electrical machinery and apparatus manufacturing)	Incidence	HbA1c $\geq 6.5\%$, FPG ≥ 126 mg/dl, random plasma glucose ≥ 200 mg/dl, or currently under medical treatment for diabetes	1770	Japanese	Dose of leisure-time exercise per week Inactive (0 MET-hours) Low dose (0.1 to < 7.5 MET-hours) Medium dose (7.5 to < 15.0 MET-hours) High dose (≥ 15.0 MET-hours)	1210 257 166 137	Ref. 0.87 (0.76-1.00) 0.92 (0.78-1.08) 0.83 (0.69-0.99)	0.024	age, sex, shift work, sleep duration, alcohol consumption, smoking, hypertension, a family history of diabetes, occupational activity, walking for commuting to and from work, and BMI	- - \downarrow

No	Author	Title	Year	Study period	Number of subjects for analysis	Source of subjects	Event followed	Definitions	Number of incident cases or deaths	Participant's race	Category	Number among cases	Relative risk (95%CI)	p for trend	Confounding variables considered	Magnitude of association
16	Sato, KK., et al	Walking to work is an independent predictor of incidence of type 2 diabetes in Japanese men: the Kansai Healthcare Study	2007	2000/2001-2004/2005	8,576	male employees of a company in the area of Kansai	Incidence	FPG level \geq 126 mg/dl or taking oral hypoglycemic medication or insulin	878	Japanese	Walk to work 0-10 min 11-20 min \geq 21 min Regular leisure-time physical exercise No Yes	190 463 225 732 146	Ref. 0.86 (0.70-1.06) 0.73 (0.58-0.92) Ref. 0.90 (0.72-1.11)	0.158 0.007 0.317	age, BMI, FPG level, daily alcohol consumption, smoking habits, leisure-time physical activity, and parental history of diabetes	- ↓ -
17	Nakanishi, N., et al	Daily life activity and risk of developing impaired fasting glucose or type 2 diabetes in middle-aged Japanese men	2004	1994--2001	2924 men	Japanese men who were office workers at one of Japan's biggest building contractors.	IFG or Type 2 diabetes	IFG was defined as a fasting plasma glucose level of at least 6.1 mmol/l but less than 7.0 mmol/l. Type 2 diabetes was defined as a fasting plasma glucose level of 7.0 mmol/l or higher or treatment with hypoglycaemic medications.	280 men developed IFG, and 168 developed type 2 diabetes	Japanese	For IFG: daily energy expenditure (kcal/kg/day) 33.1--36.7 36.8--40.3 \geq 40.4 For type 2 diabetes: daily energy expenditure (kcal/kg/day) 33.1--36.7 36.8--40.3 \geq 40.4	110 73 62 35 68 45 36 19	Ref. 0.71 (0.53-0.96) 0.67 (0.48-0.93) 0.40 (0.27-0.60) Ref. 0.76 (0.52-1.11) 0.70 (0.46-1.06) 0.41 (0.24-0.71)	<0.001 0.001	Data were adjusted for age, family history of diabetes, alcohol consumption, cigarette smoking, BMI, weekly energy expenditure on physical exercise, systolic blood pressure, HDL cholesterol and triglycerides at study entry	↓ ↓ ↓↓↓ - - ↓↓↓
18	Waki, K., et al	Alcohol consumption and other risk factors for self-reported diabetes among middle-aged Japanese: a population-based prospective study in the JPHC study cohort I	2004	1990-2000 (10-year follow-up)	28,893 men and women	JPHC study cohort I	Incidence	High casual plasma glucose level (\geq 11 mmol/l), or use of diabetic medication (insulin or oral hypoglycaemic agent)	1,185 (703 men and 480 women)	Japanese	Leisure-time physical activity (men) Inactive Active (who participated in sports at least once a week) Inactive (women) Active	NA NA NA NA	Ref. 0.90 (0.73-1.12) Ref. 1.06 (0.82-1.37)	NA	Smoking status, alcohol intake and infrequent occasional drinkers who consume alcohol on three or fewer days a month, family history of diabetes, and prevalent hypertension	- - -
19	Wang, L., et al	A case-control study of risk factors for development of type 2 diabetes: emphasis on physical activity	2002	1999		One city office in Tokyo	The cases were those who had been diagnosed as type 2 diabetes based on medical		53	Japanese	Lowest quartile Quartile 2 Quartile 3 Highest quartile	Type 2 DM	Ref. 0.43 (0.16-1.18) 0.63 (0.23-1.72) 0.18 (0.06-0.55)	0.005	Family history of diabetes, cigarette smoking, overweight, stress of life events, history of hypertension and meat, green vegetable and fiber intake	↓↓ ↓ ↓↓↓